22ND ANNUAL PACIFIC-RIM REAL ESTATE SOCIETY CONFERENCE
SUNSHINE COAST, QUEENSLAND, AUSTRALIA 17-20 JANUARY 2016

SUSTAINABLE BUILDING REUSE: UNDERSTANDING USER PREFERENCES FOR THE HOUSING MARKET

B. GLUMAC[1], C. VASILACHE and B. LOWIES

[1]Eindhoven University of Technology

ABSTRACT

Problem/Purpose - Vacant buildings represent an insufficient exploited "gold mine" for future developments. By finding, the future users' preferences, vacant buildings can be reused and could generate a significant contribution towards a more sustainable development within the construction industry.

Design/methodology/approach - Throughout this paper, the environmental, social, and urban benefits of building reuse are presented and a discrete choice experiment is used to indicate the most important attributes and the preferences of the potential future occupants.

Findings - Finally, a decision support tool is created to help real estate developers making better assessments upon choice of vacant building to fit best to future desired end user. Specifically, this study reports on the multiple groups of end users of students and young professionals.

Research limitations/implications - Further research can establish if households with children families reject the proposed housing units due to the size of the household or due to the building reuse. By increasing the size of the housing unit other market segments can be reached and their interest in such redevelopments can be tested.

Originality/value - This paper proposes an operational tool to assess the available alternatives regarding the choice of the vacant buildings to be reused and services to be provided to the end users.

Social Implications - Due to the high contribution to sustainable urban development, building reuse should be encouraged by municipalities, by being cooperative and allowing exceptions from the zoning plan or facilitating legal procedures.

Keywords: sustainability, building reuse, vacancy, discrete choice experiment, housing market, user preferences.

INTRODUCTION

Due to increased focus on sustainability and the current European Union targets to reduce the carbon footprint, the construction sector, as a major energy consumer, should also explore its options towards more sustainable solutions.

There are ongoing research works to investigate how to significantly reduce the consumption of energy and material flows in the building industry. In residential buildings, embodied energy in the building process represents between 30 and 100% (for passive houses) of total life cycle energy consumption. That is why, the adaptive reuse of existing building stock that has reached the end of its useful life, but not its physical life, is an important ingredient in the necessary change of the building industry in order to diminish its impact on the environment and to conserve valuable resources for the future.

Vacant buildings represent an insufficient exploited “gold mine” for future developments. By finding the future users preferences, vacant buildings can be reused and can generate a significant contribution towards a more sustainable development within the construction industry.

When considering sustainability performances, the environmental benefits of building reuse are obvious from waste management and embodied energy perspective, but there are other two major factors that must be taken into account. These are the economic and social development in terms of its life cycle performance. Building vacancy is an emergent problem of our society with repercussions not only on environmental level but on economic and social levels too. This research hopes to elucidate the specific attributes that would lead to success and increased feasibility of a building reuse project. Decreasing vacancy and encouraging developers to consider building reuse, as viable solution prior to demolition and new build, will lead to a more sustainable built environment.

Successful reuse and preventing vacancy in the building’s new life must be ensured by uncovering users’ preferences on specific attributes. Revealing attributes and quantifying their importance according to potential future occupants’ preferences is the key to a sustainable reuse project that will prevent further future vacancy.

This paper comprises of four main blocks: a literature study, a case study, a discrete choice experiment and results analysis and conclusion. By focusing on buildings reuse contribution to sustainability and current state of vacancy in the Netherlands and Eindhoven, the literature study tries to answer the question: Why does building reuse matter? Considering current market trends, a solution for diminishing the increasing levels of vacancy is proposed. The case study is researching Eindhoven’s potential for building reuse. Using the results of this case study and the market situation, a discrete choice experiment aims at finding future users’ preferences. This is a market research using an online questionnaire, specially developed to give insight on possible future users expectations. The last part of the paper analyses the results of the market research, a conclusion is drawn and recommendations are made.

PROBLEM DEFINITION AND RESEARCH QUESTION

According to statistics by 2030 more than 80% of the global population will live in cities. Inevitably, this puts a substantial pressure on urban land use, especially as, over time, the built environment becomes obsolete and needs replacing. By regenerating previously developed buildings to maximize the use of existing resources, the increasing pressure on urban areas can be answered. Of course this is not sufficient to solve such a great emergent problem, as urban agglomeration, but it makes the best out of the available inner city means and can diminish urban sprawl. The focus of the adaptive reuse of vacant buildings is on the ones from urban areas, justified by the high land value and the increasing losses caused by their vacancy.

"*The existence of unused buildings represents an underutilization of city resources, a missed opportunity for forms of urban development that might, with simple yet often untried technical solutions, make effective use of physical resources. These buildings represent a negative feature for the idea of the sustainable community*." (Ball, 2010). Reuse of an existing structure may be a project's major sustainable feature. But finding the right structure for reuse that also meets users' preferences in terms of location and attributes is the challenge.

Coping with vacancy by transformation into housing is the main issue of this research as the transformation of structurally vacant buildings may offer a solution to the tight Dutch housing market. This leads to the main research question:

What type of building is best suited to fulfill customer preferences in a building reuse project developed for the housing market?

During this research the focus is on building reuse for housing purposes. Both industrial and office buildings are tested against user preferences in order to asses which one proves to be best fitted for the new use.

In order to better understand vacancy coping possibilities, other sub questions are answered: What are the contributions of building reuse towards sustainability within the construction sector? What is the targeted market segment? What are the main attributes that future users look for in a reuse building project developed for the housing market?

ADAPTIVE REUSE OF BUILDINGS

'Adaptive reuse is a process that changes a disused or ineffective item into a new item that can be used for a purpose other than which it was built or designed for.' (DEH, 2004) While old buildings become unsuitable for their programmatic requirements, as progress in technology, politics and economics moves faster than the built environment, adaptive reuse comes in as a sustainable option for the reclamation of sites. In many situations, the types of buildings most likely to become subjects of adaptive reuse include industrial buildings, as cities become gentrified and the process of manufacture moves away from city; political buildings, such as palaces and buildings which cannot support current and future visitors of the site; and community buildings such as churches or schools where the use has changed over time.

Adaptive reuse is seen as an effective way of reducing urban sprawl and environmental impact of the build environment. By reusing an existing structure within a site, the energy required to create these spaces is lessened, as is the material waste that comes from destroying old sites and rebuilding using new materials. Through adaptive reuse, old, unoccupied buildings can become suitable sites for many different types of use.

There are often several criteria for deciding whether a building should be conserved and reused or just demolished, these generally concern historical and social value of the site, natural ecological condition of the site and potential for reuse of the structure, as in potential damage, and building's character and fitness for the new use.

Building reuse contribution to sustainability

Contribution of building reuse to a sustainable environment must be regarded from environmental, economical and socio-cultural points of view.

Economical benefits of building reuse

While economical benefits are still being debated, due to unforeseen expenses or costly interventions in order to update old buildings to current standards; the environmental and social ones are obvious. An important debate currently running in the building industry concerns the relative costs and related benefits and constraints of reuse versus new build. Adaptive reuse may not be an economically viable option when the structure of a building requires extensive strengthening to be undertaken. Also, the presence of contaminations by substances or other materials, such as asbestos, and nonconformance with current governmental health and safety standards can become barriers for adaptive reuse.

Environmental benefits of building reuse

One of the environmental benefits of building reuse is diminishing urban sprawl by maximizing the use of inner city resources, thus preserving greenfields.

Another environmental benefit of building reuse, compared to demolish and new build, is the preservation of the embodied energy of the building. In residential buildings, embodied energy in the building process represents between 30 and 100% (for passive houses) of total life cycle energy consumption. The total life cycle energy consumption is made up of embodied energy and operational energy. Operational energy is the energy requirement of the building during its life from commissioning to demolition (not including maintenance or renovations). The embodied energy is the energy required to construct and maintain the premises. A brick wall for example, consists of the energy required to make the bricks, transport them to site, lay them, plaster them and (if necessary) paint and re-plaster over the life of the wall.

The reuse of building components is an alternative for the reduction of construction and demolition waste when renovating and demolishing buildings. By performing building deconstruction, the recovery of building parts as functional components such as bricks, windows, tiles is enabled. This is different from traditional demolitions in which parts are transformed into amorphous materials. The energy used in producing building materials corresponds to a considerable amount of the total energy consumed during the building life cycle, thus reusing and recycling buildings parts result in an energy saving that cannot be ignored.

But still, the most energy efficient solution considering the lifecycle of a building, with smallest environmental impact, is the reuse of the building, incorporating reuse of materials, components and forms of the building. The remaining parts of the building can be reused and form a new existence, together with the additions. This way, hardly energy is required to keep the materials in the built environment. With a rehabilitation design, there are always subtractions and additions. This process can be even forward improved by reducing the unnecessary subtractions and by minimizing additions. Further on, by not extracting natural resources for the additions, the designer will be preventing and preserving the natural resources.

Social benefits of building reuse

For society, vacancy presents problems of insecurity and social uncertainty and may bring about criminality ranging from vandalism and graffiti to break-ins, illegal occupancy and fires. Abandoned buildings are often unattractive, and it is not just the building itself, but their surrounding grounds too, and they affect other properties within a neighborhood by lowering property values, having a negative effect on community and neighborhood aesthetics. Other negative impact of vacancy on social level may concern purely economic aspects of well being as they trigger loss in tax revenues for the community as a whole. By adaptive reuse of these buildings, negative impacts are removed and replaced by the benefits of new developments. Also, adaptive reuse can restore and maintain the heritage significance of a building and help to ensure its survival.

Current vacancy levels

Though it seems unrealistic for a densely populated country like Netherlands, to face vacancy, the numbers are increasing day by day, for example: a farm a day, two churches a week and so on. (Vacant NL, 2010)

In Netherlands, on industrial level there is 3.5% vacancy, leading to above 9 million sqm of vacant estate; for office 14.6% vacancy, which is considerably higher than 8% assumed normal on a healthy property market and resulting in almost 8 million sqm of vacant property; and for retail there is a 5.9% vacancy rate resulting in almost 2 million sqm.

The research is focusing on office and industrial buildings, as they generate the highest amount of vacant estate.

In Eindhoven, the office market has 13% vacancy rate, below the national level and still decreasing, and a 9% vacancy for industrial property, the second highest vacancy rate in Netherlands, with continuous increasing tendency (DTZ, 2013).

Proposed solutions

When faced with vacancy, property owners have 5 different options of coping with this problem. Preservation and waiting for better times to come, thus generating maintenance costs and susceptibility of the building to vandalism, squatting and degradation. Renovation or upgrading, resulting in disruption of building use and income of revenues, might be expensive and does not guarantee the influx of new users if vacancy is due to location characteristics. Selling, on a lower price than initially expected, because selling vacant building results in smaller prices than for a fully occupied one. Demolishment and new build, which is an expensive solution and a waste of materials if the building is in a good state. Transformation/reuse of the building, resulting in disruption of use for a shorter period, but must also consider that location is suited for the new use.

Considering the tight Dutch housing market and the continuous migration toward urban areas, vacant buildings are proposed for reuse to support the increasing housing demand and as an adjoining solution to urban sprawl.

In Netherlands, the shortage of dwellings is approximately 2.5% of the total housing stock and with the increasing number of households (CBS, 2010) and a large part of the housing stock that needs to be replaced, will lead to an increase of demand if the production of housing is not speeded. According to CBS, the number of persons per household is changed, from an average of 3.93 person/household in 1950 to 2.18 person/household nowadays and a predicted further decrease to 2.09 persons by the year 2040 (CBS, 2005; CBS, 2015b). With the highest increasing percentage (3,5%) for housing price in the last seven years and still increasing yearly number of a single households (0,5%) in the Netherlands (CBS, 2015a; CBS, 2015b). Following this trend, the demand for single occupancy dwellings (like e.g. apartments) will increase.

Transformation of structurally vacant buildings into housing can help balance the housing supply and at the same time create redevelopment possibilities for these buildings of which the current function no longer satisfies market demands.

In such a tight housing market, newcomers have a difficult time finding accommodation. So the target groups are composed of lower income groups like students and starters, singles or couples. Smaller housing units developed for starters, can also be suitable for elderly, so they are also included as possible market segments.

BUILDING REUSE POTENTIAL IN EINDHOVEN

In order to test Eindhoven's potential for building reuse, a list of vacant buildings was created using information from RealNext (2013) and Funda-in-Business (2013). Obviously not all vacant buildings are suitable for redevelopment into housing and through literature a wide variety of tools and instruments have been developed in order to analyze buildings’ transformation potential and feasibility using a range of criteria.

Wilkinson, James and Reed (2009) made an extensive literature study about the attributes identified in previous researches considering risks which need to be acknowledged and managed in reuse projects. These building adaptation criteria are summarized as age, condition, depth of the building, envelope and cladding, structure, building services, internal layout, flexibility for a range of differing uses and functional equipment, purpose of the built buildings, location, perceived heritage value, size, accessibility, proactive policy making/legislation (planning and building codes including fire), acoustic separation, user demand and site conditions. (Wilkinson, James, & Reed, 2009)

The adaptive reuse potential (ARP) is a conceptual framework, which requires an estimate of the expected physical life of the building and the current age of the building, both reported in years. It also requires an assessment of physical, economic, functional, technological, social and legal obsolescence. Here the economic variable is tightly related to the geographic location of the building relative to a major city, central business district or other primary market or business hub (Langston, 2012).

There is also a 10 performance criteria tool developed and used to assess the level of satisfaction that a residential building can offer to its users, developed by Ilesanmi (2010). These criteria concern: external visual quality of buildings, maintenance quality of buildings, structural quality of buildings, detailing quality of buildings (doors, windows, ceilings, roofing members), quality of building services and, quality of estate roads, quality of landscaping, quality of semi-public open spaces, quality of environmental layout, quality of the location. The first five criteria relate to the buildings, while the next five deal with their location. They cover aesthetic, functional and technical quality. (Ilesanmi, 2010)

In its book on building adaptation, James Douglas (2006) published a series of checklists developed by Building Research Establishment (BRE), BRE Good Building Guides. These checklists focus mainly on the buildings characteristics and their potential of transformation, and do not approach the location or neighborhood characteristics. (Douglas, 2006)

For this study only a quick-scan is used to select the case studies, using an adaptation of the “transformation meter” developed by Geraedts and Van der Voordt (2003) (2007) (Remøy & Voordt, 2007). This tool, initially developed for office buildings, uses physical aspects of buildings and their location in order to estimate their value and suitability for housing, also considering organizational and market aspects. While most of the aspects related to the internal building characteristics can be modified, the location criteria can be the source to a negative transformation advice. For transformation to be a feasible way of coping with structural vacancy, location criteria should be met. It must also be taken into consideration that the financial feasibility of the transformation projects varies greatly depending on the targeted market segment.

The initial list was filtered using aspects related to location and building characteristics, like floor height and building depth, which were unanimously considered most important throughout literature.

Location is the most important, as it is the only aspect about the building that can’t be modified no matter the amount of investment. If located in the city centre, in housing areas or on the edges of such areas, they have high possibility of suitability for transformation into housing, while transformation of buildings in mono-functional parks will need further consideration, as they need to be considered on a large scale urban area development. Other aspects related to location that must be considered are pollution, noise, air-quality, travel time, parking possibilities, level of facilities and services in or near the location, green area and the mix of functions are the most important.

From building characteristics point of view, structures must provide the minimum allowable floor height for housing units and their depth must allow day light inside the dwelling.

Taking these aspects into consideration, a final list with a total of 11 buildings with reuse potential was created, showing that Eindhoven has high potential for such redevelopments.

DISCRETE CHOICE EXPERIMENT

The discrete choice approach requires that a representative sample of customers make choices in simulated situations derived from realistic variations of market offerings. Performing a discrete choice model experiment typically comprises of three steps. First, using market assessment, case studies, industry data, literature reviews and other information sources, a list of drivers that are believed to influence customers' decisions is compiled. Once the list of choice drivers, attributes, is finalized, experimental design techniques are used to develop many realistic versions of alternative offerings. Next, choice experiments are constructed that ask respondents to select one out of two or more alternatives available to them in a series of choice sets. In the final phase, econometric models based on responses from a representative sample of potential future customers are used to identify empirical key patterns in the survey responses, providing a relative weighting, for each attribute and its levels. Developers and managers can then select the optimal combination of attributes to develop a profitable and sustainable value proposition that, under normal competitive constraints, will maximally leverage their available resources (Verma & al, 2009).

For the market research, an online questionnaire was developed both in English and Dutch, and it was distributed through social media. All respondents were presented with a scenario, developed according to the targeted market segment. Because the target market consists of lower income groups, the housing units are for rent and the energy label is B, in order to keep the redevelopment costs and also the rent prices lower. All housing units have parking and are easily accessible, as required for the selection of the case studies in Eindhoven.

The attributes used were: type of housing unit, surface of the dwelling, price that was defined in relation to the distance to city center, availability of private outdoor, furnishing and type of building.

Attributes	Levels	Explanation
Housing unit	Studio One bedroom	Partitioning of floor space: Living, dining and bedroom combined (open floor plan) Apartment with separate bedroom
Surface (in sqm)	30-49 sqm 50-75 sqm 76-100 sqm	Total surface of the housing unit
Price (€/sqm)	9-12 €/sqm 13-16 €/sqm 17-20 €/sqm	Rent price according to distance to city center: 9-12 €/sqm for 2.5-4.5 km to city center 13-16 €/sqm for 1.1-2.4 km to city center 17-20 €/sqm for 0-1 km to city center
Private outdoor	None Balcony Garden	Availability of private outdoor: none, balcony or garden
Furnishing	Unfurnished Semi-furnished Fully furnished	Only kitchen furniture Kitchen plus basics (bed, table with chairs and wardrob All amenities (washing machine, microwave and so on)
Building type	Office Industrial	The initial use of the building

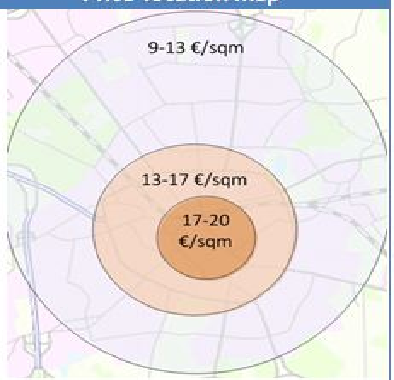


Figure 1. Researched attributes and their levels

Building type attribute was introduce because it was of interest to see how the initial use of the building affects the decision of the respondents, as building type can influence not only the exterior appearance of the building but also the internal layout and the character of the housing unit. If respondents reject a certain building type, this has a great influence on the number of buildings suitable for housing transformation that Eindhoven has to offer.

Respondents were presented with 8 choice sets each consisting of two alternatives and a "no choice" alternative.

Features	Alternative I	Alternative II	None
Housing unit	*One bedroom*	*Studio*	
Surface	*50-75 sqm*	*50-75 sqm*	
Price	*13-16 euro/sqm*	*13-16 euro/sqm*	
Private outdoor	*None*	*Garden*	
Furnishing	*Fully furnished*	*Semi-furnished*	

Figure 2. Example of choice set

Next to the discrete choice questions, respondents were asked to answer some questions regarding their socio-demographic characteristics (SDC), stating their age and size of the household, in order to generate interest groups. Though our target group consisted of singles or couples, many respondents with households with children took part in the survey.

IDENTIFYING GROUP PREFERENCES

Data collection

The data was gathered using Berg Enquête System © 2007, an on-line survey tool. The survey was open to the public from the 29/04/2013 to 31/05/2013 and was promoted on social media like Facebook and LinkedIn. The questionnaires, both Dutch and English versions, were accessed by 464 persons leading to a total of 233 complete responses. The result is satisfactory as it is above the settled threshold of 200 respondents.

Response rate

The Dutch questionnaire had a 59% of completed questionnaires while the English one had a 44% success rate, leading to an overall above 50%. The response rate is satisfactory considering the short data collection period and the lack of financial tradeoffs offered to respondents.

Data cleaning

All incomplete questionnaires were rejected and after a data consistency check, out of the 233 complete questionnaires, 3 more had to be rejected. Considering data quality, the respondents that chose only the "no choice" alternative were not rejected as they were either part of the 33-64 age group or families with children, and their lack of interest for small housing units is easily justified.

Respondents characteristics

All respondents were asked to answer some questions regarding their socio-demographic characteristics (SDC), stating their age and size of the household, in order to generate interest groups. Though our target group consisted of singles or couples, many respondents with households with children took part in the survey (Table 1).

Table 1**. Respondents socio-demographic characteristics**

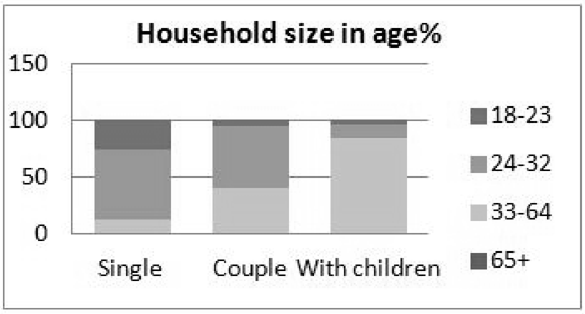
Age group	Total respondents	Single	Couple	With children
65+	2*	1*	1*	0*
33-64	87	11*	33	43
24-32	110	59	45	6*

18-23	31	24	5*	2*
Total	230	95	84	51

*socio-demographic groups unable to be modeled due to very low respondents rate

The representative group of respondents with children (between the ages of 33 and 64) also has the biggest percentage of “no choice” responses: 16,4% of their total answers. But, as expected, they are the least probable to be interested in the small housing units.

The minimum number of respondents of 30 was reached for all age cathegories except the 65+ group (Fig. 3), where only 2 respondents addressed the questionnaire. As an extemption from the 30 respondents rule, the 18-23 single group will be modeled though it has only 24 respondents, as it is one of the interest groups for this study.



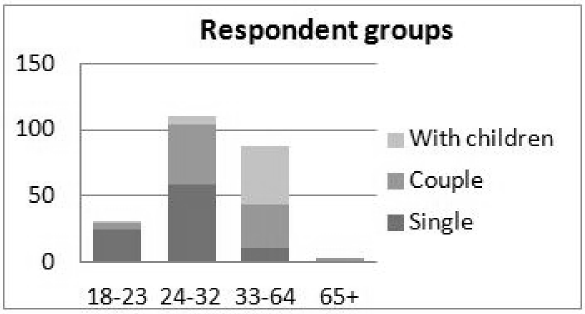


Figure 3. Graphic representations of respondents by age and household size

Model estimates

Collected data is used to generate five potential target groups (Fig. 4) capturing their age and household size: 18-24 singles, corresponding to students; 25-32 singles and couples, corresponding to starters; and 33-64 couples and families with children, corresponding to adults.

MNL model is used to analyze the general attitude towards the presented alternatives was modeled (Fig. 4). This varies from + to -, showing that age group 33-64, couples or with children, are not interested in these type of developments, while younger age groups show a high level of acceptance. This was expected as adult families were not part of the targeted groups. A positive outcome is that the targeted groups, students, young singles and couples, have a positive attitude towards this type of redevelopment. Further on, only the targeted market segments are analyzed.

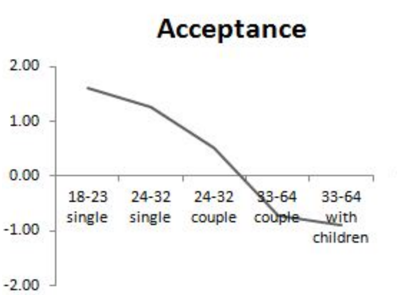


Figure 4. Acceptance

Further, fig. 5 represents the preferences for each attribute level by 3 targeted market segments that had general positive acceptance (Fig. 4) for this type of housing. Here the non-linearity of the estimated attributes levels is highly visible, and so are the differences in preferences between groups.

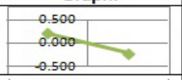
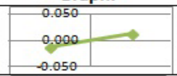
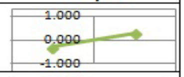
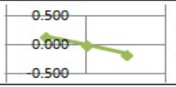
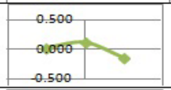
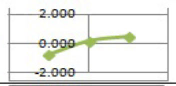
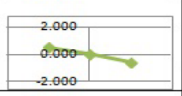
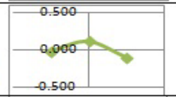
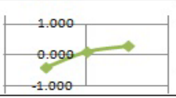
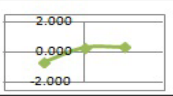
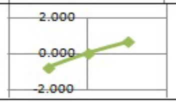
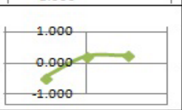
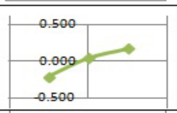
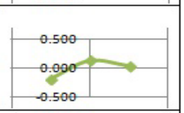
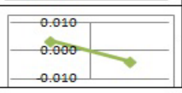
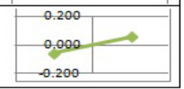
		18-23	Single		24-32	Single		24-32	Couple	
Attribute	Level	Coeff.	Sig.	Graph.	Coeff.	Sig.	Graph.	Coeff.	Sig.	Graph.
Housing unit	Studio	0.216			-0.013			-0.288		
	One bedroom	-0.216	0.079		0.013	0.853		0.288	0.001	
Surface	30-49 sqm	0.147			0.024			-0.691		
	50-75 sqm	0.005	0.974		0.119	0.187		0.202	0.069	
	76-100 sqm	-0.151	0.375		-0.143	0.172		0.489	0.000	
Price	9-12 €/sqm	0.518			0.418			-0.018		
	13-16 €/sqm	0.055	0.696		-0.054	0.565		0.120	0.293	
	17-20 €/sqm	-0.574	0.002		-0.364	0.002		-0.102	0.457	
Private outdoor	None	-0.400			-0.658			-0.745		
	Balcony	0.110	0.431		0.314	0.000		0.066	0.544	
	Garden	0.290	0.073		0.344	0.001		0.679	0.000	
Furnishing	Unfurnished	-0465			-0.210			-0.181		
	Semi furnished	0.218	0.159		0.041	0.663		0.133	0.237	
	Fully furnished	0.247	0.159		0.169	0.109		0.048	0.713	
Building type	Office	0.004			-0.100			-0.058		
	Industrial	-0.004	0.975		0.100	0.136		0.058	0.482	

Figure 5. Market preferences estimated by MNL

For students, or low income singles, the most significant attribute is price. This target group is looking for the cheapest housing possibility, with a preference for studios. The availability of a garden is also an important factor for this group, as it is for all groups within this model

For starters, 24 to 32 years-old singles, the acceptance is lower than for the previous group, but still high. Price and private outdoor are statistically significant, with similar preference for either balcony or garden.

Young couples with two incomes, have the lowest positive acceptance level, but still show a positive attitude towards these renting units. They are more interested in the division of the housing unit (with preference for separate bedroom), bigger surface and private outdoor, with an obvious preference for garden. For this group, price is not among the outmost significant attributes.

The results of the MNL model can be easily incorporated into a decision support system (DSS) so that the impact of changes in the levels of attributes on choice shares can be predicted. Also tradeoffs in different attributes levels can be tested in order to find the most attractive solution, or to test market competition. By introducing data of different alternatives, probabilities or utilities generated by them can be predicted

CONCLUSION AND DISCUSSIONS

From the discrete choice experiment it resulted that the targeted market segments (18-23 singles, 24-32 singles and couples) are open to the idea of living in reused buildings, rejecting neither industrial nor office ones. The fact that none of the industrial or office buildings are considered as a negative feature of the redevelopment represents a positive outcome as it results in an increase of the number of buildings that can be considered for transformation.

Due to the high contribution to sustainable urban development, building reuse should be encouraged by municipalities, by being cooperative and allowing exceptions from the zoning plan or facilitating legal procedures. Another way for municipalities to encourage such redevelopments is by limiting access for developers to greenfields, and forcing them to look for project opportunities within the city boundaries and by lowering land lease for vacant buildings.

Further research can be developed to establish if adult families reject the proposed housing units due to the size of the household or due to the building reuse. By increasing the size of the housing unit other market segments can be reached and their interest in such redevelopments can be tested.

Another implication of the findings of this research can be the development of a integrated support tool that assists developers in choosing the best structure for reuse, by acknowledging not only the best solution from the investor's point of view (building transformation potential), but the future users' preferences as well.

Taking into consideration that society is changing in a faster rhythm than the build environment, architects should develop buildings that are easily adaptable, thus buildings should be regarded not as a finished product, but as an ongoing process as part of a dynamic built environment.

REFERENCES

Ball, R. (2010). *Developers, regeneration and sustainability issues in the reuse of vacant industrial buildings*. Building Research & Information , 140-148.

DEH. (2004). *Preserving our past, building our future.* Melbourne: Commonwealth of Australia-Department of the Environment and Heritage.

DTZ. (2013). *The Netherlands, a national picture.* Amsterdam, the Netherlands: DTZ Zadelhoff, Research.

Douglas, J. (2006). *Building adaptation*. Oxford, UK: Elsevier Ltd.

CBS (2005). *Jaarrapport integratie 2005*. Den Haag, the Netherlands: CBS.

CBS (2010). *Bevolking; kerncijfers naar diverse kenmerken*. Den Haag, the Netherlands: CBS.

CBS (2015a). *Construction and housing*. Retrieved from http://www.cbs.nl/en-GB/menu/themas/bouwen-wonen/nieuws/default.htm.

CBS (2015b). *Population*. Retrieved from http://statline.cbs.nl/StatWeb/publication/?VW=T&DM=SLEN&PA=37296eng&LA=EN.

Harmsen, H. (2008). *De Oude Kaart van Nederland*. Den Haag: Atelier Rijksbouwmeester.

Ilesanmi, A. O. (2010). *Post-occupancy evaluation and residents' satisfaction with public housing in Lagos, Nigeria.* Journal of Building Appraisal, vol. 6 , 153-169.

Langston, C. (2012). *Validation of the adaptive reuse potential (ARP) model using iconCUR*. Facilities, vol. 30 , 105-123.

Opoku, R. A., & Abdul-Muhmin, A. G. (2010). *Housing preferences and attribute importance among low-income consumers in Saudi Arabia.* Habitat International 34, 219-227.

REMØY, H. T. (2010). PhD thesis: *Out of Office*. Deft, Delft Technical University.

Verma, R., & al., e. (2009). *Predicting customer choice in services using discrete choice analysis*. IBM Systems Jurnal, vol 47 , 179-191.

Wilkinson, S. J., James, K., & Reed, R. (2009). *Using building adaptation to deliver sustainability in Australia*. Structural Survey, vol. 27, 46-61.

Email contact: brano.glumac@gmail.com