

Article

Legal Framework of Urban Underground Space in China

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Abstract: The booming of three-dimensional (3D) land use brings a change of the connotation of land rights, which will expand “flat” 2D land legislation with 3D land legislation. The legal issues of urban underground space for 3D objects in large cities around the world have been attracting more and more attention. A supportive legal framework is crucial for underground space utilization in a country. This paper analyzes the present 173 representative laws and regulations of urban underground space utilization and management of China from 1998 to 2018, and attempts to interpret the current laws and regulations of underground space from four aspects; by quantity, spatial distribution, legislative force and content. The result shows that poor legal framework of urban underground space in China, including low-level of legislative force, disunity of local legislation standard and absence of special statutes and regulations, are the main reasons causing ownership disputation, registration chaos, as well as no unanimous judicial practice. To address these issues, the paper refers to a case study for underground space legal framework in Japan and aims to form a set of top-down unified legal framework, including basic law, special statutes and regulations, as well as supplementary policies and documents of urban underground space, and proposes that the underground space planning should be incorporated as one essential portion of the master planning in China. By studying the legal system of underground space in Japan and China, this study may offer better insight for those conducting UUS legal framework research as well as serve as reference for countries with similar legal issues.

Keywords: 3D property rights; urban underground space; legal framework; UUS laws and regulations; construction land use rights

1. Introduction

The increased stress on urban sprawl and land use will lead to the acceleration of three-dimensional (3D) utilization of land. Going upwards (skyscrapers), to a certain extent, has achieved higher density and contributed to building compact cities, but also brought some challenges, such as crowding, environmental deterioration, traffic congestion and so on [1]. However, going downwards, the concept of earthscrapers has appeared, which indicates that urban underground space (hereinafter referred to as UUS) utilization will become an inevitable requirement of the low-carbon, livable city under the implementation of sustainability and resilience ideas [2–4]. Due to the urbanization rate, China has been ushered to large-scale construction of UUS, especially the speed and quantities of the metro-oriented urban rail transit system and utility tunnels are at the top of the world [5].

When changing land use spatially from horizontal to vertical, it changes the connotation of land rights, which creates a need for redesigning the legal framework, bringing flat (2D) property rights legislation into three-dimensional (3D) property rights legislation [6,7]. With focus shifting from 2D to 3D property legislation, the concept of 3D property rights and its legal framework has been set up successively in some countries, for example the USA, Australia, the Netherlands, Sweden, Japan, and Korea. Legal issues related to 3D property seem to focus on some main topics, according to surveys of legal 3D publications [8,9]: (1) forms of 3D property rights, such as the independent model of “air rights” and the “sharing” model of condominium [10,11]; (2) standardization of 3D property, especially regarding the legal perspective of the Land Administration Domain Model (LADM) standard, such as Rights, Restrictions and Responsibilities (RRRs) [12–15]; (3) implementation, limits and consideration of national 3D property legislation [9,16]; and (4) registration of 3D property [17,18], such as registration and integration of 3D legal and physical objects [19–21]. The legal reform of 3D property rights is imperative for various countries around the world, because legal ambiguity cannot meet the increasing use of multi-storied developments and leave a latent trouble for future tenure security. Although more and more of the literature pays attention to the legal issues of 3D property rights, so far there is not much research that has analyzed laws and regulations of UUS in the form of a hierarchical legal framework.

China has recently carried out a reform to support 3D property rights, where a Property Law was enacted in 2007, the Interim Regulations on Immovable Property Registration in 2015, the Implementation Rules of the Interim Regulations on Immovable Property Registration in 2016, and the Ministry of Natural Resources was set up in 2018. All of these reforms have been conducive to providing greater unequivocal tenure security [9]. However, under the vigorous actualization of the unified registration of immovable property, the real legal issue of 3D objects in large cities in China for underground space is related to different constructions such as complexes, tunnels, parking lots, infrastructure and so on, being constructed underground instead of on the ground [22]. Particularly in recent years, various types of UUS buildings (e.g., commercial and entertainment facilities, parking lots) have developed rapidly, and the UUS legislation has lagged far behind the speed of UUS utilization and development.

By studying the legal system of underground space in Japan and China, this paper aims to determine what obstacles existing laws and regulations entail to UUS utilization and concludes with key points to offer those conducting UUS legal framework research to support the UUS utilization and planning support, as well as reference for countries with similar legal issues. Section 2 presents an international comparison of UUS legal frameworks, especially taking Japan as reference. Section 3 briefly introduces current UUS legal framework and statutory in China. The study is based on a systematical review of the current 173 representative laws and regulations of UUS utilization and management in China from 1988 to 2018 and summarizes critical emerging legal issues. Section 4 analyses the UUS legal system in China, concentrating on legislative issues. Recommendations for a revised system in China is contained in Section 5. Through the case study of the Japanese underground space legislation system, a top-down unified UUS legal framework is proposed that could possibly solve the problem concerning the Chinese UUS system. The last section contains conclusion and future work.

2. International Comparison

2.1. Underground Space Legal Framework in Various Countries

From a global perspective, UUS utilization and development are mainly concentrated to North America (such as the USA, Canada), Western Europe (such as U.K., the Netherlands and Germany), Northern Europe (such as Sweden, Finland) and Asia (such as Japan, Singapore) [23,24]. Influenced by the driving forces of spatial constraints, population agglomeration, geological conditions and climate environment, UUS development in various countries and regions have formed their own unique

characteristics and legal framework system in line with their national conditions. Considering the legal challenges and provisions of UUS, there are issues in various countries and regions focused on, e.g., UUS property rights, vertical boundaries and planning issues.

In terms of UUS property rights, the basic two principles of “*Superficies solo cedit*” (that the attached buildings or constructions on land become part of the land) and “*Cuius est solum, eius est usque ad caelum et ad inferos*” (who owns the land, owns extending from upwards to downwards) both in Civil and Common Law jurisdictions, have not always been compatible with the practical concerns [15,23]. Civil codes in many countries have prescribed the vertical extent of property ownership, intending to keep space for real property stratification [25] (e.g., German Civil Code; Dutch Civil Code; Greek Civil Code). There are also some specific legislation in many countries that have provisions for the above-ground parts, called, e.g., condominium (e.g., Uniform common Interest Ownership Act of the United States; Land Transfer Act of New Zealand), Strata title (e.g., Building Units and Group Titles Act and Subdivision Act of Queensland and Victoria, Australia), apartment rights (Swedish Land Code, Swedish Real Property Formation Act), Horizontal ownership (Horizontal Property Law in Greece), which allow vertical segmentation of real property [26–29].

This paper focuses on the underground part of 3D property rights, which also are specified in laws and regulations of some countries. For example, in Singapore, the property owner can reasonably use the subterranean space within 30 m, but 30 m below the legally defined Singapore Height Datum, as specified in the State lands (Amendment) Act and the Survey Map Act [30]. In the Netherlands, property owners can use the underground part of their real property without restriction, except for the state-owned subsurface resources (e.g., mineral resources, oil and gas) below 100 m (for geothermal resources the law applies only to heat extraction below 500 m) [31]. In Finland, the property owner can freely use the subsurface down to a depth of 6 m, which is not specified in Finnish law, however, seen as a tradition [32]. In Denmark, the shallow subsurface (0–250 m) is owned by the property owners, but the parts beneath 250 m below sea level belong to the State according to the Underground Law [33].

In the perspective of UUS planning laws, a few countries in Europe (e.g., Finland, the Netherlands, Germany) and Asia (e.g., Japan and Singapore) have introduced relevant laws and regulations and also related them to the master plan. For example, in Finland, the underground master plan has been treated as a part of the Land Use and Building Act, which included the regional plan, the master plan and the detailed plan. Meanwhile, Helsinki is the first city in the world to draft and use an underground master plan for the whole municipal area [32]. The Netherlands has promulgated a new “Environment and Planning Law”, which is planned to be implemented in 2021. The underground planning will then be regulated in this Act, and integrates amongst others the Earth Removal Act, the Water Act, the Mining Act and the Soil Protection Act with the Spatial Planning Act [34]. Mecklenburg-Western Pomerania in Germany is the first land (state) to include underground spatial planning as a separate chapter in the regional development programme. So did Schleswig-Holstein, another state in Germany, where the subsurface is regarded as a planning area and drawn up in the State Planning Act. [35]. The Singapore government has established a Steer Committee on Underground Development and an Underground Master Plan Task Force to aim at synergism and integration of underground and aboveground space [30].

2.2. Underground Space Legal Framework in Japan

Japan and Singapore, both of which are Asian countries with large population and scarce land resources, are similar to China in terms of underground space utilization. There are more complicated underground space projects, ranging from underground rail transit to underground complexes to underground blocks. However, the legal system of Japan belongs to the civil law system just like China, while Singapore is part of the common law system. Therefore, the detailed legal framework in Japan can be suitable for comparative research by China, or for reference by countries with matching legal issues. In the long-term UUS utilization, Japan has formed a sound legal framework, underground master plan and administrative organization tailored for its national conditions, as shown below.

2.2.1. Legal System of Underground Space in Japan

The complete legal system of underground space in Japan consists of four parts, including civil code, comprehensive law, special laws and supplementary laws [36].

- (1) Civil code and comprehensive law. At the beginning of the development of underground space, the basic civil law at the national level was introduced, which refers to the Japanese Civil Code and the Real Estate Registration Act. In 1966, Japan made a partial amendment to the Civil Code. Without changing the whole legal framework, Article 269 about rights of superficies was added. In addition, it has special regulations on the registration procedure of the superficies according to Article 111 (2) of Real Estate Registration Act, in particular in the range of vertical use.
- (2) From single (special) laws to comprehensive laws. Since the 19th century, Japan has enacted special laws for different fields of underground space utilization, such as the Track Act of 1921, the Land Acquisition Law of 1951, the Sewerage Law of 1958, The Rivers Act of 1964, the Urban Planning Law of 1968, the Railways Act of 1980, the Electrical Communication Business Act of 1984, etc. Until 2001, the Law on Special Measures for the Public Use of Deep was promulgated, which is a comprehensive law. It shows that the trend of the legal system of underground space in Japan is from the single management regulated by special laws to the integrated administrative system regulated by comprehensive law. This Act specifically stipulates that the attribute and principles of underground property rights, the start-stop scope of “deep underground” is between 10 and 40 m below ground level. [37], as well as the approval procedures and related compensation for underground space utilization and development, etc.
- (3) Supplementary laws. The auxiliary legislation for UUS utilization is complete. Especially, some supplementary laws have detailed regulations on construction funds, daily maintenance and financing of underground space development, for example, the Emergency Measures for Traffic Safety Facilities, the Local Autonomy Law for the Road Development Funds and, and the Local Finance Law.

2.2.2. Underground Master Plan and Administrative Organization in Japan

- (1) Underground master planning in Japan.

As an integral part of the urban planning system, the underground master planning consists of four parts, utilization master planning, guide planning, underground traffic network planning and underground street planning [24]. Meanwhile, Japan has focus on the coordination of above-ground and underground use, in particular in better synergized underground space projects with transportation or municipal planning. Furthermore, a set of legislative management, organization and negotiation mode has been established from the national level to the local level to ensure the smooth implementation of underground projects.

- (2) Streamlining government organizations and three-party management.

Japan officially implemented a new system, namely, one government and 12 functional departments after 2001. Among them, the Ministry of transport, Ministry of Construction, Ministry of Land Resources, Hokkaido Regional Development Bureau are merged into the Ministry of Land, Infrastructure, Transport and Tourism in order to solve the problems of overlapping interference and low efficiency caused by cross functions and unclear duties of each department.

A “temporary deep underground Utilization Investigation and Research Institute” was established by the Japanese parliament, the government and expert committee in 1995, as a three-party management model to clear the powers and responsibilities. The Congress mainly participates in the management at legislative level [38]. The relevant government departments are responsible for the specific implementation. The three parties cooperate with and restrict each other, with the purpose of guaranteeing a scientific, reasonable administration of underground space utilization.

3. Methodology

3.1. UUS Hierarchical Legal Framework in the Research Area

China is the selected research area, and this section focuses on current UUS legal framework and statutory in China. For the purpose of offering tenure security and efficiency, property rights should be defined clearly by law and formed through a variety of legal frameworks (such as statutory law, customary law, jurisprudence and local law) [39]. A hierarchical management model of China is adopted to divide the whole country into five administrative region levels (central-provincial-municipal-county-village or town level), which makes the system for laws and regulations of underground space more complex than in many other countries. According to the stipulation of Legislative law of the P.R.C (revised in 2015), the current legal system about UUS in China is based on the P. R. C Constitution and is made up of four layers and eight levels, which are (1) UUS law level; the written laws; (2) UUS statutes level; administrative Statutes and local Statutes; (3) UUS regulation level; administrative regulations and local government regulations; (4) normative document level (the so-called red-tape); normative documents of State Council and local normative documents (see Figure 1). Its legal force varies depending on the subject (government organ) and procedure (including legislative procedure and administrative decision-making) [40,41].

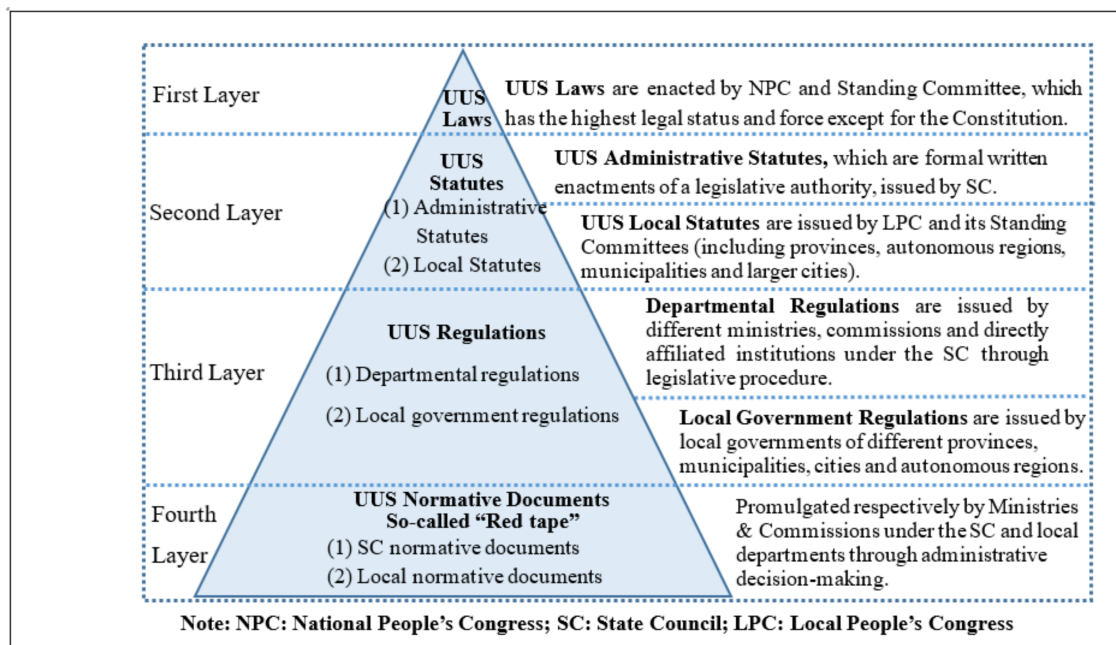


Figure 1. Current Hierarchical legal framework of urban underground space in China.

- (1) The first type is laws enacted by the National People's Congress (NPC) and Standing Committee, which has the highest legal status and force except Constitution. There are few laws regulating UUS development and utilization, such as some articles of The Property Law (2007) and the Civil Air Defense Law (1997).
- (2) The second type is administrative statutes and local statutes, which both are enacted by a legislative authority that governs a state, province, autonomous regions, municipalities and mega cities. Administrative statutes are enacted by the State Council (SC) through the legislative process, and the legal force is second to the Constitution and laws. The current representative UUS administrative regulation is the Interim Regulation on Real Estate Registration (2015).

Local statutes issued by Local People's Congress (LPC) and their standing committees (including provinces, autonomous regions, municipalities and larger cities) shall be not incompatible with the constitution, the laws and the administrative Statutes. It means that the legal force of local statutes

is lower than that of the administrative statutes, such as Regulations on the Planning and Construction of Underground Space in Shanghai (2014) and Tianjin (2009). The legislative force of local statutes is higher than the local and subordinate local government regulations (the article 89 of the Legislation Law).

- (3) The third type is the departmental regulations and local government regulations. The departmental regulations issued by the Ministries and Commissions under the State Council and local governments through the legislative process, such as Regulation for the Administration of Urban Underground Space Development and Utilization issued by Ministry of Construction in 1997 and amended in 2001. Generally speaking, the legal force of departmental regulations is lower than those of the constitution, laws and administrative statutes (the article 95(2) of the Legislation Law).

Local government regulations that are vital in the current UUS legal system are not formulated through legislative procedures, but are administrative decisions of the executive bodies (people's governments at all levels), such as Interim regulation for Underground Space of Construction Land Management and Registration in Hangzhou City, etc. The departmental regulations and the local government regulations have the same legal force (article 89 of the Legislation Law).

- (4) The fourth type is normative documents (the so-called "red tape") promulgated respectively by Ministries and Commissions under the State Council and local departments through Administrative Decision-making, whose legal force are inferior to the above three types. Examples of this are the Standard for Basic Terminology of urban underground space utilization issued by the Ministry of Housing and Urban-Rural Development in 2015.

By understanding the legal system of China, the following section attempts to analyze the UUS legislative status and problems of China.

3.2. Methodological Approach and Data Collection

The study adopted the methods of case study, field survey, interview and literature analysis. Firstly, the paper made international comparison of UUS legal system (Section 2). In particular, the legal framework of Japan's underground space was introduced in detail for China's reference. Secondly, the keywords involved in this study are searched through CNKI (China National Knowledge infrastructure) and relevant websites (<http://www.gov.cn>, <http://www.chinalaw.gov.cn>, www.law-lib.com, <http://www.zgzcinfo.cn/index.html>) to obtain the UUS laws and regulations in China (Section 3). Finally, through field survey to some typical representative cities of China, such as Beijing (capital), Nanjing and Fujian (East regions), Wuhan and Zhengzhou (central regions), Hainan (Southern region) and Qinghai (Western region), and communicating with the relevant staff of the local natural resources bureaus, the problems existing in the formulation of laws and regulations on underground space are summarized. Unlike the qualitative analysis of UUS laws and regulations adopted in most literatures, this paper try to interpret the current UUS laws and regulations in China from four aspects of quantity, spatial distribution, legislative force and policy content, with a view to finding problems (Section 4) and giving solutions (Section 5).

This paper is conducted by studying 173 UUS laws, statutes, regulations and normative documents issued and implemented by 22 provinces, 3 municipalities and 3 minority autonomous regions in mainland China from 1988 to 2018 (by December, 2018) according to statistical data issued by the Chinese government network (<http://www.gov.cn/>) (see Table 1). UUS development starts from rail transit, utilization tunnels and pipelines, where relevant special regulations are relatively sound on national or city level, even if they have limitations. All of the 173 UUS laws and regulations are specialized on the aspect of UUS utilization, management, planning and registration, not including relevant laws and regulations of utility, groundwater, underground water delivery of South-to-North Water Transfer Project, underground gas storage, underground mines, mineral exploration and survey of

underground cultural relics. Two special administrative regions (Hong Kong and Macau) were not included in this study because of different land systems used in these regions.

Table 1. Numbers of UUS laws and regulations in China in 1988–2018.

Level	Legal System	Number	Description		
			Issued Subject (Government Organ)	Decision-making Procedure	
National level	law	0	NPC and Standing Committee	Legislative Procedure	
	Administrative Statutes	0	The State Council (SC)		
	Departmental regulations	2	Ministries & Commissions under the SC	Administrative Decision-making	
	Normative Documents	1	The SC and Ministries & Commissions		
Local Level	Provincial Level	Local Statutes	0	Provincial NPC and Standing Committee	Legislative Procedure
		Government regulations	9	Provincial Government	Administrative Decision-making
		Normative Documents	8	Departments of Provincial Level	
	Municipality Level	Local Statutes	2	Municipality NPC and its Standing Committee	Legislative Procedure
		Government Regulations	8	Municipality Government	Administrative Decision-making
		Normative Documents	5	Departments of Municipality level	
	City Level	Local Statutes	2	Municipal NPC and Standing Committee	Legislative Procedure
		Government Regulations	109	Municipal Government	Administrative Decision-making
		Normative Documents	27	Departments of Municipal level	
Total		173			

Note: the data are derived from <http://www.gov.cn/> and <http://www.law-lib.com/>. These 173 laws and regulations are specifically aimed at underground space; the statistics do not contain the Property law (2007), Interim Regulations on Real Estate Registration (2015), Implementation rules of Interim Regulations on Real Estate Registration (2016), which not are specialized on underground space.

4. Results and Analysis

4.1. Significantly Increasing Number of UUS Laws And Regulations

Looking at the time dimension (see Figure 2), the number of UUS policies has significantly increased over the past 21 years. Meanwhile, the number of UUS statutes, regulations and normative documents promulgated during the period of the 12th Five-Year Plan (2011–2015) was four times that of the 11th Five-Year Plan (2006–2010). In 2015, the number of laws and regulations reached a peak of 20 years (1988–2018), with a total of 26. The construction of the UUS law system in China entered the stage of comprehensive development in the period of the 13th Five Year (2016–2020) Plan.

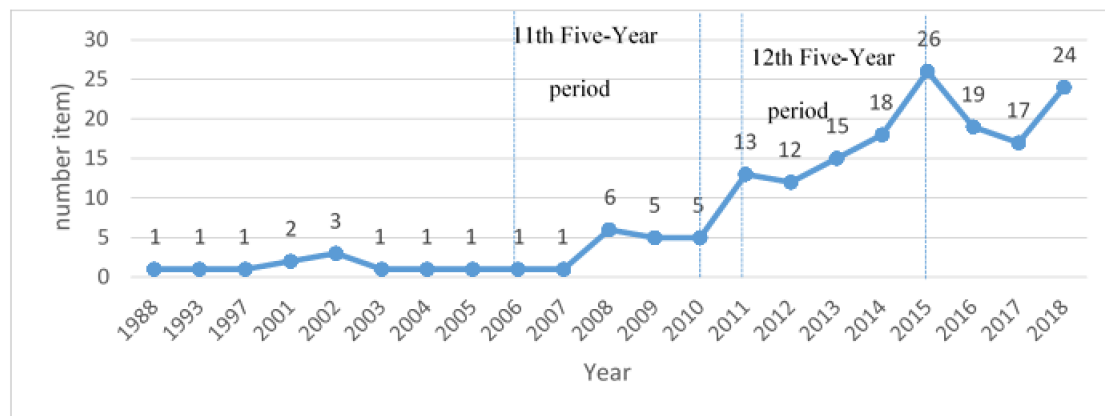


Figure 2. Quantitative statistics of China UUS law and regulations from 1988 to 2018.

4.2. Distribution of Local Statutes and Regulations

From the perspective of distribution (see Figure 3), the current local statutes and regulations of UUS are mainly concentrated in Jiangsu, Zhejiang, Shanghai, Guangdong, Sichuan and Shandong provinces, which is positively related to the overall level of UUS development in the whole country. Among them, Zhejiang and Jiangsu provinces have issued 20 and 15 local regulations and departmental normative documents of UUS in 2004–2018, ranking top 1 and 2 in China. The reason lies in that Zhejiang is one of the provinces in China with the most active economy but the smallest area; Jiangsu Province is situated in the eastern coastal center of China's mainland, and the land area per capita is the smallest in all provinces and regions of China, so there is a great demand for UUS utilization. The provinces in which there are few local regulations and departmental normative documents on UUS are mainly concentrated in the minority autonomous regions such as Inner Mongolia and Ningxia. They are located in the northwest of China, the economy is underdeveloped, and there is less demand for UUS development. On the UUS legislation issue, the local statutes and regulations are allowed to formulate and pilot firstly, and when later the relevant national laws and administrative regulations are promulgated, they will be amended or abolished accordingly.



Figure 3. Distribution map of UUS laws and regulations in various provinces of China from 1988 to 2018.

4.3. Lack of Superordinate Law of UUS at the National Level

From the perspective of legislative force, there is a lack of superordinate law of UUS at the national level. Among the existing 173 UUS laws, statutes, regulations and normative documents, there is only one set of national-level regulation, which is Regulation for the Administration of UUS Development and Utilization issued by the Ministry of Construction in 1997 and amended in 2001. According to its legal range and validity, this ruleset is neither a national-level law nor an administrative statute of the State Council. It is only regarded as departmental regulation [42]. However, it stipulates the UUS development and utilization in principle only from macro-level, and does not involve details such as vertical scope, registration, paid-transfer, etc. of UUS property rights, which means that it has a very limited guiding for practice. Particularly, it is difficult to provide guidance for the local UUS utilization.

The Property Law (2007) issued by NPC and the Interim Regulations on Immovable Property Registration (2015) promulgated by the State Council (SC) are national-level law and administrative statutes, which have established the registration system of stratified construction land use rights (LURs), but they are not basic law specifically aimed at regulating UUS.

Except for four UUS statutes and normative documents issued by the ministries and commissions under the State Council, 98% of the UUS statutes, government regulations, and normative documents are promulgated at the local level (see Figure 4a,b). Four of these are UUS local statutes issued by the local people's congresses through legislative process, lacking provincial-level statutes of UUS. The rest are government regulations promulgated by local governments through administrative decision-making. Moreover, in 126 Government regulations, accounting for 73% of 173 laws and regulations, only six provinces and one municipality (Zhejiang, Fujian, Jilin, Shandong, Sichuan, Yunnan province and Shanghai) have issued government regulations at the provincial level, and the rest are city-level government regulations. These data fully illustrate that the current UUS legislation in China lacks unified legislation at the national level, which leads to different local judicial trial on disputes over the UUS ownership in real cases. This is not conducive to the formation of a unified norm, and might seriously obstruct UUS exploitation and utilization.

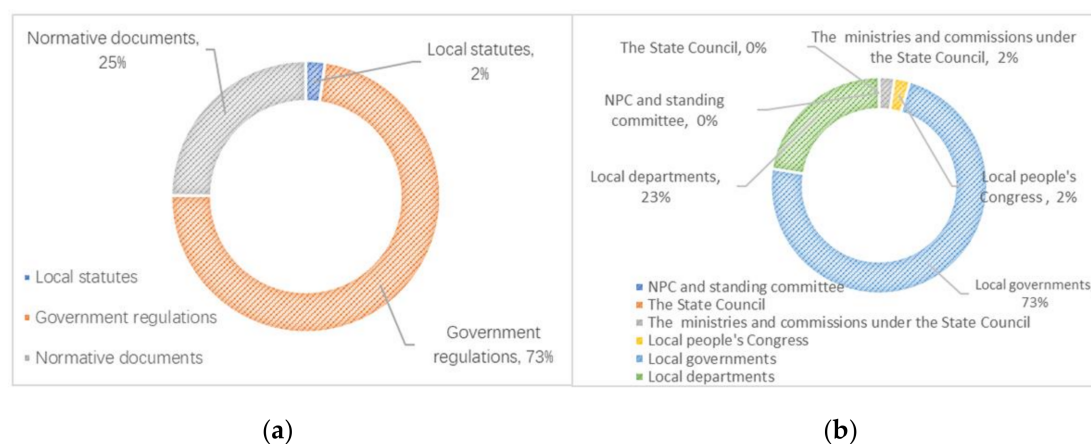


Figure 4. (a) Types of UUS law and regulations; (b) UUS law and regulation making units.

4.4. Content Interpretation of UUS Laws and Regulation Issued

From the perspective of policy contents, the current 173 UUS laws and regulations have been interpreted from the following three aspects:

4.4.1. Disunity of UUS Local Legislation Standard

Local UUS legislation has contradictory statutes and regulations on UUS property rights by different local practices and legislative needs, which is rather confusing and mainly reflected in the following aspects. (1) Each province or city applies different terminology to describe UUS property

rights; even different local statutes and regulations have different interpretations of UUS property rights. The long-term existence of this confusion in concept may affect people's cognition and is not conducive to future unified legislation on national level. For example, some cities, like Shanghai, Shenzhen, Guangzhou, Wuhan, Changsha, Jinan, call underground construction LURs, while it is named rights to use underground space in Xi'an, Ningbo, etc. and underground (on ground) construction LURs in Suzhou, etc. It is even described as state-owned construction LURs in Qingdao, Weifang, etc. [43]. (2) Each province or city adopts different registration rules of UUS. In some places, underground projects are divided into combined or independent underground projects, which are registered separately according to whether it is an extension of the adjacent surface, such as in Shenzhen, Changchun and Nanchang, etc. [23]. However, in some places, the principle of stratified registration (which means that each layer is registered as an independent parcel) is adopted directly without considering the above principle of "structural connection", such as Hangzhou, Wuhan, Changsha etc. In practical application, laws and regulations are used to guide practice, but the different local statutes, regulations or normative documents for the same case are bound to prevent the UUS utilization, especially disunified and scattered local legislation standards which cannot give UUS effective constraints and normative guidance in content and institutional arrangements.

4.4.2. Deficiency of UUS Special Statutes and Regulations

The 173 UUS statutes, regulations and normative documents can be divided into six categories (see Figure 5), of which 101 are related to UUS utilization and management from the macro level, and rather vague for solving real-world complex problems, such as the Rules for the Administration of UUS Development and Utilization issued by the Ministry of Construction in 1997 and amended in 2001. The remaining five categories are related to UUS planning (17), UUS approval and registration (38), underground subway, parking and rail transit (11), UUS safety management (3) and others. Obviously, parts of the existing 101 UUS laws and regulations related to UUS utilization and management issued by various cities of China regulate 3D property rights and market-oriented transfer management to some extent, but the contents are relatively principle-based and not applicable to the handling of actual problems in real life. The remaining five categories are rarely involved in the special legislation on vertical division of 3D property rights, UUS transfer management, UUS price of leasing and sale, UUS mortgage loan and financing, UUS taxation and codes of UUS design and technical standards, resulting in various disputes in daily life.

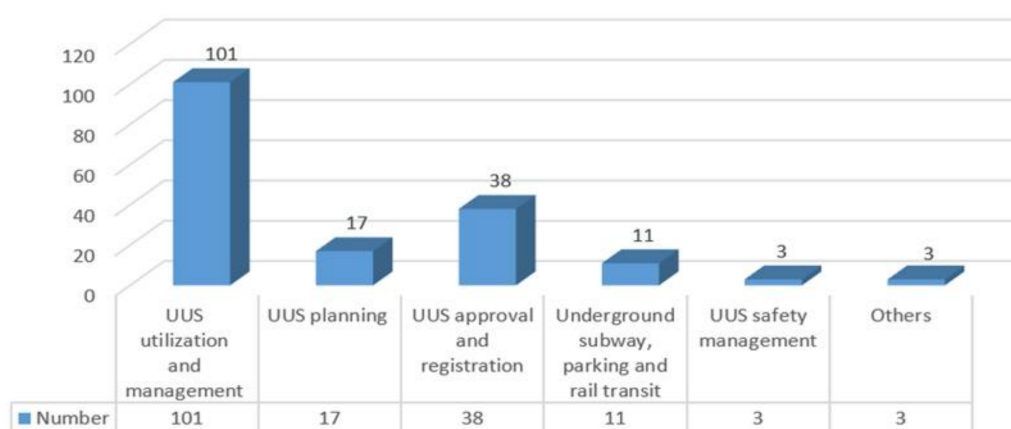


Figure 5. Types of UUS laws and regulations.

- (1) The UUS ownership issues that investors are most concerned about, such as registration of the ownership of UUS buildings, the civil air defense basement, the property rights of the underground garage under the high-rise residential buildings and engineering connectivity, as well as UUS adjacent rights and priority rights, have not been clearly defined (particularly in

vertical height) in the existing UUS policies, leading to misunderstanding and disputes among local governments and investors.

- (2) Special legislation for UUS market-oriented management is still non-existing, lacking in laws and regulations specifically for underground space market-oriented operation, particularly in specialized policies for paid-transfer using, declaration, approval of urban underground space, as well as private capital investing, financing, preferential promotion, etc.
- (3) Codes and technical standards for UUS utilization are being improved, some construction standards related to underground complex, particularly in junction between subway station and surrounding buildings, are also being conducted [44]. Codes and standards for some safety and disaster prevention of underground engineering, application and quality standards of special materials, health safety and environmental protection for underground projects are also being completed. Until now, there is only a Standard for basic terminology of UUS utilization (2015).

4.4.3. Fragmentation and Disconnection of UUS Local Statutes and Regulations

There seems to be a serious fragmentation of local statutes and regulations, the contents of which are not cohesive enough or not existing at all. This is mainly embodied in local statutes and regulations only aimed at regulating a specific aspect or field of UUS utilization, such as obtaining the rights to use construction land or registration of UUS property rights or metro construction. Furthermore, UUS planning does not belong to the master plan of many cities in China [45]. The UUS utilization lacks planning laws and regulations, resulting in the development of UUS projects that are inconsistent and conflicting with existing urban planning and land use planning. The first-come-first-served strategy of UUS in China has led to lack of integrity and systematization of underground projects constructed by various industries in accordance with their own development needs. In the long run, the overall layout of UUS in China shows a mainly dotted distribution, thus forming scattered “isolated islands”. The absence of unified planning may cause disorder among various underground facilities competing for space. Due to the lack of corresponding standards and norms for UUS planning, there is currently no unified framework of UUS planning in China [46]. Thus, there seems to be a need for many aspects to be supplemented and improved in terms of planning concepts, planning systems, planning content, planning rules or standards, legal procedures, and planning implementation.

5. Solution: Proposed New UUS Legal Framework in China

Based on the above analysis of Section 4, there seems to be a need to carry out relevant reforms in China in order to tackle problems existing in UUS laws and regulations. The core of the unified registration of immovable property is to achieve the “four unifications”, which is also the principle to be followed in the formulation of UUS laws and regulations. The four unifications are unification of legal and procedural basis for registration, registry institution, registering books and information platform, which are proposed by Makai on the first session of the 12th National People’s Congress of the People’s Republic of China. In 2017, the information platform of the national, provincial, municipal and county levels was officially launched, requiring the implementation of the unified registration system for immovable property rights in China to achieve the four unifications. Firstly, the construction of Japan’s legislation system on underground space can be a reference for China. Secondly, it is high time to form a set of top-down unified UUS laws and regulations framework, changing the present passive situation of UUS utilization. Thirdly, UUS planning should be incorporated as one essential part of the master planning and combine the underground space with the existing cadastral management system.

5.1. Form a Top-down Unified UUS Legal Framework

Comparing the experience of Japan and the specific situation of China, a unified set of laws and regulations framework for UUS should be composed of three parts: UUS basic laws, UUS special statutes and regulations, and UUS supplementary regulations and documents (see Figure 6) [47]. The proposed top-down unified UUS legal framework in China legal system refers to Japan, and

consists of two levels and four parts, including civil code, comprehensive law, special laws and supplementary laws.

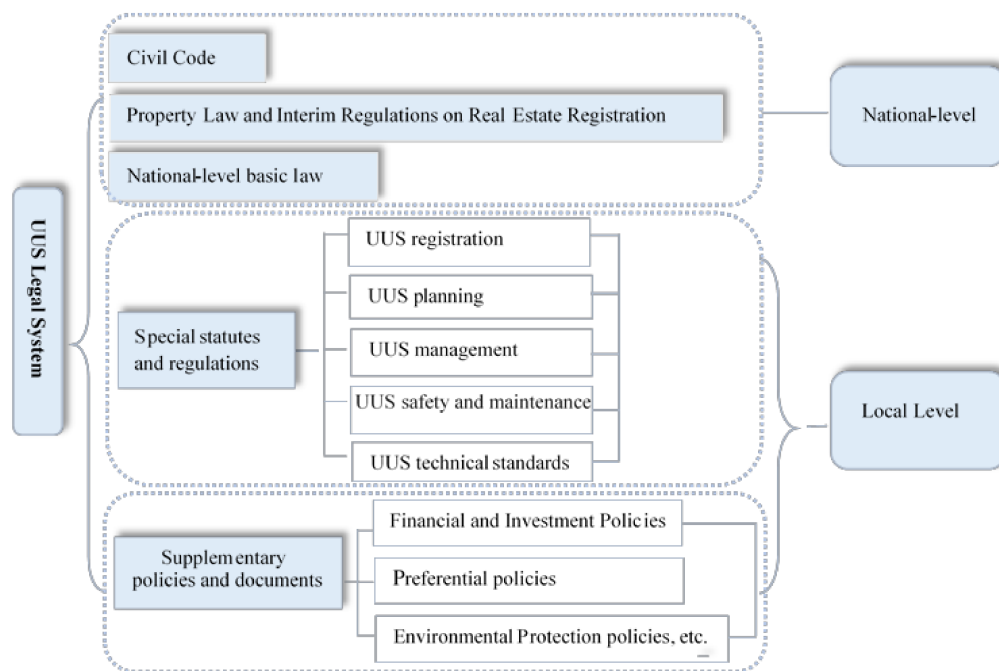


Figure 6. Proposed Top-down unified UUS legal framework in China. 5.1.1. Promulgation of unified national superordinate law of UUS.

At present, China is drafting a civil code, suggesting that relevant contents regarding the rights to use construction land can be added to the Civil Code. Facing the problem of missing national-level law, on the basis of the promulgation of the Property Law (2007) and Interim Regulations on Immovable Property Registration (2015), it is necessary to map out a unified national-level superordinate law of UUS by the NPC or its Standing Committee (SC), for example, an Underground Space Law of P.R. C. This basic law should stipulate in detail the basic principles and policies of the definition, acquisition, transfer, protection and registration of UUS property rights, especially the terminology of UUS property rights, the vertical scope of multi-layer use of UUS, the compensation criteria for UUS construction, and the occupancy permit provisions of UUS public facilities.

Following the principle that the lower law cannot violate the upper law, the local government can formulate local statutes and regulations of UUS to cater for the needs of local economic development, as well as refine and specify the provisions of the basic law in order to implement them better in reality. However, the reality of unbalanced development between the East and the West in China also allows some developed mega cities, such as Shanghai, Hangzhou, Shenzhen and Tianjin, to take the lead in promulgating local-level statutes and regulations of UUS. Its successful experience has proved that the first trial of local legislation is fitting for China's national conditions. Moreover, the local statutes and regulations show the characteristics of flexibility, strong operability and low cost of legislation, which is conducive to speeding up the construction of the entire UUS laws and regulations system.

5.1.1. Improvement of Special Statutes and Regulations

In consideration of deficiencies in the special legislation for UUS, it would be essential to introduce a series of special statutes and regulations with Chinese characteristics for UUS utilization, also referring to the legislative experience of Japan. The UUS utilization in modern cities of China has been involved in various fields, such as transportation, municipal construction, storage, business, culture, entertainment, sports, scientific research, energy, and environmental protection. Therefore, it

would be imperative to boost the effective special legislation of UUS, which underlines the aspects of planning, management design, technical specifications, safety management and hygiene standards for UUS of, e.g., metro, underground commercial facilities, utility tunnels, underground intersections, underground parking garages, underground power facilities, and underground large-scale facilities such as sewer and groundwater resources utilization.

5.1.2. Formulation of Supplementary Policies and Documents

In addition to the basic law and special statutes and regulations of UUS, it is necessary to enact some supplementary policies and documents of UUS tailored to local conditions, such as investment and financing policies (investment model of underground complex and financing policies, issuance of construction bonds, securities market financing), relevant preferential policies (loans, land, tax, etc.), and environmental protection policies.

5.2. Improvement of Existing Laws and Regulations Related to UUS

At present, the existing laws and regulations related to UUS have low legal force, narrow coverage, rarely involve the essence of UUS, and often cause dispute and conflict with each other. Once the basic laws at national level and administrative statutes have been issued, the existing laws and regulations concerning UUS can be modified, supplemented and improved accordingly. (1) Provisions for the UUS utilization in the existing Land Administration Law of P.R.C could be added. The main practice of above-ground management can be followed, such as defining the UUS property rights. Underground space without secured property rights forms a part of the national resources. It would also be necessary to clarify the subjects, scope, responsibilities and obligations of underground space use rights. (2) At present, there are no relevant provisions on UUS planning and management in the City Planning Law of the P.R.C. and the local urban planning regulations. In the long run, it would be necessary to integrate the UUS planning into the entire urban design planning, and treat it within the urban planning of a country or region. (3) In order to form a comprehensive policy and legal system, the existing laws and regulations on urban construction management should also be supplemented and improved in related to UUS development and utilization, such as the Mineral Resources Law of the P.R.C., the Highway Law of the P.R.C., the Water Law of the P.R.C., etc.

5.3. Unified UUS Planning and Management Committee

The promulgation of the Interim Regulation on Immovable Property Registration in 2015 and the Ministry of Natural Resources (MNR) established in 2018 symbolizes that all space resources are managed by the MNR, which provides convenience and feasibility for implementing unified planning and management. UUS property rights, as a part of construction land use rights, is a type of immovable property right, and should also be included in the unified registration of immovable property rights in order to achieve the “four unifications” to tailor the new requirement.

(1) Integration of UUS planning into the Unified Master Planning.

Integration of multi-planning is a hot issue in spatial planning of China in recent years. At present, 28 pilot cities or counties in China have launched an experiment on Multi-Planning Integration. It means that all kinds of plans (land use planning, urban and rural planning, urban master planning, ecological environment protection planning and other planning) are integrated into one spatial planning system, and gradually form one blueprint per city or county. The purpose is to ensure that some important spatial parameters (e.g., city scale, protection space and development boundaries) and control lines are consistent across a unified spatial information station, so as to attain the goal of reasonable space layout optimization and effective resource allocation. UUS planning, as an essential part of the spatial planning system in China, will effectively coordinate the different needs of UUS in various regions and the overall development of cities. Thus, UUS planning, incorporated in the master planning, should also be included in the reform of multi-planning integration, which is conducive to resolving

the problems of the existing types of planning, such as fragmentation, content conflict and lack of cohesion, in order to eventually realize the thought of “one city, one planning, one blueprint”. It is imperative that the reform of multi-planning integration should be governed by law. In this paper, it is proposed that Regulations on spatial planning can be issued by the Ministry of Natural Resources and the relevant departments of the State Council, forming a legal connection in the transitional period, and laying a foundation for the later upgrading to the planning law, and a Spatial planning law can be formulated by the NPC when practical experience and legislative opportunity are ready for this. Meanwhile, the underground space should be organically combined with the existing 2D cadastral system to realize a 3D cadastral information system, so as to achieve the information sharing of various professional systems in different fields.

(2) Establishment of an integrated UUS management committee.

The Japanese experience shows that in order to handle the issue of UUS organizational overlapping and multi-sectional management, it would be appropriate to establish an integrated management organization to undertake the functions of leadership, coordination and management of UUS utilization. However, the UUS development in different cities of China is not balanced, but also has local characteristics. Therefore, it might not be ideal to set up an integrated management organization at the national level, but it is indispensable to set up a comprehensive management organization at the urban level. The establishment of the Ministry of natural resources in 2018 is conducive to improving the limitations of the past sectoral segmentation and providing an opportunity for unified management of underground space resources. In this paper, it is proposed that the integrated UUS Management Committee can be directly led by the local Natural Resource Bureau and be composed of staff from various functional departments, such as the Municipal Development and Reform Commission, the Municipal Office, the Finance Bureau, the Civil Air Defense Office, the Fire Department, the Electricity and Water Affairs Bureau, the Power Supply Bureau, etc., making everyone all play their own part. Moreover, an expert consultation forum could be set up under the integrated UUS Management Committee, with industry experts, the public and other representatives from various circles invited to join.

6. Conclusions and Future Work

Facing the reality that the Chinese UUS legislation and planning lag behind the status of the booming UUS utilization, this paper gives an overview of the UUS legal framework, making international comparison and referring to the Japanese legal framework of underground space. The paper studies the present 173 representative laws and regulations of UUS in 20 years (1998–2018) of China, presenting the quantity and spatial distribution. Through content interpretation of the 173 UUS laws and regulations, the identified legal barriers are focused on lack of national-level basic law, disunity of local legislation standard, deficiency of UUS special legislation and fragmentation and disconnection of UUS local statutes and regulations, causing ownership disputation, registration chaos, as well as no unanimous judicial practice. With reference to the Japanese system, a set of top-down unified UUS laws and regulations framework is proposed, where the UUS planning should be incorporated as one essential part of the master planning and combining the underground space with the existing cadastral management system. This could be a model also for other countries implementing or reforming UUS legislation and planning, in particular where local legislation and planning levels exist.

The contents of this paper are only a part of ongoing research. In future research, more attention will be directed to the UUS legislation mode and UUS institutional issues, particularly in overlapping management of different sectors in China, since unclear responsibilities arising from overlapping management will eventually lead to inefficiency of management. In addition, policy conflicts in different sectors will certainly influence effective and efficient management, especially prone to trigger the insufficient coordination and cooperation among the different departments. Aiming at the confusion

of the management system, further research work should focus on accelerating the implementation of “four unifications” of immovable property rights registration.

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