Influence of Urban Renewal on the Assessment of Housing Market in the Context of Smart City Development

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Abstract

The variability of the urban environment, where the symptoms are observed in terms of spatial, aesthetic, architectural, urban and socio-economic development, seems to be relevant to the functioning of the local real estate market. Housing issue is the vital component of sustainable socioeconomic city development. The perception of the property attractiveness is determined by price-setting attributes such as: building standard, area, utilities, zoning and also location and neighbourhood. The attractiveness of the residential property is manifested in its market value. As part of the follow-urban transformation, it seems to be important to reconstruct the impact of the neighbourhood changes on the housing market. The authors attempt to explain the ensuing problem on the example of one of the streets in a Polish city – Kalisz, which over the years has gained a new streetscape and market image. They endeavour to simulate changes in the market value of selected properties located on the street, in order to map the influence of changes on the value.

1. Introduction

Symptoms of changes in the urban environment can be seen in a number of aspects: spatial, aesthetic, architectural, urban and socio-economic. They seem to be relevant to the functioning of local property markets. Perception of property attractiveness by potential buyers depends on evaluation of its vital qualities, the result of which is an objective economic measure – property market value. This value is affected by all relevant market attributes, which in turn affect a particular property.

Under this study, observations focused on revitalization processes in Dobrzecka Street in a Polish city, Kalisz, in 2006-2014. The analysis was accompanied by identification of trends and dynamics of changes in the local property market in Kalisz. The choice of the research object was deliberate – within a few years Dobrzecka Street gained a new aesthetic streetscape and market image.

The main purpose of the study was assumed to be an evaluation and interpretation of the impact of urban transformations upon the economic and social assessment of residential properties. Thus, a possibility was recognized of conscious programming of a sustainable city development taking into account the influence of revitalization processes upon attractiveness of the local property market.

The research procedure employed the principles of a quantity and quality analysis of the property market (including a statistical analysis of phenomenon structure and dynamics), a case study, a comparative analysis, a methodology of property assessment in a comparative approach, a simulation method and a questionnaire. Above

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all, a market survey was conducted to evaluate the level of value changes and related factors used by various social and trade groups during their assessment.

The article sheds new light on contemporary changes in a smart city space. It simultaneously presents two diverse systems for measuring revitalization outcomes: objective analysis of transfer prices and trends on the residential real estate market as well as the perception of changes from the social perspective. This unusual juxtaposition of quantity modeling with the analysis using sociological methods was intentional. The aim was to directly compare factual and socially perceived response of the real estate market to revitalization. Such approach allowed for representation of the perception and response of two groups: those actively involved in the transactions made in the real estate market (investors) as well as the passive users of the domain (observers). The picture obtained as a result, merges two ways of perceiving real estate and its surrounding area – as an economic as well as a social space. The presentation of different reactions of diverse groups of stakeholders helps to better understand and in future better design the changes in space during the process of smart city revitalization.

2. Impact of Changes in the Urban Environment Upon the Property Value

Properties are characterized by interdependence, which means that by possessing a certain image, they affect the surrounding, including properties in the close and more distant neighbourhood [1]. The interdependency in the property market also means spatial and functional interrelations. This kind of interaction is explained by concentration of functions in space, influence exerted by development methods, neighbourhood effects, local site development plans and the power of brand [2], [3].

A diagnosis of the sources and essence of the interdependence first led researchers to consider environmental causes of changes in property values. They analyzed impact of air quality and its pollution upon market listings of flat and house prices [4]. Already then, the term of externalities began to be used, which determine change in attractiveness of individual premises in the property market [5]. The externalities also include relations caused by neighbourhood of specific assets or limitations. Microlocation may mean a potential asset or a negative circumstance affecting the value, depending on the nature and perception of the neighbourhood. Also complexes of properties desired due to popularity, usually improve assessment of their surrounding [6]. The most vivid effects can be observed in commercial property markets where interdependence causes more intense investment activity in the neighbourhood (for instance, IKEA, "Old Brewery: in Poznan, "Manufacture" in Lodz) [1], [2]. It is not only connected with investments in the commercial property market, but also in residential and public properties [7], [8]. Studies of the neighbourhood nature and quality consider presence of organized urban greenery and recreational areas (municipal parks or areas accompanying residential estate

space) [9], [10]. The widely understood public space and its influence on fluctuations of property value or more generally – on neighbourhood assessment – was analyzed referring to several cities in Poland [11], [12]. The said studies prove that among various types of urban public space, centres and representative squares to a large extent determine market aspects of the surrounding development.

In the context of transformations in the property market, a lot of attention is dedicated to space transformations, including revitalization processes. The notion of city revitalization combines both revitalization and gentrification. Variety of forms and conceptions of developing European urban space as part of revitalization projects or gentrification phenomena [13] points to conscious attempts of determining interdependence effects in the property market. What is interesting from the point of view of evaluating phenomena accompanying city revitalization, is in particular reconstruction of the way it affects the residential and commercial property market [14], [15], [16], [17], [18], [19]. The property market plays an important role in attracting both investors and residents. A huge capital consumed by revitalization processes is a barrier to its development. A rapid growth of prices in the property market, especially in the residential one, attracts entities with strong capital which follow a disinvestment strategy (meaning a relatively quick sale at a high price) [20].

The market value is the estimated amount for which an asset or liability should exchange on the valuation date between a willing buyer and a willing seller in an arm's length transaction, after proper marketing and where the parties had each acted knowledgeably, prudently and without compulsion [21]. The market value is a resultant of attractiveness of perception of important property qualities. These qualities comprise attributes related to a particular property (such as a standard and technical condition, usable area, plot area, premises location within a building) and other non-related attributes (such as general location, detailed location, neighbourhood nature and quality, available technical infrastructure, designation in the local site development plan). These attributes, called price determining attributes, are defined each time for a market segment where the assessed property falls in. Weights of individual attributes may be assigned by examining customer preferences in a particular property market or by analyzing transactional prices [22], [23]. Relations between city revitalization or functional and quality surrounding transformations and the property market value in Poland are not exhaustively described; they are still open to preliminary analysis. The development level of domestic residential segment suggests a necessity to carefully examine the phenomenon of transmitting revitalization effects in the property market.

The market value is determined in relation to properties which can be traded. This value is the most probable price that could be obtained on the real estate market, having taken into account the price levels of realized deals, as well as making the following assumptions: the parties are independent from each other, do not act under pressure and

are willing to conclude a deal; the parties have sufficient time to negotiate, according to the market conditions. The market value is determined without taking into consideration the property related sale-and-purchase costs, as well as any additional taxes and fees. One of the approaches to valuating the property is the comparison approach, which is based on immediate comparison against verified market information on transactions, having comparable characteristics, similar to those of the object of valuation [11]. Following a selection of comparable properties, in a similar area and of similar characteristics, similar method of construction and other comparable attributes, the significant similarities and/or differences are established, making adjustments to determine a market price, based on which the estimate value of the real estate under valuation is determined. The comparison approach in Poland has three forms: the method of pairwise comparison; method of average price adjustment; method of statistical market analysis. In this paper we applied average price adjustment method. The method of the average price adjustment makes use of a group of properties, similar in characteristics to the appraised real estate, that have been a subject of market transactions. Under this method an average price adjustment is applied in relation to comparable properties, using weighted coefficients depending on the individual characteristics of the real estate.

3. Changes in the Market Value of Living Premises in Kalisz – a Case Study

Analysis of the Residential Property Market in Kalisz in 2006-2014

The analysis of the residential property market included sale transactions of flats in Kalisz from the beginning of January 2006 to the end of December 2014. The authors analyzed 2,941 market transactions of flats. Between 2006 and 2010, the number of transactions declined, however, in the period considered as crisis in the property market in Poland, it grew. Every second flat sold had an area between 30 sq m and 50 sq m (an average size of a property sold in 2006-2014 in Kalisz was 49 sq m).

By examining unit transactional prices, a trend formula was created for flats sold in Kalisz between 2006-2014. The linear trend function takes the following form:

$$f(x) = 2681x + 2108.81 \qquad (1)$$

The average price of one square metre increased month by month by PLN 0.27 and its theoretical value in the period immediately preceding the analysis, i.e. in December 2005, amounted to PLN 2,108.81. The average increase of residential properties in Kalisz property market in 2006-2014 was found to be 0.39% monthly. Throughout the entire analysis the average unit price reached 2,526 PLN/sq m (Fig. 1).
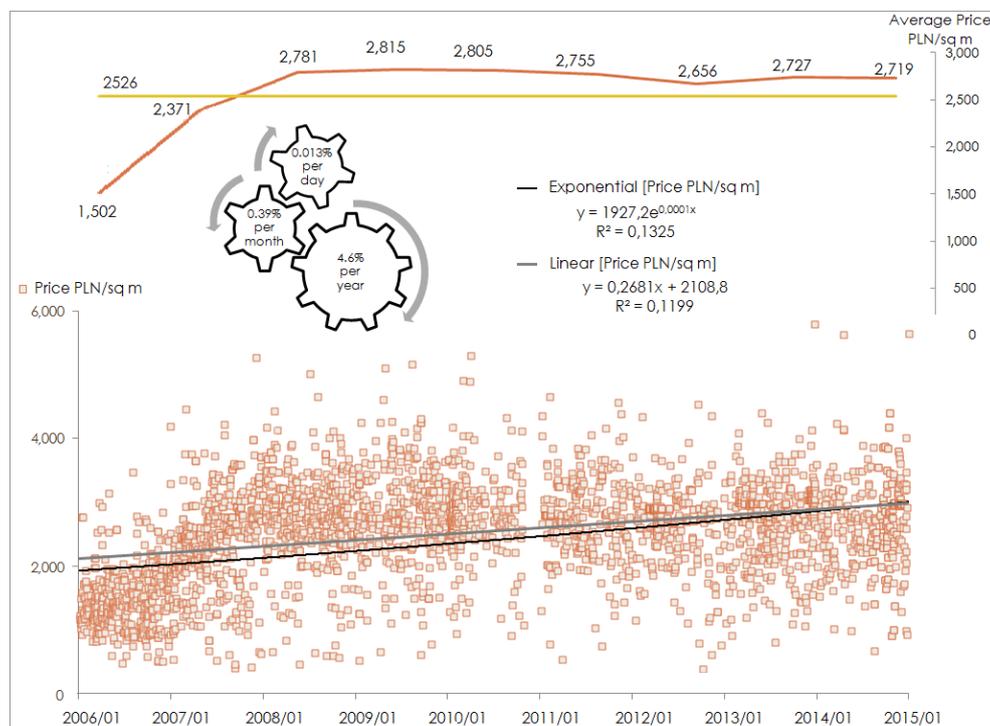

Figure 1. Average Price and Linear and Exponential Price Trends [PLN per sq m] of Flats in Kalisz from 2006 to 2014.

The goodness of fit of the linear trend function is poor. Correlation coefficient R2 equals 11.99%. Similarly, the exponential function explains only 13.25% of individual price variability during the analyzed period. Because of that, a non-linear model was constructed, explaining the individual price variation over time. The best fit proves to be the degree 6 polynomial function, accounting for 30.72% of individual price variability over time. Using this trend function for adjusting the prices for appreciation/depreciation, allows to eliminate at least some of the price differences stemming from the passage of time. Other research [24] confirms the low values (30-35%) of the correlation coefficient, even when using polynomial trend functions. This is due to the heterogeneity of real estate – there are no two identical pieces of real estate. The examined sample of apartments was very diverse. The flats traded ranged from studios to 4-bedroom units, with the surface area starting from 13.7 to 138 m2, located centrally, in-between and in the outskirts, differing in standard, fit-out, condition and other variables influencing the price. Such a high number of real estate attributes with price influence

suggests that the passage of time might not be the dominant factor in this case.

By examining unit transactional prices a polynomial trend formula was created for flats sold in Kalisz between 2006-2014. The trend function takes the following form (coefficients have been rounded):

$$f(x) = 1.49E\ ^{16}x^6 - 1,54E\ ^{12}x^5 + 5.96E\ ^8x^4 - 1.05E\ ^5x^3 + 0.0074x^2 + 0.1171x + 1322.66 \qquad (2)$$

The theoretical value in the period immediately preceding the analysis, i.e. in the end of December 2005, amounted to PLN 1,322.66. The average increase of residential properties in Kalisz property market in 2006-2014 was found to be 0.32% monthly. However, this interpretation does not apply to the price variability within the whole analyzed period – as illustrated by the line of the trend function, the years 2006-2014 recorded both price increases and decreases (Fig. 2).
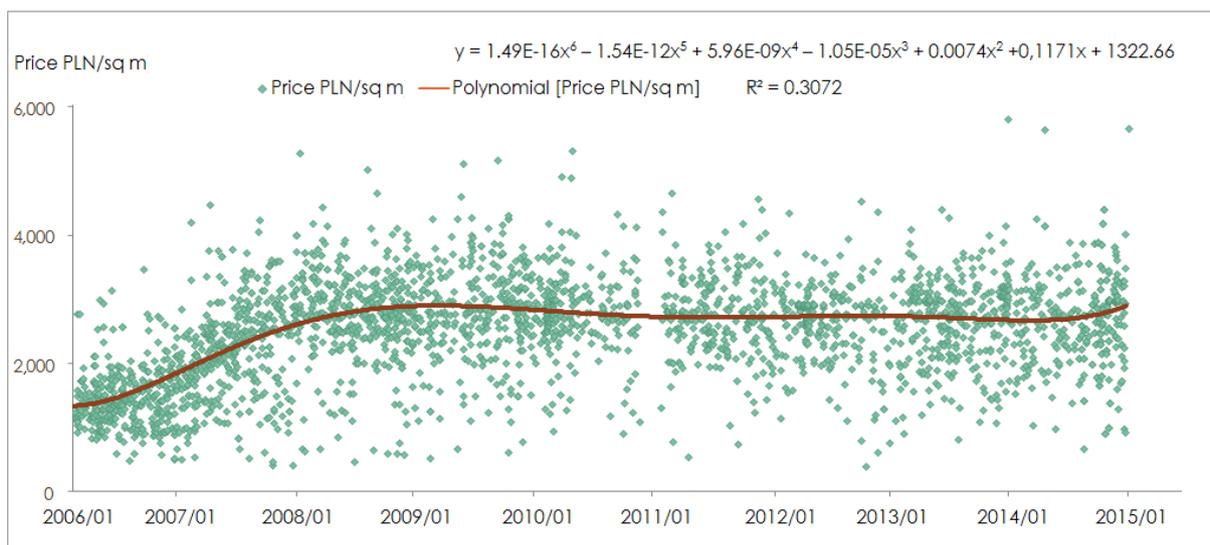

Figure 2. Polynomial Price Trend [PLN per sq m] of Flats in Kalisz from 2006 to 2014.

Characteristics of the Analyzed Area

Dobrzecka Street in Kalisz is about 2.6 km long; it starts near the city centre and reaches the administrative areas of the village of Dobrzec. The name "Dobrzec" goes back to the oldest tradition of this land and bears a large emotional and historical significance. The first mentions of the Dobrzec settlement date to 1280.

The street has a non-homogenous nature. Its beginning consists of multi-family residential buildings which are about one hundred years old, built close to each other. In the post-war years they were confiscated from private owners by the State and at that time they were mostly tenement blocks. They alternate with other buildings: community services (a blood donor station, social aid centre) and

manufacturing (former clothes plant). In its middle section the street is built up with warehouses, engineering and service buildings. The end of Dobrzecka Street crosses the area of the former Dobrzec Village, partly transformed into detached house estates, and partly still settlement and farming areas. A particular attention was paid to transformations in the initial sections of the street. This area has changed its character in years. Tenement houses administrated then and partly now by a municipal company have been regained by previous owners; other ownership transformations have taken place. The first effective action was the change of ownership of a shabby residential building located at 6 Dobrzecka Street. The building was later demolished and in 2006 replaced with a new one.

A similar step aimed at changing the street character, was the replacement of the old residential structure at the junction of Dobrzecka and Poznańska Streets, where one of Kalisz housing associations built the first block of flats in 2005 and the second one in 2008. The obsolete petrol station located at the beginning of the street was dismantled in 2007. In the same year the ownership transformation of the property located at 10 Dobrzecka Street was finalised enabling its general repair.

At the same time, some manufacturing areas, which formerly belonged to KALPO Textile Plant, were – upon announcing the company's bankruptcy – bought out by a local investor (a quasi-developer) and transformed into residential areas. Construction of a block of flats (flats and apartments) began in January 2008 and finished in December 2009. The result was a 37 m tall building of 9 overground and 1 underground storeys and 100 flats. To make room for this building, the manufacturing facility was mostly demolished. The only thing left was a raw structure which was subsequently developed and a few storeys were added.

In 2009 the perpetual administrator (PCK) of the property located at 2 Dobrzecka Street renovated the building, made the façade, replaced the woodwork and roof.

Recently, renovation of the building at 5 Dobrzecka Street was completed. In 2014 the legal status of the property located at 8 Dobrzecka Street was regulated. Currently, the third building joining the two residential houses owned by a housing association is being built.

The legal status of a few of the properties is still unregulated, there have been no inheritance proceedings carried out, they are not entered into the title deeds register (land and mortgage register). The current law does not provide for the option to demolish an unsafe and unsightly old tenement house which is adjacent to an apartment building.

Market Value of the Flats in the Analyzed Area

In order to show changes in values of the flats as a result of positive changes in the surrounding, a flat situated in an old tenement house in Dobrzecka Street in Kalisz was valued. The said flat covering 50.0 sq m is situated on the first floor of a short building, consists of two rooms, a kitchen, a bathroom with a toilet and a hall. Its market value was determined. Transactions connected with non new-build properties were analyzed, which were located close to the flat and were of a similar technical condition and standard. Based on our own analysis and surveys of preferences among potential buyers in property agencies, basic attributes were identified which determine the property's value as well as their percentage weights. The average annual time trend was found to be 4,6% in 2006-2014. Due to non-linearity of the applied trend for price variability, the average value of price variability over time is not an indicator of the future price behavior. Therefore, the transactional prices were corrected due to elapsing time based on the degree 6 polynomial function – see formula (2). Next, transactions

were selected which best correspond to the said flat. For the representative sample, parameters shown in Table 1 were identified.

Table 1. The Parameters of a Representative Sample – Flats in Kalisz in 2006 and 2014 [PLN per sq m].

Parameter	2006		2014	
	Transaction prices	Adjusted (polynomial) prices	Transaction prices	Adjusted (polynomial) prices
Minimum price	489	797	679	725
Average price	1502	2805	2719	2868
Median price	1429	2710	2788	2967
Maximum price	4197	6393	6130	6662
Standard deviation	504	923	704	732
Coefficient of variation	34%	33%	26%	26%

The most important asset in the calculation was comparison of the market value of the same flat in two situations – the former unimproved surrounding (picture of Dobrzecka Street in 2006) and upon the image transformation of the surrounding (picture of Dobrzecka Street in 2014). The property prices which were the reference point in both situations referred to the same moment – 31.12.2014. As a result, it was possible to maintain comparability of all other market conditions. The results of the property assessment were as follows (Fig.3):

- PLN 113,000 before the surrounding changes (2006),
- PLN 128,000 after the surrounding changes (2014).

Interestingly, adjusting of the transaction prices after considering the linear trend function for price variability over time, as per formula (1), may lead to false perception regarding changes in the surroundings of the property being valued. Assuming that the price variability in 2006-2014 was linear, the value of the property with the surroundings as per 2006 and price adjusted for 2014, would amount to PLN 83,000. If the property was valued with the surroundings as per 2014 and price adjusted for 2014, the value would reach PLN 123,000. Refining the methodology of the research through the introduction of the polynomial trend function improved the quality of the model used and allowed for more precise representation of the local real estate market.
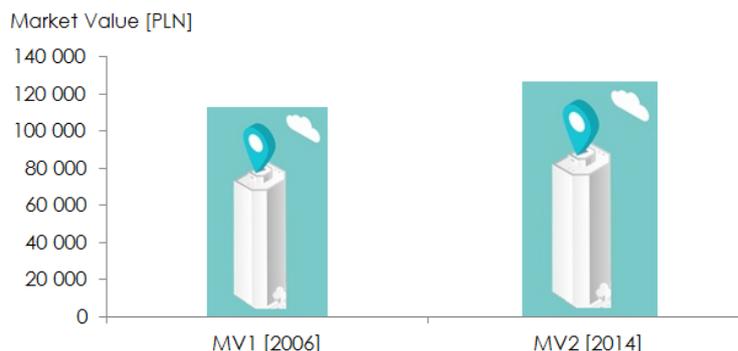
Figure 3. The Value of the Flat According to Its Surrounding in 2006 and 2014 (Prices as on 31.12.2014).

Econometric Modelling of Apartments Value According to their Surroundings

As the issue of surroundings influencing apartments value has not been fully examined, additional study has been carried out, based on the analysis of 2,945 transactions of apartments sold in Kalisz during the years 2006-2014 and the changes in their surroundings which took place at that time. The analysis was carried out on the base of econometric modelling with the use of multiple regression equations. In the chosen procedure, the dependent variables were:

- the transaction price [PLN/sq m] of a flat,
- the adjusted price [PLN/sq m] of a flat.

11 independent variables were initially chosen:

- x_1 – building a block of flats (2 Poznańska Street),
- x_2 – destroying and building a new building (6 Dobrzecka Street),
- x_3 – renovating a building (10 Dobrzecka Street),
- x_4 – destroying a gas station (Dobrzecka-Poznańska corner/beginning of the street),
- x_5 – building a block of flats (2B Poznańska Street),
- x_6 – building a block of flats (16 Dobrzecka Street),
- x_7 – renovating a building (2 Dobrzecka Street),
- x_8 – building a pavement,
- x_9 – renovating a building (5 Dobrzecka Street),
- x_{10} – building a block of flats (2A Poznańska Street),
- x_{11} – change in the legal state of a property enabling its renovation (6 Dobrzecka Street).

After carrying out the consecutive steps of regressive elimination, it occurred that the parameters of the regression function did not show statistical significance. Estimating the equation of relations between the variables could not be written.

Perception of Space Transformation in the Analyzed Area by Kalisz Residents

One of the purposes of the study was to collect information about perception of changes in the urban surrounding by Kalisz residents. The questionnaire asked about feelings and knowledge about changes in the city's image within the last ten years and about the trend, visibility and image transformation of Dobrzecka Street (from Poznańska to Al. Wojska Polskiego Streets). A question was also asked about most likely and desired trends in this area. The survey was designed to recognize and compare knowledge of Kalisz inhabitants about changes in values of the properties located there.

The respondents were Kalisz residents belonging to various groups:

- property market specialists (property agents and property surveyors),
- clerks employed in Kalisz City Office,
- students from The President Stanisław Wojciechowski University School of Applied Sciences in Kalisz,
- inhabitants of Dobrzecka Street,
- passers-by.

Table 2. Number of Surveyed Residents.

No	Trade group	No of respondents	Share in total
1	Specialists	25	6.6%
2	Clerks	70	18.4%
3	Students	43	11.3%
4	Dobrzecka St residents	43	11.3%
5	Passers-by	199	52.4%
	Total	**380**	**100.0%**

Survey Results

The respondents were asked to define the image trend within the last decade for the analyzed section of Dobrzecka Street. The changes were perceived as common, repeatable and lacking outstanding diversity. Furthermore, Dobrzecka

Street was evaluated subjectively – despite the changes – as ugly.

When asked about the degree of changes in the image of Dobrzecka Street over the last 10 years, the respondents most often gave neutral answers as they thought the street's image had changed to some extent (45%). Few (17%) considered the changes as visible.

The survey also examined the knowledge of trends in flat prices in Kalisz. Kalisz citizens were asked about changes in flat prices in Kalisz within the last ten years including Dobrzecka Street. The biggest number of the respondents thought that the prices of flats in Kalisz and in Dobrzecka Street had been stable, however, almost as large a group said the prices went up. Only 4% marked a high increase of the prices in Kalisz – 3% for Dobrzecka Street. As many as 22% of the respondents thought that flat prices had gone down in Kalisz.

Of the 22% who said that flat prices in Kalisz went down, 28% said that flat prices had been stable in Dobrzecka Street, while other 19% thought that in Dobrzecka Street they had gone up. Also every fifth who thought the prices were generally stable in the city, pointed to their rise in Dobrzecka Street.

What is interesting, (compare: Fig. 1) wrong answers about the drop of flat prices in Kalisz within the last 10 years were most frequently given by property agents and clerks. The surveyors, students and passers-by marked the price increase whereas the inhabitants of Dobrzecka Street were convinced of their stabilization.

The respondents were asked to identify which presently existing element is the strongest sign of space changes in the analyzed section of Dobrzecka Street. The block of flats dominated the spontaneous answers. Supported answers were similar. Even though 100 new flats were built in the analyzed vicinity, as many as 16% thought the social structure of the street inhabitants had not changed while 35% thought it had been poor (Fig. 4).
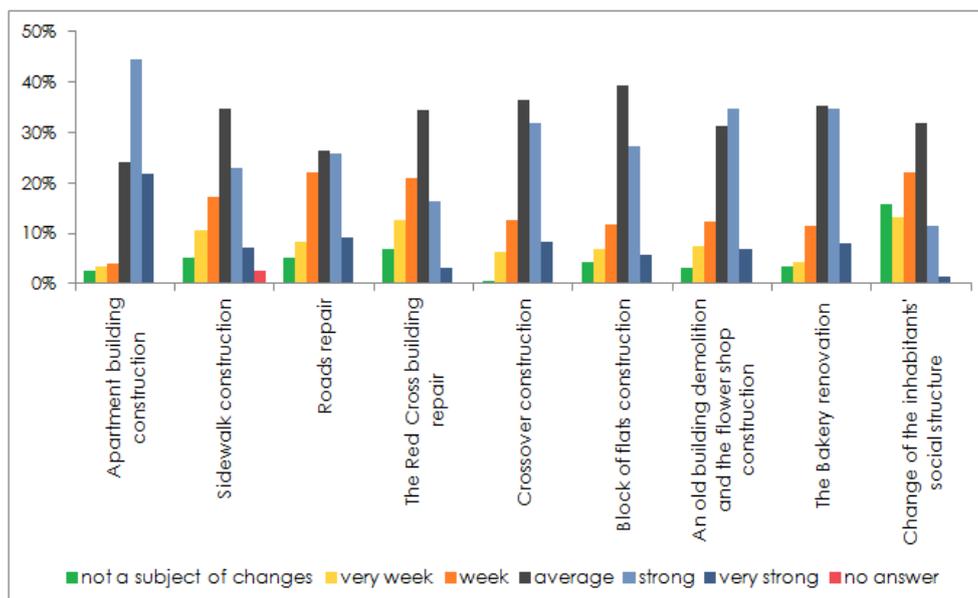

Figure 4. Accents of Changes within Dobrzecka Street.

Next, they were asked about respondent anticipated and desired trends in that area. Spontaneous answers about the desired trends boiled down to two main options:

- renovation of tenement houses,
- development of transportation infrastructure.

Next, the respondents were offered a few variants of answers regarding the change of Dobrzecka image. The respondents considered the majority of the suggested trends as quite or rather unlikely. The highest score was given to further growth of blocks of flats – renovation of tenement houses (p=0.49). On the other hand, construction of tall buildings is regarded as slight less likely (p=0.38). The respondents also pointed to transfer of the current trend to the farther section of the street or adjacent areas as quite probable (p=0.46). The likelihood of growth of commercial and other functions was estimated by the respondents as p=0.38 and p=0.36 respectively.

The last question asked to Kalisz citizens was about their satisfaction with transformations within Dobrzecka street within the last ten years. Most people did not clearly state their attitude to the changes (selected the neutral answer), however, the emotionally burdened answers were mostly positive (Fig. 5). The lowest satisfaction with the changes was shown by property agents and passer-bys; the students are slightly more satisfied. Among the street inhabitants negative scores prevail, which proves their dissatisfaction with the changes.
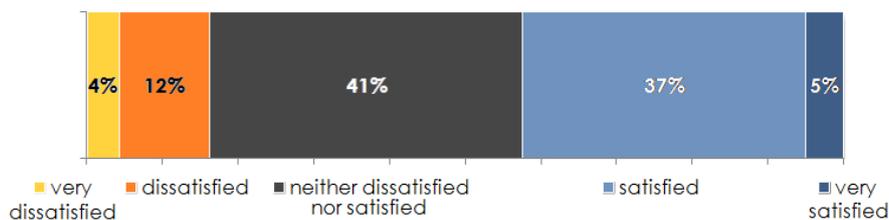
Figure 5. The Level of Satisfaction with the Changes within Dobrzecka Street in the Last Ten Years.

4. Conclusions

The article discusses a new approach to studying contemporary transformation in a smart city space. Measuring the quantitative effects of city revitalization (analysis of transaction prices and trends in the residential real estate market) as well as the qualitative effects (perception of changes in social perspective) allows for comparison of factual and socially perceived response of the real estate market.

The study shows the trends and dynamics of the changes in the market value of the flat located in Kalisz, Dobrzecka Street. This area was subject to urban transformations which in 2006-2014 improved the surrounding quality and image and consequently increased attractiveness of the local flat market.

The flat's market value was defined according to its surrounding in 2006 and 2014. Due to the simulations taking into account various states of attractiveness of the analyzed flat, it was assessed that should the surrounding's condition remain relatively low and typical of 2006, its market value would now amount to PLN 113,000. However, the actual improvement of the neighbourhood's image and quality made the value go up to PLN 128,000. Therefore, in the observed period the real appreciation of the said flat increased approximately by 13%.

This change, arisen as a consequence of the local revitalization, proves a connection between transformations in the space and flat valuation. It illustrates possibilities of stimulating price increase in a property market in areas subject to revitalization.

Consciousness among the respondents of the scale of changes in flat prices is low. They diagnosed the difference slightly higher on the scale for Dobrzecka Street than for the whole city. When asked about desired trends of changes in that area, the respondents indicated a necessity to modify the social structure.

Significance of changes in urban space and their market consequences reaches more strongly and quickly to profiteers who seek to multiply their assets through successful investments. General social consciousness is limited and blurred. Typical space users behave inconsistently – they notice accents, evident signs of

transformations, however, at the same time they say the transformations cannot be easily noticed. They also cannot see a link between changes in the surrounding with prices of flats. In this way, a surprising mechanism was caught of separation between social and market consciousness. This indicates a gap in consciousness or economic competence in the society which is unable to translate significance of physical changes in the space to their market consequences. This phenomenon identifies diverse potential of social consumption of benefits offered by smart city transformation. It is an important factor for consideration to ensure a balanced development of urban areas.

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