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Research paper

INDUSTRIAL BUILDINGS IN TETOVO AND POSSIBILITIES FOR TRANSFORMATION

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Abstract

Existing industrial buildings and sites serve as reminders of the industrial past and the socio-economic transformations caused by industrialism. Nevertheless, all the architectural, cultural and historical values of these sites are being lost, as with the decline of production, abandoned buildings are demolished and replaced with new. Although many studies claim that the awareness of the values of industrial heritage and the possibilities related to them may have increased in recent years, Tetovo's continuous destruction of industrial buildings proves otherwise. This research is conducted in the city of Tetovo, North Macedonia, where in the first part of this paper, industrial buildings and sites, especially those that are underutilized or no longer have a manufacturing purpose, are identified, mapped and analyzed. While the second part of this paper explores the historical development and the current state of "Todor Cipovski Merjan" - Teteks, one of the largest Macedonian textile manufacturers. The historical development is researched to understand the value of this location for the city of Tetovo and the collective memory of our citizens. The analysis of the layers of the buildings in terms of flexibility, creates a picture of the existing situation and provides insight into the potential for transformation and opportunities for reuse. The aim of this research is to promote Tetovo's industrial heritage as a key element for urban and regional development, by supporting the process of cultural recognition and protection of industrial buildings and complexes.

Key words: *Industrial buildings, Heritage, Values, Transformation, Reuse*

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1. INTRODUCTION

The greatest industrial development in Macedonia occurred after World War II, during the socialist period, in spite of the fact that the first industrial capacities appeared at the end of the 19th century. Industrialism impacted the lives and memories of citizens, because of all the changes that brought in the country's economy, architecture, urban planning, education, etc. Industrial buildings are the bearers of this era's history, and as such, they should be preserved, especially if the original production function is discontinued and the building is no longer used [1-2].

A characteristic of industry in Macedonia is the inconsistency in development, whether in relation to time periods, or territorial distribution. There have been constant crises and the process of industrialization was slow, but in the post-war period the volume of industrial production increased by five times compared to the pre-war level. Around the sixties, in addition to Skopje, Tetovo, Bitola, etc. industrial centers were also established in smaller Macedonian cities and the number of employees increased [3].

After the division of the Yugoslav federation, there followed an enormous decline in industrial production. As a result of the crisis, only a portion of industries managed to recover and continue production, the rest faced a continuous decrease that ended with their closure, consequently a large number of industrial abandoned locations appeared, namely brownfields [4,5].

These inactive industrial locations, if left unused for a long time, not only risk decline in their historical and cultural values, but also become dangerous areas within the city. Therefore, adequate management of brownfields is very important, both in terms of the protection of cultural heritage and in the development and planning of the city [5].

In most cases, the buildings are demolished to make way for new ones, without documenting or assessing their potential. But recently, with the growing awareness of the values of industrial heritage and the importance of reuse in today's times, industrial buildings are seen as resources with high potential to receive new urban programs and functions that enable contemporary spatial and economic development.

Although there is proof of the significance and advantages of adaptively reusing existing structures; of the possibilities for transformation that lie in their site area, enormous volumes and structures, there are also many obstacles that must be taken into account. After all, not all buildings are optimized to receive new programs in the future [6].

Several studies claim to identify the barriers that appear during adaptive reuse and strategies to deal with them, however, there is no agreement on the criteria that should be taken into account when evaluating the potential for the future adaptive reuse of structures or how to weigh the criteria in different contexts. This is considered a significant shortcoming in current knowledge [6].

Thus, the objective of this research is to analyze and verify a flexibility assessment tool that helps towards decision-making process for future adaptive reuse of industrial locations in Tetovo.

2. METHODOLOGY

One of the biggest challenges in researching abandoned industrial buildings is the lack of documentation, regardless of whether the buildings remain unused or have taken on new functions, many documents are lost because no one feels responsible for them in the period between new and old use. Consequently, even though archival research (drawings, project documentation, photographs) has been used, as a basic method for heritage protection research, for significant information about the industrial and economic context in Macedonia, numerous books from economic fields have been considered.

After identifying industrial locations through the study of general urban plans, observational research (sketching, measuring, drawing, digital photography) was used to assess the current state of the facilities, spatial quality and the interaction with the surrounding area and community.

To determine the value and capacity of the industrial heritage for further use, many methods have been analyzed. Since according to various studies, flexibility was seen as a key factor that can help or hinder the transformation process, the method used in this research is Flex method.

This method allows to analyze the flexibility and the possibility of reuse. Flex is a method presented by Rob Geraedts and his associates, which breaks down the building into 5 layers: location, structure, skin, services, spatial plan. Each of these layers has its own group of questions that are numerically weighted and valued. The end result is a ranking in flexibility classes from class 1: inflexible, to class 5: very flexible. There are currently several versions of Flex, 1.0 to 4.0; a method combining Flex 2.0 light and Flex 4.0 was used for this research. The selection of the indicators/questions is based on literature research on the most important physical factors in the transformation of industrial capacities, while the assessment of the value is based on the guidelines of Geraedts [7], and the research of Amiri [8].

The data analyzed in this study are communicated and presented through text discussion, tables and figures.

3. TETOVO AND THE DEVELOPMENT OF INDUSTRY

3.1. Historical Analysis of Industry in Tetovo

Tetovo, as a settlement where trade and crafts (weaving, tailoring, soapmaking, carpentry, butchery, saddlery, etc.) take place, was first mentioned in legal documents from 14th century, when this settlement entered the Ottoman Empire. As the main administrative center of Kalkandele vilayet, Tetovo experienced rapid development in the 19th century when the so-called Tanzimat reforms took place, and the Ottoman society wanted to get out of its isolation and catch up with the developed western countries. Many new crafts were developed, shops, schools, religious buildings were opened, and so on. The first data from this period can be found in the many manuscripts of European travelers that passed through the Balkans during this period [9].

After the departure of the Ottoman Empire in 1912, Tetovo's economic and business importance was developing at a fast pace, however, the only industrial capacity was the Polog Mill, built in 1906 along the river Pena. In the upcoming period 1912-1918, Macedonia faced many difficulties as a result of wars. In Tetovo during the interwar period there were 4 industrial facilities and several warehouses for tobacco fermentation. One of these facilities

was Polog Mill, while the other three were: Petar Lekic's cord factory, Mishkovski brothers' leather processing company, and TIAD Hydropower plant. The industrial facilities of this period were mainly built inside the city and along the course of river Pena [10].

The post-war period brought an industrial revolution to Tetovo and Macedonia. By the end of 1947, the physical volume of industrial production had tripled since 1953 and doubled since 1939. Even the old facilities were equipped with new tools to replace or repair outdated or broken ones. Electro-metallurgy, textile and food industries had a leading role in the economic growth of the city of Tetovo. [11] Tetovo had implemented highly efficient actions for the improvement of its industrial companies, among them the most famous were: “Jugohrom”, “Teal”, The factory for medical products, “Teteks”, “Edinstvo” fashion confection, “ZIK”, “Jugotutun”, “Napredok” Printing House, “Nemetali”, “SHIK Jelak”, etc. [12]

The independence of the Republic of Macedonia, after the fall of the Socialist Federal Republic of Yugoslavia, was accompanied by numerous challenges as a result of poor developed infrastructure and a high unemployment rate compared to the former Yugoslav nations [13].

The Macedonian economy began to grow again in 1997, but in 2008, faced the global financial and economic crisis, which spread to the industrial sector. Production was reduced, some facilities were closed, and many employees were laid off. Following the lead of other nations, the Government of the Republic of Macedonia implemented a set of policies aimed at solving the crisis, which turned out to be successful to some extent [14].

3.2. Spatial Analysis of Industry in Tetovo

According to the data from the State Statistics Office, the industry in Tetovo covers the following three areas: A. Mining and quarrying, B. Processing industry and C. Supply of electricity, gas, steam and air conditioning. In 2020, the number of industrial facilities from the processing industry in Tetovo reaches 420, out of a total of 431 industrial enterprises, while the location of these industries is mainly on the outskirts of the city or in the surrounding areas [15].

In the General Urban Plan of the city of Tetovo, of 2003, the industrial sites cover an area of over 600,000 m^2. From the field observations, it was concluded that only a small part of these sites has preserved their primary function, most of them are former industrial sites, which are rented out for industrial or other purposes, and some of the sites (abandoned or partially active) are planned to be demolished for the construction of new buildings.

In this process, not only important documents and data about these sites are lost, but it also happens that the new proposed functions are in conflict with the needs of the community. The position within the city’s structure and the current state of these industrial locations is described in the following illustration.

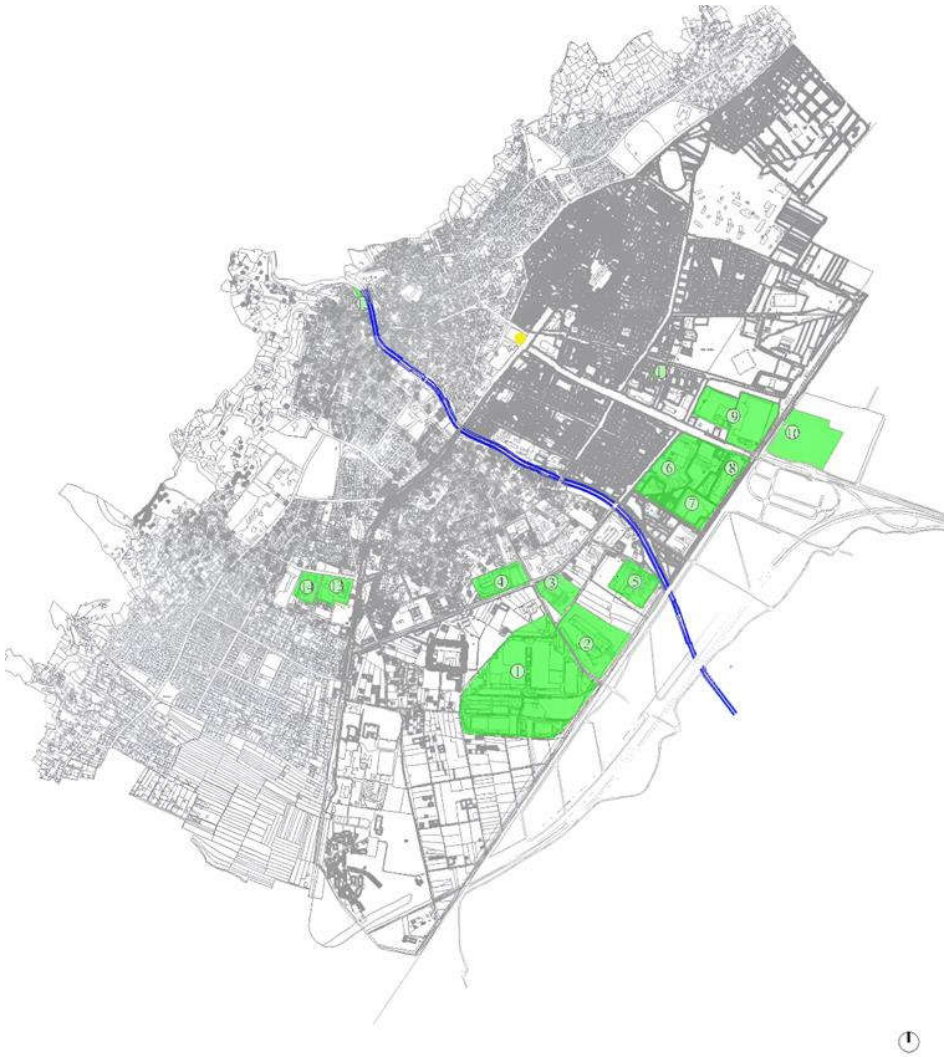

Figure 1. Spatial layout of the industrial locations in Tetovo, by the author
Industrial sites, ===== River, City centre

Many industrial facilities built in the socialist period are located within the city and have the potential to be reused and integrated into the urban fabric. With the passage of time and the change of generations, one can notice their gradual loss from the structure of the city. Today, a small part of the industrial facilities in Tetovo are active or converted, and the others where they still exist are inactive and empty, and their condition is deteriorating while they await a decision on their fate.

The largest industrial site, listed as number 1, TETEKS AD - spans a total land area of 250,000 m^2, with 140,000 m^2 occupied by buildings. The company provides industrial infrastructure, including electricity, technical steam, and rental space available in various sizes. Of the total constructed area of 140,000 m^2, numerous businesses have so far leased a total of approximately 22,000 m^2 of industrial space, 4,000-5,000 m^2 have maintained their primary purpose, while the rest of over 113,000 m^2 is available for rent, suitable for industrial or other functions [16].

Table 1. List of industrial locations in Tetovo

Site number	Site name	Type of industry originally formed	Current state	Site area
1	Todor Cipovski Merjan - TETEKS	Textile industry	Part leased/part for rent	250000 m^2
2	Teal	Electromechanical industry	Active industry	70180 m^2
3	Pofix	Construction industry	Active industry	23000 m^2
4	Edinstvo/ Pofix	Textile industry	Rented (by Pofix - Construction industry), planned to be demolished for construction of new facilities	27500 m^2
5	Godel-Velur	Leather industry	Part leased/part for rent	40000 m^2
6	SHIK Jelak	Wood industry	Inactive	71 000 m^2
7	ZIK	Food industry	Part leased/part for rent	36000 m^2
8	Žito Polog	Food industry	Active industry	20000 m^2
9	Macedonia Tabak	Tobacco industry	Part inactive, part rented (Pofix)	
10	Medical plastics	Chemical industry	Inactive, demolished for construction of new facilities	52000 m^2
11	Printing house Napredok	Graphic industry	Part leased/part for rent	3000 m^2
12	Polog Mill	Food industry	Inactive	3000 m^2
13	Auto progress	Metal industry	Inactive	19000 m^2
14	Nemetali	Construction industry	Rented	13500 m^2

4. TETEKS AND TETOVO

In the period after the Second World War, "Todor Cipovski Merjan" - Teteks employed almost a third of the locals of Tetovo, which by that time was an important industrial center.

Four large factories operated in Teteks: Yarn and Wool Factory built in 1951, Fabric Factory in 1954, Garment Factory in 1963, and Knitwear Factory in 1968. Teteks was a major supplier to the Yugoslav market and abroad. Besides providing fabrics, blankets, suits, coats and jackets, sweaters, pullovers, knitwear sets, uniforms for first responders and other professions, Teteks had its own infrastructure which consisted of various amenities such as own sources of electricity and heat energy, canteen, transportation, an ambulance, its bank, a kindergarten, a bakery, a shop and a showroom for the presentation of products [17].

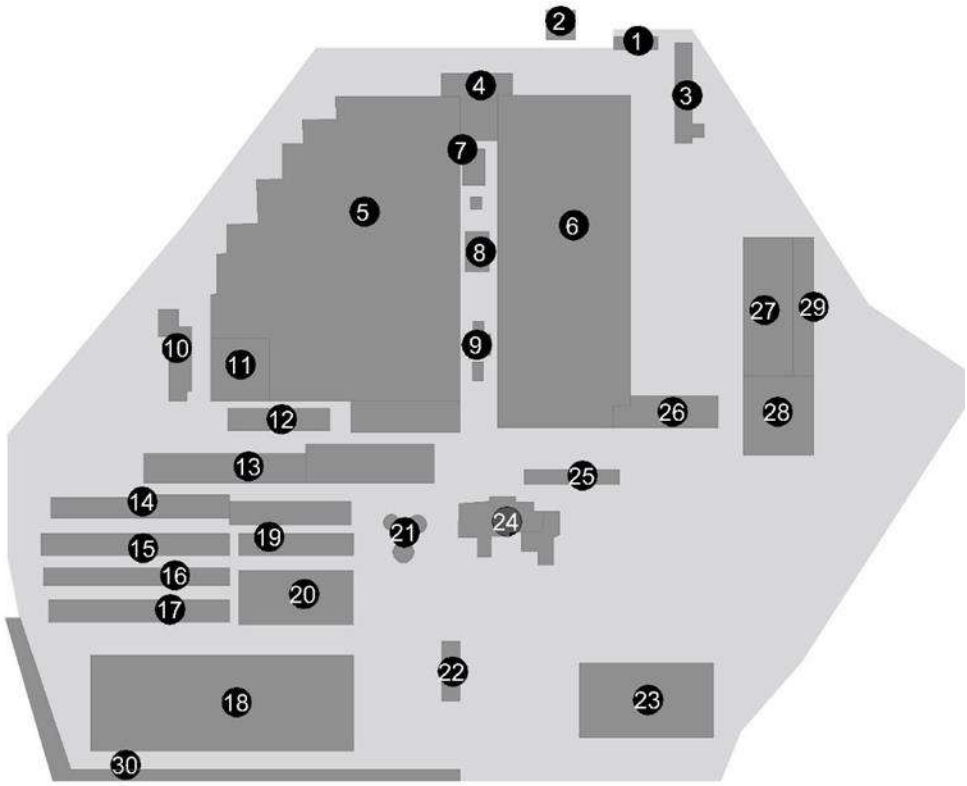

Figure 2. Map of Teteks, by the author

Legend: 1 gate, 2 ambulance, 3 administrative building, 4 canteen, 5 yarn and wool factory, 6 fabric factory/ knitwear factory, 7 telephone central, 8 plumbing and compressor station, 9 substation, 10 administrative building, 11 machine and electrical workshop, 12 technical warehouse, 13 factory and warehouse, 14 bakery and warehouse, 15 metal structures and warehouse, 16 warehouse, 17 warehouse, 18 blanket factory, 19 warehouse for raw materials, 20 regenerate factory, 21 fuel oil tanks, 22 construction operations and warehouse, 23 warehouse, 24 energy centre, 25 garage with workshop, 26 fabrics and knitwear warehouse, 27 garment factory old part, 28 garment factory new part, 29 clothing warehouse, 30 canopy.

In 1970 through 1985, Teteks reached its peak performance participating with 30- 42 percent in production in the Municipality of Tetovo, and employing one third to half of the total number of industrial workers. [15] In June of 1991, Teteks was transformed from a social enterprise into a mixed joint-stock company, with mostly private capital. During this period, the production in China and other countries, negatively impacted the textile production in Macedonia, so despite attempts to survive the crisis, Teteks stopped textile production on 10.02.2020 [16].

Nowadays, the company offers many spaces that can be rented, accompanied by various industrial, technical or technological services, but also maintenance, accounting and printing services [16].

Figure 3. Current situation of Teteks, by the author
Active, Rented, For rent

To define the class of flexibility, architectural plans and direct access to the buildings are necessary, so in this research only 5 objects will be studied in more detail since only for them sufficient data have been found to develop the analyses. The buildings included in this study are:

1. Blanket factory (no.18 in the map)
2. Warehouse for raw materials (no.19 in the map)
3. Warehouse for fabrics and knitwear (no.26 in the map)
4. Yarn and wool factory (no.5 in the map)
5. Fabric factory/ knitwear factory (no.6 in the map)

5. RESULTS- ADAPTIVE CAPACITY OF BUILDINGS THROUGH THE FLEX METHOD

The 5 objects highlighted earlier were analyzed according to the Flex method and based on the result they were categorized into flexibility classes.

First-class of flexibility are objects with very little flexibility that are not suitable for implementing new functions. Second class facilities also show a low flexibility score and adaptation can be realized with greater difficulty. Buildings belonging to the third class are buildings with limited flexibility, that can be repurposed but may not be suitable for all functions. The buildings of the fourth class are objects with good flexibility, which can be easily transformed. Class 5 facilities have high flexibility, with excellent capacity for adjustment.

Table 2. Flexibility class table

Flexibility Class Score Chart	**Range of results**
Class 1: Not flexible at all	17-54
Class 2: Hardly flexible	55-108
Class 3: Limited flexibility	109-163
Class 4: Good flexibility	164-218
Class 5: Excellent flexibility	219-272

Analyzes with the flex method are done by dividing the building into 5 layers where for each layer we have a certain number of indicators that must be evaluated. The weighting value was taken from Amiri's research, [8] while the assessment value was specifically evaluated for each indicator according to the current state of the building and the specifications for evaluation given by Geraedts. [7] The result for each indicator is obtained by multiplying the weighting and assessment value, which are added together and their sum represents the result of flexibility based on which the class can be assigned.

Table 3. The adaptive capacity of Teteks facilities according to the Flex-method

Layer	**Flexibility performance indicator**	Weighting	**Building**									
			1 (no.18 in the map)		2 (no. 19 in the map)		3 (no.26 in the map)		4 (no. 5 in the map)		5 (no. 6 in the map)	
			Assessment	Result	Assessment	Result	Assessment	Result	Assessment	Result	Assessment	Result
Location	1. Does the site have excess undeveloped space?	4	3	**12**	3	**12**	3	**12**	3	**12**	3	**12**
	2. Is the location capable of supporting multiple functions such as offices, housing, care, shops, etc.?	3	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**
Structure	3. What is the free height of the building?	4	4	**16**	4	**16**	4	**16**	4	**16**	4	**16**
	4. To what extent has centralized access to the building been implemented?	2	3	**6**	3	**6**	1	**2**	4	**8**	3	**6**
	5. What is the size of the usable floor area?	3	4	**12**	3	**9**	4	**12**	4	**12**	4	**12**
	6. Do the supporting elements represent an obstacle for adaptation?	3	3	**9**	3	**9**	3	**9**	3	**9**	3	**9**

	7. Is it possible to add new stairs/elevators to the building and reuse the existing ones?	2	3	**6**	2	**4**	3	**6**	3	**6**	3	**6**
	8. What is the shape of the pillars in the building?	1	4	**4**	4	**4**	4	**4**	4	**4**	3	**3**
	9. Is it possible to extend the building horizontally for a new expansion of the user unit?	3	3	**9**	2	**6**	2	**6**	2	**6**	2	**6**
	10. Is it possible to extend the building vertically for new floors or a new basement?	4	1	**8**	2	**8**	2	**8**	2	**8**	2	**8**
	11. Is it possible to set aside part of the building for sale/lease to third parties?	2	4	**8**	3	**6**	4	**8**	4	**8**	3	**6**
Facade	12. How is the thermal and acoustic insulation of the façade?	2	1	**2**	1	**2**	1	**2**	1	**2**	1	**2**
	13. How are the facade openings positioned and shaped?	2	3	**6**	2	**4**	4	**8**	4	**8**	2	**4**
Services	14. Is it possible to adjust: temperature, ventilation, electricity, ICT?	3	2	**6**	2	**6**	2	**6**	2	**6**	2	**6**
	15. Does the building have specific capacity for hot/cold water distribution, treatment, cooling and gas?	4	3	**12**	3	**12**	3	**12**	3	**12**	3	**12**
Space plan	16. To what extent are the internal walls in the building easily replaceable?	4	2	**8**	2	**8**	2	**8**	2	**8**	2	**8**
	17. Is it possible to apply suspended ceilings or raised floors and adapt them to different user requirements?	2	4	**8**	4	**8**	4	**8**	4	**8**	4	**8**
Flexibility result			**144**		**132**		**139**		**145**		**136**	
Flexibility class			**3**		**3**		**3**		**3**		**3**	

Based on the analysis of the adaptive capacity of Teteks, using the flex method, the level of flexibility ranges from 124 to 145, in which case they belong to the third class. These facilities may receive new uses, but may not be suitable for all functions, for this reason they are part of the class of objects with limited adaptive capacity.

6. DISCUSSIONS

Flexibility as one of the most important characteristics of any structure plays a big role in the reuse of industrial heritage, it can even define how much an object or site with industrial heritage has the potential to be reused. The Flex method, chosen for this research, helps to examine the transformation issues at different levels/layers and then obtain the result for the entire object.

According to the analyses presented in Table 3, it is noted that the advantages of the buildings in Teteks are mainly: the potential for mixed use development, where all buildings reach maximum value, the height of the building, which is also accompanied by the possibility of adding suspended ceilings, the size of the usable floor area, and in most cases the shape of the structural elements. As for the disadvantages, although they vary from facility to facility, it is noted that most have difficulties with thermal and acoustic insulation, as well as the ability to expand horizontally or vertically on other floors.

According to the results of this study, it is observed that buildings with similar typology show similar flexibility results, even if their size or shape changes. Yarn and wool factory and Blanket factory show higher flexibility scores compared to warehouses; but all facilities fall into the category of facilities with limited flexibility.

Regarding the evaluation results, it is important to note that it is more than acceptable that the buildings may have limited flexibility because they were formerly designed for specific programs. And while these buildings can adequately meet the needs for which they were created, in the process of adaptive reuse, where we move from one function to another, it is normal for difficulties to arise.

These analyses reveal the capacity for future changes without considering the new functions, and according to some earlier studies, while some buildings may show low results in general flexibility table, their flexibility class may improve when evaluation shifts from a general to a specific type of function. So, in upcoming researches, implementing Flex method with specific indicators, will allow to evaluate of which new programs these buildings show greater levels of flexibility, and define more precisely which new programs can be received by these objects and which cannot.

7. CONCLUSIONS

The industry in Macedonia and in Tetovo developed most intensively after the Second World War. The buildings built during that period are witnesses of the industrial development and contain great historical and cultural values. In recent years, as a result of numerous changes, most of these buildings have remained abandoned and are often in danger of demolition.

In Tetovo there are many buildings from this period, most of which are located within the city and have the potential to be reused and integrated into the urban structure. One of the

locations with the highest industrial values is Teteks, the textile factory, where a significant part of the buildings has been leased, while others are being prepared for this process.

Many methods were studied for the evaluation and reuse of industrial facilities, but also of other types of facilities, and in the end, it was chosen to continue with the Flex method as it allows to define the class of flexibility in existing objects in general, regardless of the new function; or to precisely define whether a building is suitable for a specific new program or not.

By analyzing the location of Teteks and its buildings, it turned out that these facilities are suitable for accepting new functions, but with some limitations. Therefore, further research and analysis are planned according to the latest version of the Flex method (4.0) in order to define which new uses are more suitable for this location.

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