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CHANGING THE FUNCTION OF INDUSTRIAL BUILDINGS – SURVEY

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Abstract. *The paper analyses the re-use of defunct industrial buildings paying special attention to the examples to be found in Budapest. It gives an account of the fate of the industrial buildings having lost their function and the reasons of the changes as well as the conditions promoting and hindering such changes in the function. The main goal of the research work is to elaborate a system of conditions enabling the analysis of the implemented re-uses and the various buildings using uniform criteria and the comparison of the various examples. The system of conditions extend to the grouping by the usual functions, but consider the location, the monument protection features, the floor-plan and the ownership of the property as well. The systematisation assists the re-use and the changing of the function and, in addition, it can expediently be used to the scientific analysis of the implemented re-use and the classification as well.*

Key words: *Industrial heritage, re-use, changing function.*

1. INTRODUCTION

The even accelerating technological development and the transformation of the changes in the economic structures having taken place in the 1970's and 1980's have resulted in the close-down of factories and plants all over Europe. In our country, this process comes to the fore with the social transformation in the early years of the 1990's.

After the liquidation and disintegration of the companies, several buildings are ill-utilised, unexploited and a significant part of them is uncared and is in bad repair. One part of such industrial buildings, however, is of historic value, i.e. they must be saved. Due to financial, rationalisation and utilisation reasons, the classic monument protection, scientific exploration and restoration can only be carried out for a few buildings. The re-use of the buildings is more effective method of preservation that can be extended to a wider circle of buildings.

The viability of the re-use can be verified by both foreign and domestic examples; in spite this fact there are many buildings in Hungary waiting for the exploration and ex-

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ploitation of their hidden virtues and usability. If the buildings are considered as resources, one can easily see how important their utilisation can be. For this reason, before their demolition, the possibilities of the re-use shall be considered.

The presentation of the re-used buildings and the scientific analysis of the examples may help us to avoid the demolition of the valuable industrial building by changing their function.

Most of all, the domestic and foreign literature, mainly the papers published in architectural journals refer to the presentation of some examples of the changes taken place in the function of the buildings concerned. Beside such presentations, however, there are studies offering a more complex approach of the issue of the changes in the function of the industrial buildings. [1, 2, 3, 4].

When analysing the re-used buildings [5], a German study uses a grouping by the following new functions: a) industry, industrial yards (Gewerbehof); b) services, commerce and gastronomy; c) flat; d) social infrastructure; e) mixed usage; f) temporary/pre-utilisation. This grouping like this may satisfy an investor's requirements, but it's ill-qualified to consider architectural and technical points. The main points to considered are not only the location, town-structural issues, and the social effects but also the economic, monument protection, structural and architectural points, which are, however, of less importance.

The goals of the research are to reveal the factors influencing the prospective function(s), set up a uniform system of criteria promoting the preparation of the changes to be accomplished in the function and analyse scientifically the re-uses implemented. The potentials of the elaborated system of criteria will be shown through a specific example.

2. Factors Forming the Fate of Defunct Industrial Buildings

The preservation of the industrial heritage in not always rational, possible and profitable. The preservation of the buildings is often made by re-using. When re-using a building, the original industrial activity will be discontinued in the building or buildings. In such case, the future of the industrial building can be demonstrated as shown in Fig. 1. The individual stations of the process are worthy of analysis, because they can be the direct or indirect precedents of a change in the function while the demolition appears as the alternative of the usage.

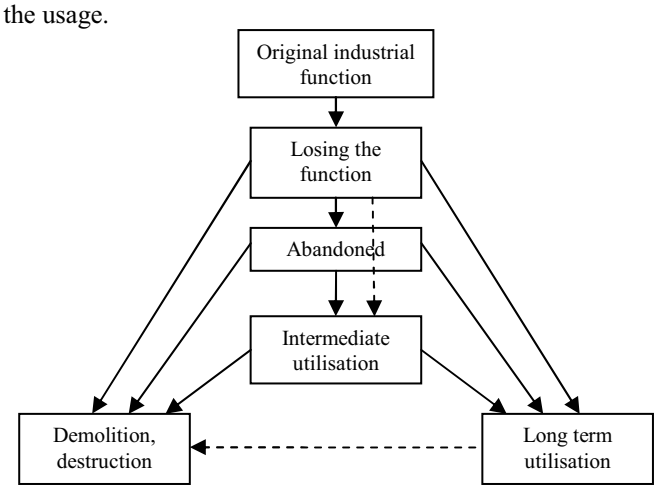

Fig. 1. Future of the industrial building after losing function

2.1. Losing the function

The function of an industrial building can be lost for several reasons:
- The **location** of the building is inadequate to the industrial purpose or technology. Among the reasons environmental, township development, communication or infrastructure problems can be mentioned;
- Size, form, load capacity of the **building** excludes the development and expansion of the production, i.e. it can not satisfy the capacity, space and technological requirements of the new technology;
- Stoppage, liquidation or replacement of the **production** for economic and technological reasons;
- Closing down the **company** for various economic reasons.

2.2. Abandoned

After the liquidation of the industrial activity, the building may not be used officially for shorter or longer periods. During such periods, unofficial, even illegal use without the owner's knowledge may happen. This situation is characterised by the fact that – due to the neglected maintenance and the careless use – the condition of the abandoned building deteriorates exponentially. The further life of the abandoned building will be determined by a decision preceded often by changing the owner.

2.3. Temporary usage

After having lost its function, the building may be the subject of a lasting or temporary re-use. In case of a temporary re-use, after having lost its function, the building will be used without any technical intervention in its original state, but the function and the users may change from time to time. No significant reconstruction or demolition works will be carried out (e.g. for reason of location, value of use, legal problems or other obstacles). The reasons of the temporary use may be economic (no replacement is possible, no developments can be carried out) or strategic (higher profit opportunities later).

It's easy to see that in case of temporary usage, the condition of the building may become better or worse depending on the approach and financial conditions of the users. Typically, in addition to the maintenance works, insignificant, partial refurbishments will be made. The owner of the building may change even several times in the period of the temporary usage.

2.4. Demolition, destruction

Demolition and destruction may take place after losing the function or temporary – even long-term – use; the reasons are:
- **Technical condition** of the structure of the building;
- **Contamination** of the building; this time the demolition is a part of the damage windup;
- The building and the planned **function** are **incompatible**; in such cases the need to the planned function is "stronger" than the urge to maintain the building;

– **Economic points**, when the change in the function would cost more than the demolition and the re-building;
– **Decision of the investor**.

In other cases, the utilisation may appear as an alternative in the development plans. In the few past years, several buildings, among them many valuable industrial monuments have become the victim of development-purpose demolition.

2.5. Long-term use

In case of long-term ("final") use, the building will be used after technical intervention (refurbishment, rebuilding, enlargement or partial demolition) when the original function was lost. The function and the circle of users are stable, but the owner may change during the period of utilisation.

3. Analysing the Re-Use of the Industrial Buildings

For the presentation and analysis of the re-use of industrial buildings, the precedents and circumstances of the projects, and after that, the direct parameters of the possible changes in the function shall be examined.

3.1. Conditions of the change in function:

– Temporary utilisation;
– The building is under protection, it must be saved. The owner must find a proper function compatible with the protection and the limited architectural possibilities;
– In case of state (town) owned buildings, if the end is to save them, a development- and building-compatible function shall be found that meets the financial requirements as well;
– In case of buildings in private ownership, the re-use depends on the decision of the investor. If the investor knows several, successfully realised examples, the chances of the preservation of the building are increased, but the decision itself is generally passed on economic bases;
– There is a conception to change the function (specified function) of the industrial building; a proper building will be sought.

The reason of the preservation is often the protection of the value. The old industrial buildings may carry various values:
– Architectural value, when the architectural or structural form is special, unique or it is the creation of a famous architect or the building in itself represents a special style or type;
– Historic value, when the building was used by a plant of industry- or technology-historic significance, especially, if the original equipment is available;
– Economic value, when the load carrying structures of the building require no special intervention, refurbishment, reinforcement, i.e. the building to be re-used possesses a ready-to-use structure.

3.2. Conditions promoting and hindering the re-use and the change of function

The change of function is **facilitated** by the following factors:
- Township development processes, e.g. functional needs created by the development concept and the changes in the township structural plan;
- The beneficent location of the building from the point of view of town-structure and communication;
- The good condition of the supporting structures of the building;
- Financial and professional assistance from the government, the self-government or the monument protection authority to support the reconstruction and damage liquidation activities.

The utilisation is **hindered** by the following factors:
- Disadvantageous location, poor accessibility;
- Zonal rating hindering the developments, development options, other indicators;
- Financial expectations concerning the plot, if the plot would be more expensive undeveloped, it means a speculative behaviour;
- Complicated or unclear conditions of the ownership as a result of the privatisation in Hungary;
- Soil contamination, contamination of the building;
- Obsolete or not independent system of infrastructures.

4. Factors Influencing and Determining the Future Function

Consequently, the re-use of a building is influenced by several factors, i.e. it is not enough to analyse the future function alone. The analysis of the accomplished re-use shall also be done under the consideration of several factors. My goal is to elaborate a uniform system of criteria to be used to both the preparation of investments and the analysis of the examples of accomplished re-uses. The points of the examination are:

Environment of the building:

The location of the building in the town-structure, the communication connections, the layout plans and the parts of the township development, i.e. the present (at the time of the development) and future position of the building may strongly influence the future function of the said building. The location can be assigned to three groups:
- Internal zone, i.e. a downtown zone comprising mainly residential and institutional areas;
- Interim zone, industrial and residential areas between the external and internal zones formed during the earlier development of the towns;
- External zone, suburban residential and working area formed during the expansion of the towns.

My paper does not extend to the buildings and constructions situated in the outer areas.

Features of the building, historic and architectural values:

The future function will significantly be determined by the historic and architectural values of the building concerned. The monumental protection of the industrial buildings limits their re-use, first of all in terms of architectural interventions. But, especially in Western-Europe, the reconstruction of the monumental buildings is supported by the self-governments, the government offices and various tenders as well. The significant architectural or historic value may directly influence the future utilisation of the building. For example, a building of industry historical value may serve the purposes of a technical museum. When stating the protection, the architectural and historic values are not separated sharply.

The monumental protection imposes various obligations upon and opens various opportunities for the individual countries. In Hungary, a two-level protection is operation, i.e. the national and town-level protection. For the sake of simplicity, my paper did not differentiate between the monument protection of the individual countries and the individual levels of the same.

Requirements of the authorities:

The architectural interventions relating to the re-use of the building the official regulations shall always be complied with that may influence both the architectural solutions and the functions. Concerning the function and the building itself, the following requirements apply:

– Town planning (regulations);
– Dimensioning (static), technical points;
– Fire prevention;
– Building energetic points;
– Health;
– Planning, functional.

The requirements differ from each other by function, country and even areas of a settlement. Detailed examinations are needed to find out how the future function will be able to satisfy the requirements. One part of the regulations to be observed does not relate to the building themselves, but the formation of the environment.

Structure and condition of the building

The original static system, the construction technology, the earlier use and the maintenance of the building influence significantly the conditions prevailing before the re-use. The structural system and the elements of the construction determine materially the architectural solutions to be applied for the re-use. The technical refurbishment and rebuilding take a significant part from the investment budget. The survey of the building and the various load carrying parts and the static examinations (checking the load capacity) are essential factors for the planning of the re-use. To see whether the building is suitable to reconstruction, a preliminary survey of the condition of the constructions and static examinations are needed. The condition of the load carrying structures of the building determines the required and possible modifications. The required inspections are listed in Table 1.

Table 1. Grouping the examinations

Search for written or drawing sources	Search for the original designs of the building and knowing the construction history (rebuilding, refurbishment)
Survey of the building	Documentation of the present floor-plan, sections and facades of the building
Visual inspections	Condition survey of the building by e. g. room list method or building element procedure
Non-destructive testing	Checking the condition of the building structures by non-destructive testing methods
Exploring testing	Construction historic and building structure examinations by exploring the covered structures
Sampling and laboratory tests	Testing the building structures and materials in laboratory.

The load carrying capacity, deformation, fire prevention, thermal, acoustic, etc properties of the supporting structures may influence the function. In the majority of cases, the new function can only be implemented by the reinforcement or modification of the said structures.

The structural/technical modifications may be:

– Reinforcement due to static reasons;
– Partial demolition due to contamination, static or architectural reasons;
– Rebuilding due to static, mechanical or architectural reasons;
– Building in new constructions;
– Compliance with various regulations;
– Architectural or aesthetic interventions.

The buildings are always subject to unique solutions for which the knowledge of the structure is of vital importance.

Floor-plan and dimensions of the building

The floor-plan and the extent of the building determine the form and size of the spaces available. This influences significantly the function to be chosen and the creation of the architectural program. Some functions require definite forms of spaces; for this reason, there are types of building that can easily be fit to specific functions. The floor-plan or the size, however, are not irremovable obstacles, as the space demand can be satisfied by architectural solutions (addition, partial demolition, reinforcement, replacement, etc). The basically skeleton-type industrial buildings can easily be rebuilt. The typical floor-plans of the industrial buildings are shown in Fig. 2.

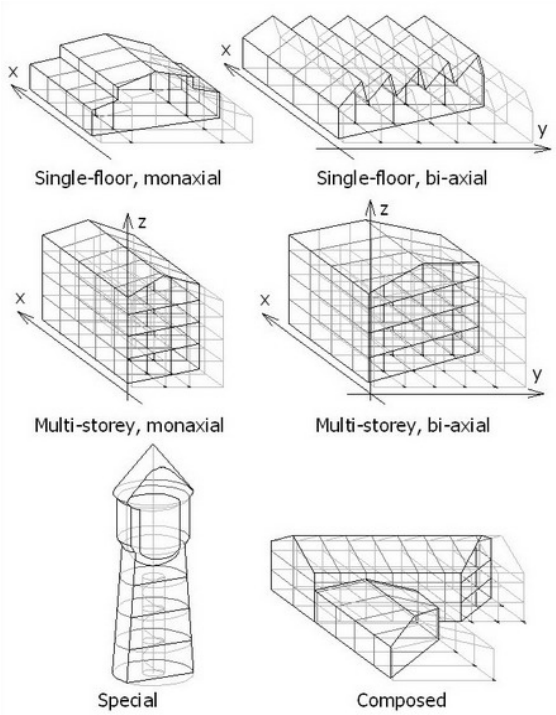

Fig. 2. Typical floor-plans

Owner, project master (investor):

The person of the owner plays decisive role in a re-use project. As the private investors prefer the return and the profit, the function, architectural solutions and floor-spaces are chosen to satisfy this need, while the PPP projects implemented by co-operation between the government and township or the government and the private sector may consider long term social and economic points as well when planning the future. In case of civil initiatives, the needs of some strata of the society appear intensively. Beside the civil initiatives, the profit-oriented private investments may be supported by the government or the self-government (e.g. reconstruction projects).

5. Analysing the Functional Groups

The functional grouping applied by ILS [5] could not be used for the purposes of my research, as it disregards the technical points. The new functional division is as follows:

– Dwelling function;
– Office;
– Commerce, services;
– Industry, warehousing;

– Cultural – exhibition, presentation, education;
– Leisure, sports;
– Miscellaneous;
– Others.

Table 2. Examples for the elements of the analysis matrix

Analysis matrix of re-used industrial buildings The individual fields contain the codes of the examples	Dwelling function	Industry, warehousing	Office	Commercial, service functions	Cultural – exhibition	Cultural – presentation	Cultural - education	Leisure, sports	Miscellaneous	Others
Environment of the building										
Internal zone	a			h					n	
Interim zone			ef	g	i	j	k	l	o	
External zone	b	cd						m		
Features of the building, architectural, historic value										
Monument (protected) – with historic value		c	f				k		no	
Monument – with architectural value		d		g		j				
Not monument – with historic value	a							m		
Not monument – with architectural value	b		e							
No significant architectural or historic value				h	i			l		
Floor-plan and size of the building										
Single-floor, monaxial (x)		cd		g		j		l		
Single-floor, bi-axial (x; y)										
Multi-storey, monaxial (x; z)			e						n	
Multi-storey, bi-axial (x; y; z)	a			h	i		k			
Special	b		f						o	
Composed								m		
Owner, project master										
Private	ab	c	e	gh	i			l	n	
Governmental, self-governmental							k			
PPP, state subsidised projects		d	f			j		m	o	

Dwelling function: a) Bp., Mill-Loft; b) Krefeld (D), Hohenbudberg water-tower;
Industry, warehousing: c) Bp., Go Metal machining; d) Sayn (D), ironworks;
Office: e) Bp., Dorottya-udvar; f) Berlin Leibnitzstr. (D), late transformer shelter;
Commerce, service: g) Bp., Récsei Center; h) San Francisco (USA), The Cannery;
Cultural functions: i) Bp., MEO Galéria; j) Frankfurt /M., Bockenheim (D), tramway barn;
k) Karlsruhe(D), Industriewerke;
Leisure, sports: l) Bp., Wellness centre; m) Duisburg-Meiderich (D), Thyssen ironworks;
Miscellaneous functions: n) Bp., Riverloft (flat, trade, office); o) Vienna (A), Gasometer}

5.1. Application of the analytic matrix

The combination of the system of conditions expounded under item 4. and the function groups results in a analysis matrix analysing the various points of the inspection as a function of the function groups. This matrix had been created and can be used when planning the re-use.

Table 2. shows some realised examples for the individual elements of the said matrix. If the well-known the international and domestic examples are arranged in the matrix (Table 3.), the following conclusions can be drawn:

(I) Generally, the industrial buildings situated in the interim zone are re-used (almost 49% of the examples available), as a great part of the industrial buildings are situated in this zone.

(II) The function of the buildings without significant architectural or historic value is often changed (29%).

Table 3. Summary of the well-known domestic and foreign examples

Analysis matrix of re-used industrial buildings Example analysis results The individual figures indicate the processed examples assigned to the proper category	Dwelling function	Industry, warehousing	Office	Commercial, service functions	Cultural – exhibition	Cultural – presentation	Cultural - education	Leisure, sports	Miscellaneous	Others
Environment of the building										
Internal zone	7		5	2	3	3	3	4	1	
Interim zone	6	5	2	8	7	4	4	5	11	1
External zone	4	6	2	2	2	1	1	4	5	
Features of the building, architectural, historic value										
Monument (protected) – with historic value	3	2		1	5	1		2	5	
Monument – with architectural value	2	3	2	4		2	3		6	
Not monument – with historic value	2			1	5	1		3		
Not monument – with architectural value	4	2	5	4	1	2		3	2	
No significant architectural or historic value	6	4	2	2	1	2	5	5	4	1
Floor-plan and size of the building										
Single-floor, monaxial (x)		2	1	1	2	4		4		
Single-floor, bi-axial (x; y)	1			4	1					
Multi-storey, monaxial (x; z)	10	5	4	4	3	1	2	3	6	
Multi-storey, bi-axial (x; y; z)	4	1	2	1	3	2	3	1	2	
Special	1		2		1			3	1	
Composed	1	3		2	2	1	3	2	8	1
Owner, project master										
Private	4	3	7	10	2			2	4	
Governmental, self-governmental	2		1		4	2	6	3	1	
PPP, state subsidised projects	11	8	1	2	6	6	2	8	12	1

(III) The representation of the multi-storey buildings (52.3% from what the multi-storey, monaxial buildings' share is 34.6%) among the processed examples is surpassingly high.

(IV) The proportion of the purely governmental investments is minimal, while the combined financing of the re-use using private and governmental capitals (civil, supported or PPP) is predominant. The reason is that the processed examples from Western-Europe have decisively been subsidised monument utilisations.

5.2. Application of the examination system to a specific building

The application of the analysing matrix will be shown through the example of Foundry Museum at Budapest (Fig. 3.). By its function, the Museum is a cultural building or exhibition hall.

Fig. 3. The Foundry Museum

Environment of the building: Budapest, II. Bem József street is situated in the internal zone (Fig. 4.), it can easily be accessed by car or mass transportation vehicles. The surrounding areas are typically residential areas, but there are some downtown functions as well there, e.g. education, trade, offices, etc). Classification of the area in the township arrangement plan: central mixed purpose area allowing the establishment of residential, administrational, commercial, cultural, health and educational functions.

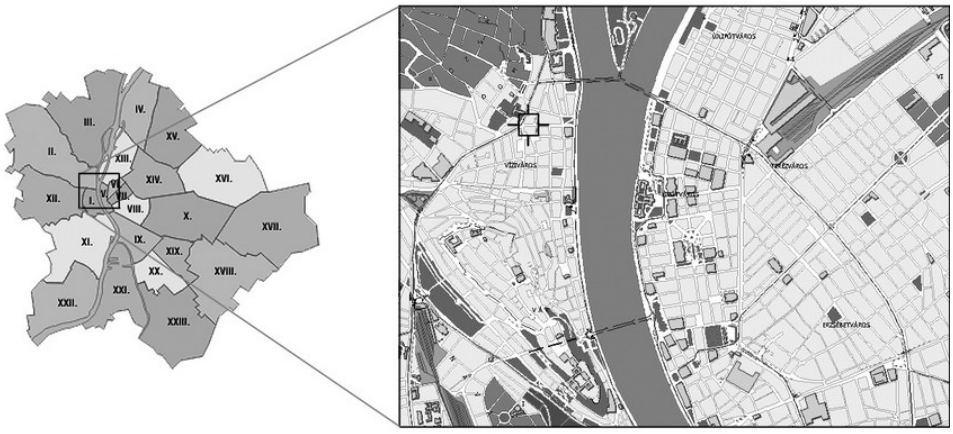

Fig. 4. Location of the Foundry Museum

Value of the building: The building was built between 1858 and 1862 and represents the only Howe-type wooden shed roof hall (Fig. 5.) in Hungary. Its building owner was Abraham Ganz and a foundry of industry historical significance was operated in it until 1964. When closed down, the building was pronounced to be a monument and – retaining the original equipment – became an industry historical exhibition centre.

Fig. 5. The wooden shed-structure

Structure of the building: The building itself is a hall made of brick perimeter wall with Howe-type wooden grid structure and shed roof. To be able to take the new function, no significant rebuilding was required; the cast iron screw-stairs was taken from another building of the Ganz plant.

Floor-plan and size of the building: The shed-structure hall represents the basic example of a single-floor, bi-axial floor-plan scheme.

Owner, project master: As a part of National Technical Museum, it was built as a governmental investment. The building was in governmental ownership at the time of its closing down.

The place of the above explained example in the matrix is shown in Table 4.

Table 4. The example presented in detail, position of Foundry Museum at Budapest in the analysis matrix

Analysis matrix of re-used industrial buildings Results of the detailed example analysis	Dwelling function	Industry, warehousing	Office	Commercial, service functions	Cultural – exhibition	Cultural – presentation	Cultural - education	Leisure, sports	Miscellaneous	Others
Environment of the building										
Internal zone					X					
Interim zone										
External zone										
Features of the building, architectural, historic value										
Monument (protected) – with historic value					X					
Monument – with architectural value					X					
Not monument – with historic value										
Not monument – with architectural value										
No significant architectural or historic value										
Floor-plan and size of the building										
Single-floor, monaxial (x)										
Single-floor, bi-axial (x; y)					X					
Multi-storey, monaxial (x; z)										
Multi-storey, bi-axial (x; y; z)										
Special										
Composed										
Owner, project master										
Private										
Governmental, self-governmental					X					
PPP, state subsidised projects										

6. CONCLUSION

A new system of conditions was elaborated in the framework of my research to be applied to the scientific analysis of accomplished re-uses and the preparation of the re-use of industrial buildings. To facilitate the examinations, a new functional grouping was also introduced. By combining the system of conditions and the functional grouping, an analysis matrix can be defined, the usability of which was shown through a specific example.

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PROMENA FUNKCIJE INDUSTRIJSKIH ZGRADA – PREGLED

Adrienn Lepel

Rad analizira ponovnu upotrebu zastarelih industrijskih zgrada, sa posebnim osvrtom na primere koji se mogu naći u Budimpešti. Rad opisuje stanje industrijskih zgrada koje su izgubile svoju funkciju i razloge za promenu, kao i uslove koji potpomažu ili ometaju promene funkcije. Glavni cilj istraživanja je da se sačini sistem uslova koji omogućavaju analizu mogućih revitalizacija i ponovnog korišćenja zgrada, korišćenjem jednakih kriterijuma upoređujući različite primere. Sistem uslova uključuju grupisanje po zajedničkim funkcijama, ali sa osvrtom na lokaciju, zaštitu istorijskih spomenika, izgled osnove objekta i vlasničke odnose. Sistematizacija će pomoći vraćanje u upotrebu i promenu funkcije zgrada, i takođe može biti iskorišćena u naučnoj analizi vraćanja u funkciju i u klasifikaciji.