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SUSTAINABLE DEVELOPMENT OF HOUSING IN POLAND – PSYCHOLOGICAL FACTORS VERSUS ECONOMIC CHOICES IN THE MARKET IN TERMS OF THE NEED FOR CONTACT WITH THE GOODS OF NATURE AND THE GOODS OF CIVILISATION AT THE PLACE OF RESIDENCE

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ABSTRACT: This study investigates the social impact of developer-promoted trends in real estate and their influence on consumer housing preferences, focusing on the need for both nature and urban amenities in urban residences (cities > 50,000). In order to answer the research question posed, survey and statistical analyses were carried out using the IBM SPSS Statistics 27 package. With its help, an analysis of basic descriptive statistics, exploratory PCA analysis with reliability test, Student's t test, Mann-Whitney U test, Pearson's r correlation analysis, analysis of variance, classification-regression trees (CRT) and ROC curve analysis were performed. The findings can contribute to a better understanding of this phenomenon and inform social design in architecture, considering user preferences for designed spaces.

KEYWORDS: housing preferences, social aspect, need for contact with nature and civilised goods

Introduction

Housing offers directed by developers can influence the decisions made in the choice of housing and thus have a social impact, secondarily shaping the real estate market. Since the late 1990s, the real estate market in Poland has seen a trend among developers promoting the choice of a place to live in an area that allows quick access to civilisation goods. It is only in the last few years that this trend is beginning to change, and access to or proximity to nature is becoming increasingly important.

The development of the residential real estate market increasingly reflects individual human needs. Nowadays, in highly developed countries, social design or participative design is already standard. It determines a person's personal preferences regarding the use of designed spaces (Sanoff, 1999) and determines housing choices. Important elements of it are the opportunities created by the progress of civilisation and the mutual relationship between man and nature (Laposa & Mueller, 2017). The need for contact with the goods of civilisation and with the goods of nature in the place of residence is understood as an aroused motivation to take advantage of the opportunities created by nature and the development of civilisation in man's pursuit of bio-psycho-social well-being. However, it should be borne in mind that these individual needs may be shaped by trends promoted by real estate developers. Consumers' choices would thus be a manifestation of the developers' social influence, understood as a change in a person's beliefs, thoughts and feelings, as well as attitudes or behaviour, resulting from interaction with another person or group of people (Rashotte, 2007).

In the literature on residential real estate market analysis and the economic and psychological determinants of housing choice (Yongsheng, 2022), there is a lack of research describing what role developers' housing strategies and actions play in consumer choices. This is a particularly important question because of the importance that developers play in shaping the residential real estate market and meeting the growing need of urban residents for a green environment where they live (Stankowska & Stankowska-Mazur, 2022).

Accordingly, the purpose of the research presented in this chapter is to verify whether the trends promoted by developers in the real estate market have a social impact and can explain consumers' housing preferences. To this end, research hypothesis H: It is assumed that the decisions and actions of developers exert social influence on consumers' housing choices.

Therefore, verification of the hypothesis posed requires verification of which human needs change over the course of life and development (Smykowski, 2019, 2020) and are of greatest importance to residents of large cities. As well as whether they can be the result of the social influence of real estate developers or rather whether they are the result of individual human needs, which developers notice and respond to.

An overview of the literature – factors determining a person's housing choices

The literature indicates that people's housing choices are determined mainly by four factors (Rameshkkumar et al., 2024; Łaszek et al., 2018; Laposa & Mueller, 2017; Kazak et al., 2017; Kanak, 2014; Malinowska, 2012; Gostkowska-Drzewicka, 2010; Kałkowski, 2003; Śliwa, 2022):

1) demographic and social – changes in the lifestyle of the population – number of marriages, fertility, population, labour migration, consumer needs and preferences,
2) resource-based (including supply, availability of construction land, gross monthly wages in the economy (PWC, 2019), market competitiveness,
3) economic (including GDP per capita, economic prosperity, inflation interest rates, availability of housing loans),
4) instrumental and legal (state interventionism, legal conditions, taxation, market privatisation) (Zaremba, 2009).

Thus, these factors can be linked to the functioning of the housing market in the economic, political, legal and social environment (Bryx, 2006). However, the housing market is treated as a segment separate from the real estate market because of the function that housing plays in people's lives (Nykiel, 2008). Because of this function, the development of the real estate market is largely determined by factors of a social nature, including consumer preferences and consumption patterns

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(Łaszek, 2004). The literature argues that the relatively invariable factors influencing housing demand, in addition to price, cost of living and household income, include such non-economic factors of choice as location, housing area, number of rooms, distance from work, access to the city centre, standard of housing, housing density, green areas, access to care and education centres and services and commerce (Brueckner, 2011; Bryk, 2019; Collen & Hoekstra, 2021; Głuszak & Małkowska, 2017; Nanda, 2019; Schirmer et al., 2014; Berrill et al., 2024; Hanni & Rao, 2024). The 2018 survey of developers indicates (Powichrowska & Prokopiuk, 2019), for example, that the location of a development has a strong influence on consumers' choice of offerings (66.7%). Among the factors determining the choices of those who prefer city centres are access to urban infrastructure and faster commute to work and school. On the other hand, the choices of apartments on the outskirts of cities are influenced by such factors as peace and quiet and the opportunity to commune with nature (Powichrowska & Prokopiuk, 2019; Berrill et al., 2024; Hanni & Rao, 2024).

However, one cannot disregard the fact that people's preferences can change when activities carried out outside the home are moved into the home (Robinson & McIntosh, 2022; García-Lamarca et al., 2022), which happened as a result of the COVID-19 pandemic. Restrictions and limitations imposed to curb the spread of COVID-19 caused people to be confined to their homes. Domestic spaces, which had previously been a refuge and a place of relaxation for many, have expanded their functions. The introduction of remote working and learning, the closure of public facilities and restrictions on the use of green spaces have naturally resulted in increased time spent indoors. It has thus become a daily occurrence to make some significant and more permanent changes in the way we use our homes. Such a situation undoubtedly may have reinforced health[1] concerns indicating that the lack of adequate spaces for work, study, exercise and privacy in the apartment can cause higher levels of stress and ultimately affect the well-being of residents (Redlich et al., 1997; Wang et al., 2022; Palmquist & Claeson, 2022; Söderholm et al., 2016). These concerns have triggered a number of social and economic changes (Nicola et al., 2020), as they have forced people to suddenly adapt to new situations and challenges in daily functioning on an individual and social level. It is presumed that urban residents have particularly experienced these concerns due to restrictions on movement that have confined them to their homes for weeks at a time while significantly blocking their contact with other people, urban infrastructure and with nature.

Attention to the environmental qualities of life and their consequences for physical and mental health, long before the pandemic, has sparked interest in the functional aspects of architectural and urban design. An important element of these is the reciprocal relationship between man and nature with the inclusion of green areas. This is partly the result of a shift away from treating nature solely in utilitarian terms. This is because it is no longer seen solely as a source of raw materials, a commodity use of resources and an object of exploitation. It is increasingly treated as a partner in all its forms (DuPuis & Greenberg, 2019), a relationship with it as one of the basic values of human life, and contact with it as an indispensable element of human well-being (Stankowska-Mazur, 2022).

Abraham et al. (2007) conducted a thorough meta-analysis of available research results in the area of the influence of the surrounding natural landscape on human physical and mental health. Their review of the literature allowed them to conclude that human well-being is conceptually linked to six components. The researchers found that in the area of the component:

1) ecological – a positive effect on the health of human contact with nature is observed; health is affected by landscape elements such as noise, sounds and weather,
2) aesthetic – pro-health urban design is observed,
3) physical – the influence of environmental areas on physical activity is observed; landscape areas designed and perceived to be conducive to physical activity influence the real level of physical activity,
4) psychological – the influence of natural environmental landscapes on human effectiveness in coping with stress and mental fatigue, as well as mental well-being and the experience of mental disorders is observed,
5) social – it is observed that green spaces increase a person's social involvement in the functioning of his environment and enhance the sense of social integration,

[1] According to the WHO (1946) definition, health is understood as physical, mental and social well-being.

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6) educational – it is observed that green urban landscapes and rural landscapes have a positive impact on the motor, cognitive, emotional and social development of children and adolescents.

Sideris E. (2021) checked, for example, the effect of distance of residence from green areas on the prevalence of selected diseases. They proved that Dutch patients living more than one kilometre from green spaces had a higher prevalence of 15 of the 24 diseases highlighted in the analysis. They further proved that proximity to green spaces was particularly important for children and those of lower socioeconomic status. In both groups, a significantly lower incidence rate was revealed among those who had more green areas within a 1-kilometer radius of their residence. Song et al. (2016) verified how city residents are affected by walking in an urban park and walking in a non-green area of the city. The researchers proved that walking in the park in spring increases the activity of the parasympathetic nervous system (its activity increases in situations of relaxation and rest), inhibits the activity of the sympathetic nervous system (responsible for mobilising the body, for example, in situations of stress) and reduces the heart rate. At the same time, they confirmed that the effect persists regardless of the season (the experiment was repeated in autumn and winter), and the undertaken activity carried out among greenery shows physiological relaxation effects. Cackowski and Nasar (2003), on the other hand, verified the effect of landscaped areas on levels of frustration and aggression. They concluded that urban greenery, such as parks and urban vegetation, increases frustration tolerance.

The cited data are directly related to the concept of "green building" or "green city", which has evolved over the years and has gained a new dimension with the growth of environmental awareness. In its current form, it already stems directly from the principles of sustainable development and is written into the strategies of urban development (Powichrowska & Prokopiuk, 2019; DuPuis & Greenberg, 2019; Gould & Lewis, 2017). It focuses primarily on urban greenery, which has a positive impact on the climate and environment and plays an important role in the lives of city residents. As pointed out in the report (Global Compact, 2022), the green environment of buildings, together with a suitable interior, improves the quality of life and prevents the appearance of Sick Building Syndrome – SBS (Redlich et al., 1997; Wang et al., 2022) or Building-Related Illness – BRI (Palmquist & Claeson, 2022; Söderholm et al., 2016).

Research methods

Recruitment of participants and study procedure

The presented analysis of results is part of a project launched after the first wave of the pandemic in Poland (from September 2020). The empirical material used in this chapter was obtained between April 2021 and September 2021.

It was measured using an online survey questionnaire, examining respondents' preferences regarding the need for contact with natural and civilised goods in their place of residence and socio-demographic metrics. The survey invitation was posted on social media and university websites. At the same time, a snowball method was used, i.e., a non-random sampling method involving the recruitment of participants by other participants. The choice of method and technique for selecting respondents was dictated by the difficulty of reaching people surveyed during the pandemic period. Recruiting participants by other participants in the study, moreover, made it possible to reach respondents more quickly. The need to reach respondents quickly was primarily due to the planned period of data collection (after the third wave of the pandemic, but still the beginning of the announced fourth wave). The criterion for inclusion in the study sample was the age of the respondent above 18 years and residence in a city with a population of more than 50,000 in Poland.

Of the collected responses from 524 respondents residing in cities with more than 50 thousand residents, 233 completely completed questionnaires were used for further analysis. Due to the desire to capture the specifics of the revealed preferences after the third wave of the pandemic, but before the beginning of the announced fourth wave in Poland, it was decided to complete the collection of results and analyse the responses obtained. The data collected on this basis may consequently not be representative of the country as a whole but nevertheless allowed for the establishment of relevant conclusions.

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Research tools

Preferences regarding the need for contact with the goods of nature and the goods of civilisation at the place of residence were estimated using closed questions. Preferences were assessed retrospectively (before the COVID-19 pandemic) and at the time of the survey (after the third wave of COVID-19 in Poland). In the first part, respondents were asked, among other things, how important it was to them before the onset of the pandemic to live in a place with varying degrees of contact with the goods of nature and the goods of civilisation. Participants responded on a 3-point scale (1 – "not important/not very important," 2 – "don't know/have no opinion," 3 – "important/very important"). In the second part, respondents were asked to identify their preferences in these areas at the time of the survey, i.e. after experiencing the third wave of the pandemic.

The need for contact with nature's goods was determined by respondents' assessment of how important it is for them to be close to natural and urban green spaces, to have a garden next to their home and an off-site plot, to have a green view outside their window, and to have access to a private outdoor space like a balcony or terrace. The need for contact with the goods of civilisation was determined by assessing how important it is for respondents to have close proximity of their place of residence to government offices, health care institutions, educational institutions, cultural centres, sports and recreation centres, places of religious worship, small shopping facilities and shopping centres, and the need for proximity to neighbours.

Using questions in the personal questions section, gender, age, place of origin, number of children, income, access to one's own garden and the distance of one's current residence to natural and urban green spaces were determined.

In order to answer the research questions posed, statistical analyses were carried out using the IBM SPSS Statistics 27 package. With its help, an analysis of basic descriptive statistics, exploratory PCA analysis with reliability test, Student's t test, Mann-Whitney U test, Pearson's r correlation analysis, analysis of variance, classification-regression trees (CRT) and ROC curve analysis were performed. The significance level in this chapter was considered to be $\alpha = 0.05$.

Study participants

The study group (Table 1) included 233 urban residents (52.40% of whom are male), aged 25-56 (M = 34, SD = 7.9). The overwhelming majority of respondents came from urban backgrounds (68.20%) and had an income of more than PLN 3501 per person. Among the respondents, 59.65% of parents (with the largest group being those with one child – 30.43%) and 40.34% of those without children. The largest group of respondents on the day of the survey resided at a distance of more than 1.1 kilometres from natural green areas, such as meadows forests (59.23%) and at a distance of 0.51 to 1.0 kilometres from urban green areas, such as parks, squares, urban gardens (63.95%). Only less than 17% of respondents have their own garden next to their house or apartment.

Table 1. Selected socio-economic characteristics of the sample (N = 233)

Category	Variable	N	%
gender	male	122	52.40
	female	111	47.60
age	25-30	64	27.47
	31-35	69	29.61
	36-40	35	15.02
	41-50	41	17.60
	50-56	24	10.30
place of origin	village	74	31.80
	city	159	68.20

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Category	Variable	N	%
number of children	childless	94	40.34
	persons with 1 child	71	30.47
	persons with 2 and more children	68	29.18
access to own garden	I have a garden	39	16.70
	I do not have a garden	194	83.30
income per capita [PLN/person]	to 2500	23	9.90
	2501-3500	100	42.90
	above 3501	110	47.20
distance of residence from natural green areas	0.5 km	19	8.15
	0.51-1.0 km	99	42.49
	1.1-3.0 km	34	14.59
	above 3 km	81	34.76
distance of residence from urban green spaces	do 0.5 km	77	33.05
	0.51-1.0 km	138	59.23
	above 1.1 km	18	7.73

Results of the research

In the survey, respondents were asked in what direction they subjectively believe social influence in the real estate market is taking. The largest group holds the belief that developers determine what is most desired by residents at the current moment or even "force" the choice of the dominant need through the decision to locate the development (50%). 44% of respondents point in the opposite direction, i.e. they recognise that it is the developers who adjust their investments to the needs revealed by home buyers (Table 2).

Table 2. Assessing the impact of developers on individual consumer housing decisions

I think the trends promoted by developers:	quantity	%
fit in with people's revealed general needs for a place to live, because developers adapt their investments to the revealed needs of residents	102	44
influence people's decisions in choosing where to live, as they determine what is most „trendy", desirable and fashionable at the current moment	88	38
‚force' the dominant need related to the place of residence by having to choose a place from the offer presented	27	12
have no influence on people in choosing where to live	16	7
Total	233	

The results obtained became the basis for an attempt to identify the direction of social influence and verify the factors determining choices. Taking into account the above-mentioned knowledge presented in the literature, indicating four main groups of factors determining the decisions of consumers of the residential real estate market, the focus was on the analysis of selected demographic and social factors. Respondents were asked what guided them before the pandemic when they made their choice about where to live. The results presented in Table 3 show that for the largest group of respondents, it was price (33%). The remaining responses indicated individual preferences, but only proximity to the city centre and its amenities exceeded 26%.

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Table 3. Main criterion for choosing a place to live before the pandemic

Criterion for selection of residence before the COVID-19 pandemic	quantity	%
price	77	33
proximity to the city center and its amenities	61	26
the possibility of contact with other people (neighbors, social groups, distant family)	40	17
proximity to natural green areas (forests, meadows, lakes, floodplains, etc.).	24	10
the standard of the apartment/house	19	8
access to public transport	12	5
Total	233	

Respondents were also asked to assess what, besides price, they would be guided by if they were deciding to change their place of residence at the time of the survey. The results (Table 4) showed that the dominant selection criterion would be proximity to natural (38%) and urban (31%) green areas. Not a single respondent considered the availability of government offices and commercial facilities.

Respondents also responded to a request to imagine what would become the main selection criterion if the pandemic still restricted mobility and contact with people for many months or years. Such a perspective affected the evaluation of respondents, in whom the preference for proximity to natural green spaces dropped significantly (to 19%). The need for proximity to urban green spaces did not change. However, the need for proximity to sports and recreation centres (22%) and education and schooling (16%), among others, increased.

Table 4. Criteria for choice of residence on the day of the survey and in the future

Main selection criterion excluding price	Evaluation after the experience of the third wave of the pandemic COVID-19		Evaluation of the choice if the pandemic would still restrict free operation for a long period of time	
	quantity	%	quantity	%
proximity to natural green areas (forests. meadows. lakes. floodplains. etc.).	89	38	44	19
Proximity to urban green spaces (parks. squares. gyms / outdoor playgrounds. etc.)	72	31	72	31
proximity to neighbors	17	7	25	11
proximity to government offices	0	0	0	0
proximity to cultural centers (community centers, theaters, museums, etc.)	12	5	2	1
proximity to sports and recreation centers (sports halls. sports clubs. places for individual or team training)	22	9	51	22
proximity to shopping facilities	0	0	0	0
proximity to education and schooling	15	6	38	16
proximity to places of religious worship	6	3	1	0
Total	233		233	

Pandemic and individual choice preferences

In order to verify what factors may be important for the constancy or change of individual choice preferences, respondents' answers were compared in terms of the need for contact in their place of residence with the goods of civilization and the goods of nature in the period before the pandemic and after the third wave of the pandemic.

The results (Table 5) allow us to observe that the need for contact with natural goods increased in all the variables assessed, compared to the assessment of these needs before the pandemic. The

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most frequently rated as either important or very important was access to a private outdoor space of the following type: balcony or terrace (87.55%) and proximity to natural green spaces (81.97), which saw the largest increase of more than 54% – proximity to natural green areas. Among the surveyed variables related to the availability of civilisation goods, there were no longer such pronounced changes. The importance of proximity to cultural and healthcare centres decreased slightly compared to the pre-pandemic assessment, and the importance of access to government offices, places of worship and sports and recreation centres also increased slightly. There was, however, a marked change in the need for proximity to shopping centres and small retail facilities. Prior to the pandemic, access to shopping centres was important to 63.95% of people, while it was important to only 6.87% during the pandemic experience. In contrast, the need for proximity to small shopping facilities was considered either important or very important by 31.76% of respondents before the pandemic, while during the pandemic, it was already considered important by 60.09%. It was further observed that preferences for the need for neighbours had changed. In the pre-pandemic period, almost 67% of respondents declared the need to have neighbours in close proximity. During the pandemic period, more than 71% already indicated a need for neighbours, but at a greater distance.

Table 5. Preferences for the need for contact with the goods of civilisation and the goods of nature before and during the pandemic

The need for proximity to selected goods of civilization and nature	Value	Before the pandemic COVID-19		During the COVID-19 pandemic	
		quantity	N%	quantity	N%
proximity to neighbors	no need for neighbors	0	0.00	1	0.43
	the need to have neighbors in close proximity	156	66.95	66	28.33
	the need to have neighbors at a greater distance	77	33.05	166	71.24
proximity to government offices	not important/not very important	144	48.93	110	47.21
	I have no opinion	59	25.32	62	26.61
	important/very important	60	25.75	61	26.18
proximity to cultural centers	not important/not very important	0	0.00	12	5.15
	I have no opinion	178	76.39	174	74.68
	important/very important	55	23.61	47	20.17
proximity to education and schooling	not important/not very important	100	42.92	100	42.92
	important/very important	133	57.08	133	57.08
proximity to places of worship	not important/not very important	148	63.52	130	55.79
	I have no opinion	14	6.01	30	12.88
	important/very important	71	30.47	73	31.33
proximity to health care centers	not important/not very important	75	32.19	8	3.43
	I have no opinion	86	36.91	154	66.09
	important/very important	72	31.90	71	30.47
proximity to shopping centers	not important/not very important	22	9.44	72	30.90
	I have no opinion	62	26.61	145	62.23
	important/very important	149	63.95	16	6.87
proximity to small shopping facilities	not important/not very important	78	33.48	18	7.73
	I have no opinion	81	34.76	75	32.19
	important/very important	74	31.76	140	60.09

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The need for proximity to selected goods of civilization and nature	Value	Before the pandemic COVID-19		During the COVID-19 pandemic	
		quantity	N%	quantity	N%
proximity to sports and recreation centers	not important/not very important	104	44.64	118	50.64
	I have no opinion	63	27.04	35	15.02
	important/very important	66	28.33	80	34.33
proximity to natural green areas	not important/not very important	142	60.94	9	3.86
	I have no opinion	27	11.59	33	14.16
	important/very important	64	27.47	191	81.97
proximity to urban green areas	not important/not very important	9	3.86	2	0.86
	I have no opinion	198	84.98	101	43.35
	important/very important	26	11.16	130	55.79
access to private outdoor space such as a balcony or terrace	not important/not very important	42	18.03	29	12.45
	important/very important	191	81.97	204	87.55
green view outside the window	not important/not very important	53	22.75	3	1.29
	I have no opinion	134	57.51	133	57.08
	important/very important	46	19.74	97	41.63
own plot of land outside the residence	not important/not very important	126	54.08	97	41.63
	important/very important	107	45.92	136	58.37
own garden by the house	not important/not very important	147	63.09	124	53.22
	I have no opinion	65	27.90	26	11.16
	important/very important	21	9.01	83	35.62

Having children and housing decisions

As a result of the data obtained, the authors of the study decided to verify whether there were factors determining the changes shown. Among the results analysed, it was revealed that having children may be important in housing decisions in terms of the need for contact with the goods of civilisation.

Classification-regression tree (CRT) analysis was used to test whether having children is related to residence choice, and cross-validation was used in the analysis (figure 1 – model 1), I added an indication in the text. Six independent variables were used in the model: proximity to neighbours, government offices, cultural centres, places of worship, health care centres, shopping centres, small commercial facilities, sports and recreation centres, and education centres. Detailed data are provided in Table 6 and 7 Figure 1 and 3.

Table 6. Tree quality analysis

Observed	No children	1 child	2 or more children	Sensitivity
No children	94	0	0	100.0%
1 child	5	62	4	87.3%
2 or more children	1	55	12	17.6%
			Traficability	72.1%

Relevance – Percentage of correct classifications.
Sensitivity – Percentage of correctly classified positive cases.

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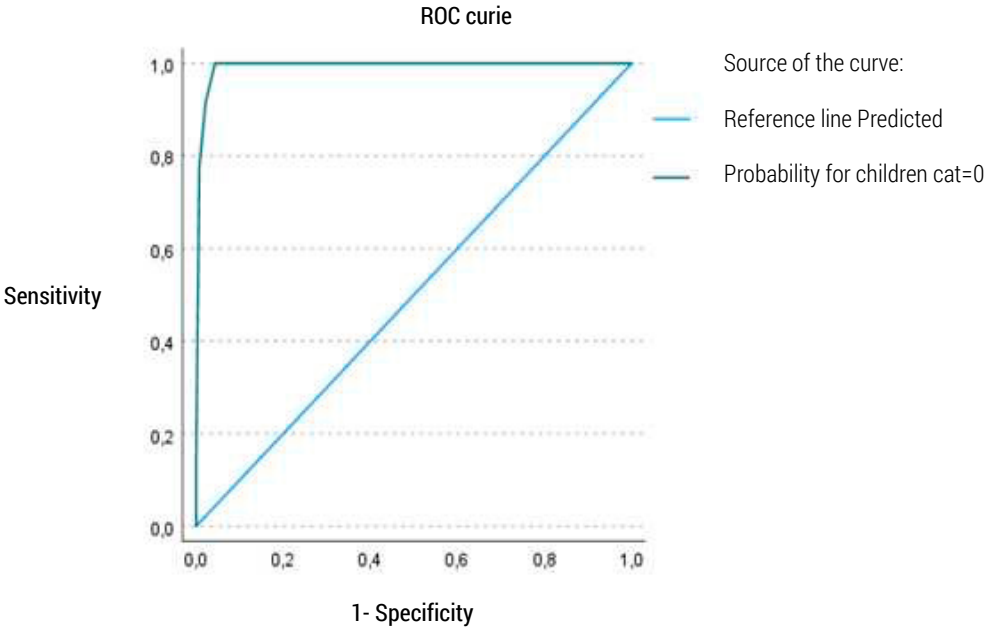

Figure 1. ROC curve for the decision tree model 1

The tree quality analysis shows good power. The certainty of the forecast is 72.1% for the entire model. Figure 1 shows the ROC curve (Reciever Operating Characteristic), graphically presenting the relationship between the specificity and sensitivity of the test calculated for childless individuals. The measure of test accuracy (Area Under the Curve – AUC) for the analysed model is 99.3%.

The results of the analysis based on decision trees can be seen in Figure 1. Decision rules are designed here in the root, branch and leaf views. However, considering the validity of the predictors (Figure 2), it is noticeable that the predictor's proximity to educational and educational centres completely determines the course of the tree. Therefore, in order to observe the validity of the other variables, the first component (predictor proximity to educational and educational centres) was eliminated from the model and model 2 was built.

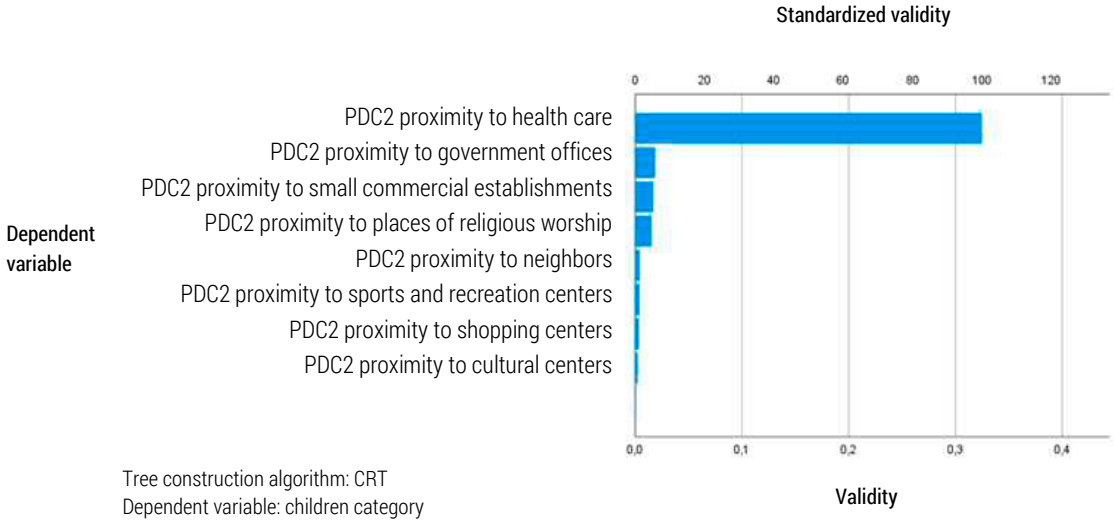

Figure 2. Validity of predictors for model 1

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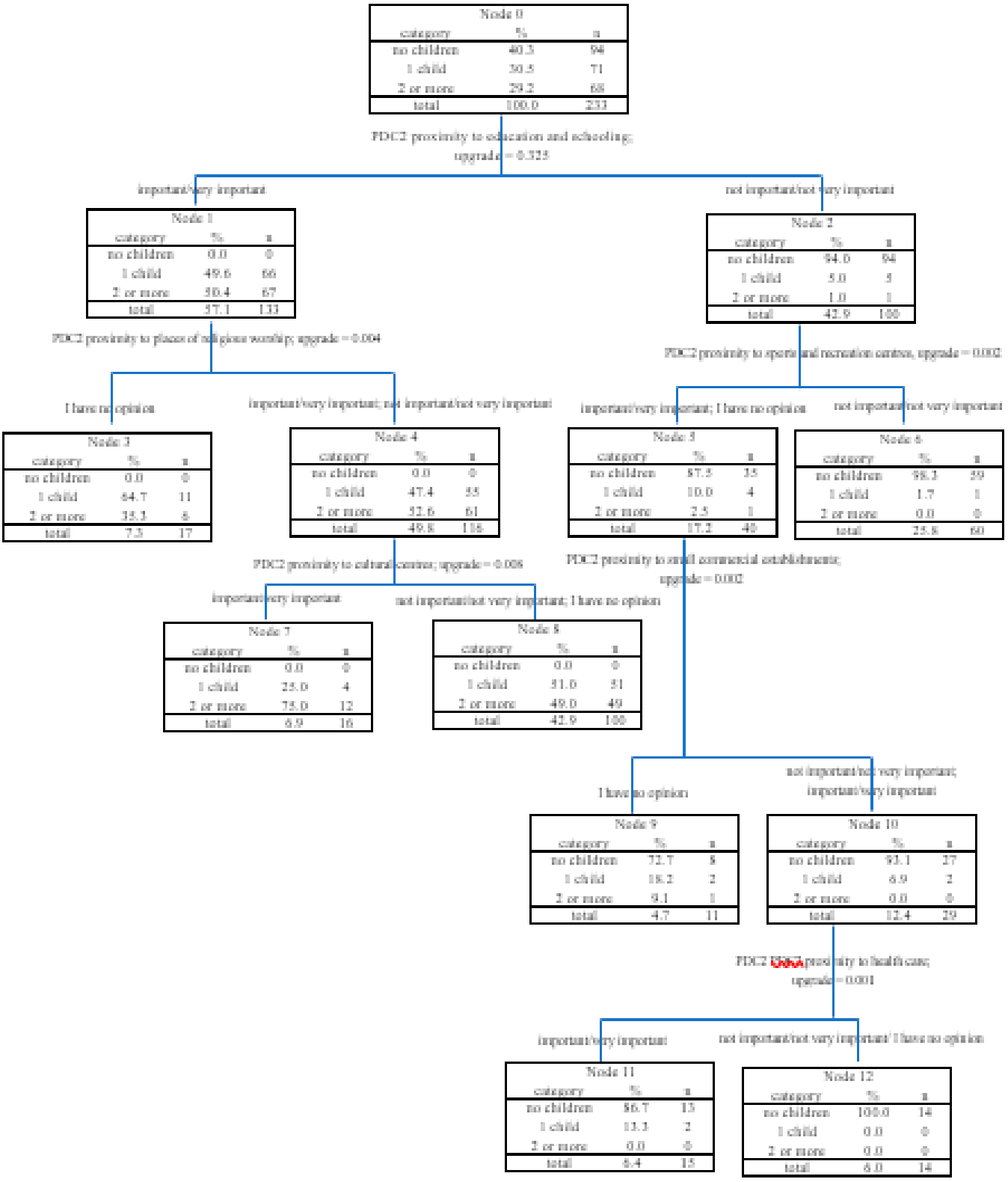

Figure 3. Decision tree for model 1

After analysing the twin of model two, the following measures of tree quality were obtained (Table 7 and Chart 3).

Table 7. Tree quality analysis model 2

Observed	No children	1 child	2 or more children	Sensitivity
No children	61	17	16	64.9%
1 child	17	38	16	53.5%
2 or more children	26	18	24	35.3%
			Traficability	52.8%

Relevance – the percentage of correct classifications.
Sensitivity – the percentage of correctly classified positive cases.

Explanation of the Table 7:

Observed (Rows): This represents the actual, true categories of the trees in the dataset. They are classified into three groups: No children (trees with no offspring), 1 child, and 2 or more children.

Predicted (Columns): This shows how the model classified the trees into the same three categories.

Numbers within the Table: Each number indicates the count of trees that fall into a specific combination of observed and predicted categories. For example, the top-left cell (61) shows that 61 trees with no children were correctly predicted to have no children.

Relevance vs. Sensitivity:

a) Relevance (Accuracy): This is the overall percentage of correct classifications made by the model. In this context, it would be calculated as:
   – (Number of correctly classified trees) / (Total number of trees) * 100%.
b) Sensitivity (True Positive Rate or Recall): This measures how well the model identifies a specific category of interest. In this case, we have sensitivities for each of the three tree categories:
   – Sensitivity (No children): The percentage of trees with no children that were correctly classified as having no children,
   – Sensitivity (1 child): The percentage of trees with one child that were correctly classified as having one child,
   – Sensitivity (2 or more children): The percentage of trees with two or more children that were correctly classified as having two or more children.

Example Interpretation. The model has a 64.9% sensitivity for trees with no children. This means it correctly identifies about 65% of trees in this category.

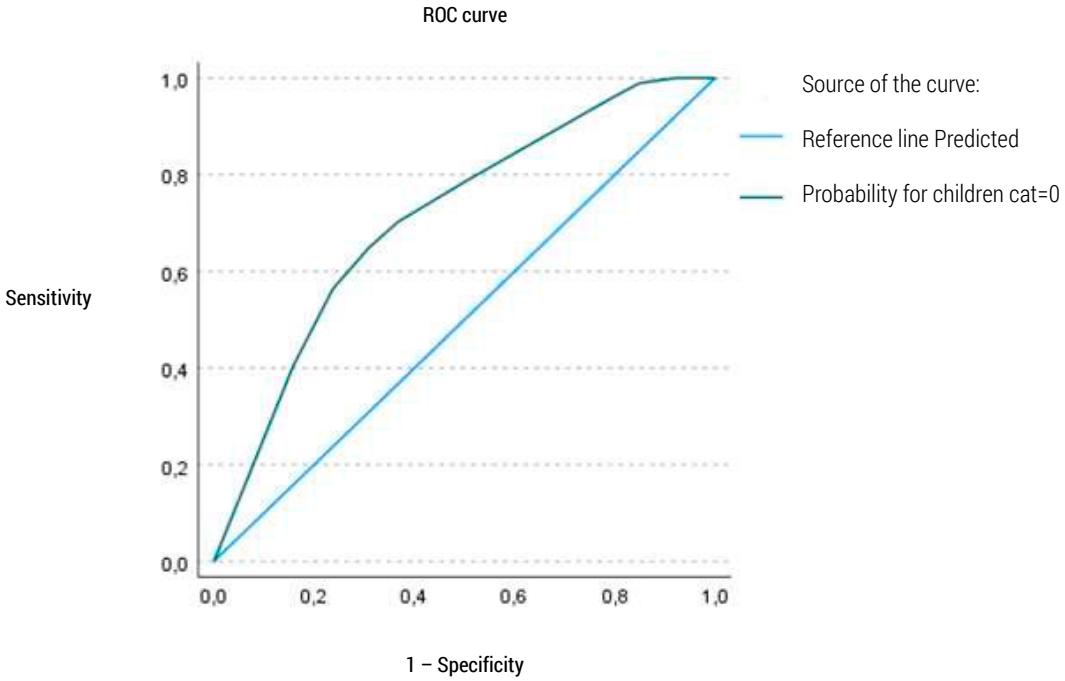

Figure 4. ROC curve for the decision tree model 2

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The tree quality analysis shows good power. The certainty of the forecast is 52.8% for the entire model. Figure 4 shows the ROC curve (Reciever Operating Characteristic), graphically presenting the relationship between the specificity and sensitivity of the test calculated for those with no children. The measure of test accuracy (Area Under the Curve – AUC) for the analyzed model is 71.2%.

The results of the analysis based on decision trees can be seen in Figure 6. Decision rules are designed in the root, branch and leaf views. The validity of the predictors is shown in Figure 5.

The analysis showed that having children is a reliable predictor of choosing a future residence. However, more reliable results are obtained for those who do not have children. The conclusions, too, are applicable to places this group will not choose. More in-depth research is needed to find out what other factors are key to the selection of particular locations by those without children. In relation to those with children, close proximity to educational centres, as well as sports and recreation, is a key aspect. However, the sensitivity of both models for this group is poor, meaning that the decision to choose a residence is more multidimensional in nature.

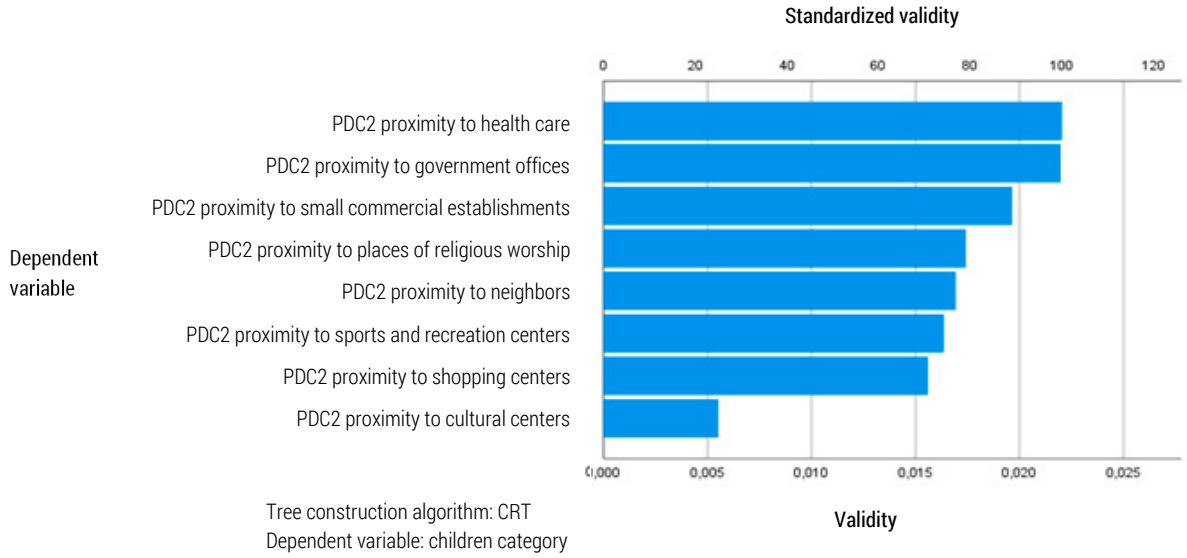

Figure 5. Validity of predictors for model 2

Next, people's backgrounds and individual preferences regarding the need for proximity to natural resources where they live were examined.

Looking for other determinants that determine housing choices, it was shown that there are significant differences between people from rural and urban backgrounds in terms of the need for proximity to nature's goods where they live (Table 8).

Table 8. Differences in origin vs. need for proximity to natural goods in the place of residence before and during the pandemic

Variable	origin rural (n = 74)				origin urban (n = 159)						
	average rank	M	Me	Min	average rank	M	Me	Min	Z	p	η2
Importance of proximity to natural assets before the COVID-19 pandemic	195.94	6.51	6.00	5.00	80.26	3.28	3.00	3.00	-13.25	<0.001	0.76
Importance of proximity to natural assets during the COVID-19 pandemic	194.12	11.24	12.00	9.00	81.11	7.28	7.00	5.00	-12.32	<0.001	0.65

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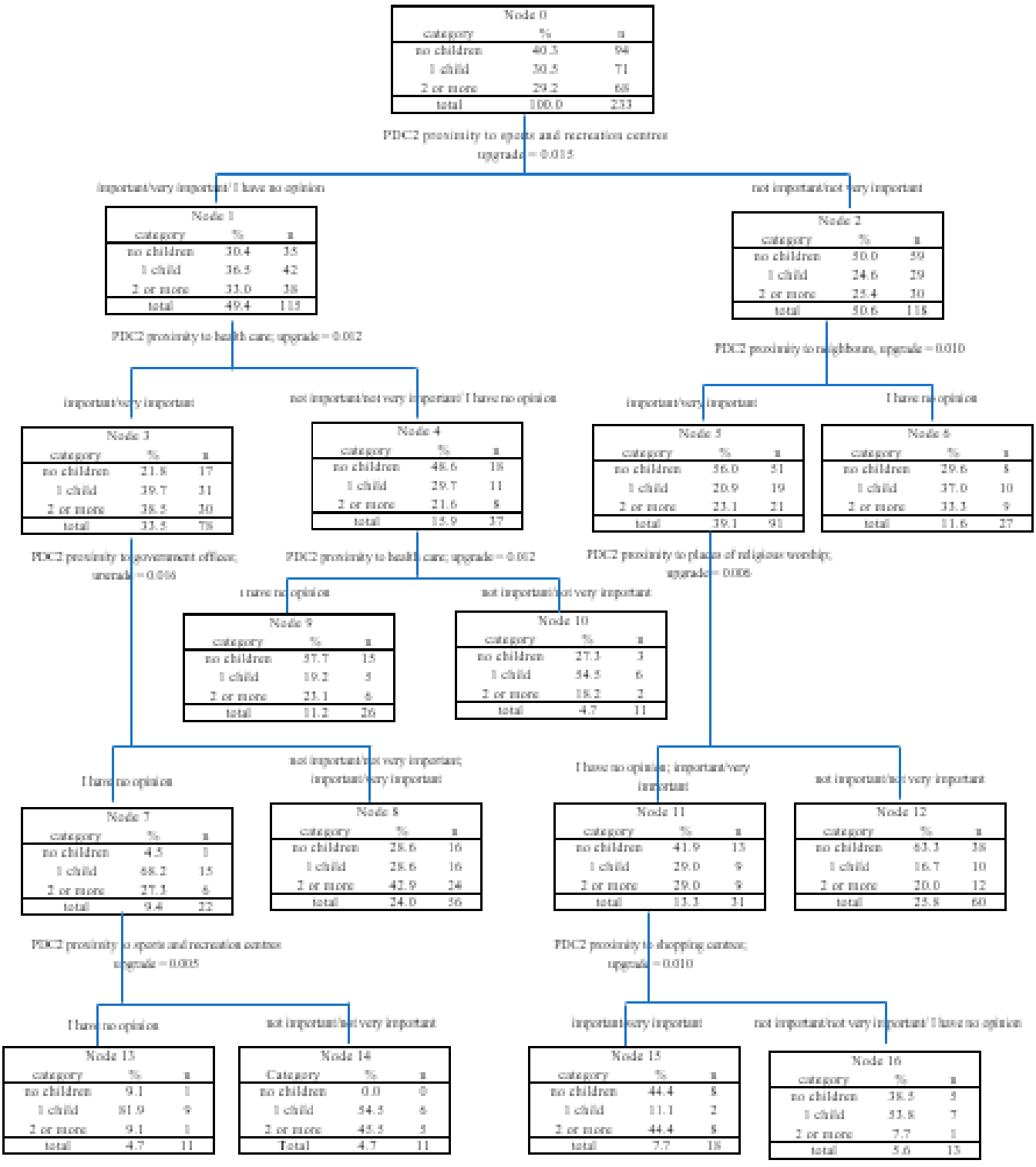

Figure 6. Decision tree for model 2

There are statistically significant differences ($p < 0.001$) between individuals from rural and urban backgrounds in their perceived importance of proximity to natural assets, both before and during the pandemic. This is evidenced by the high Z-values (-13.25 and -12.32) and the low p-values. Individuals from rural backgrounds consistently rank the importance of proximity to natural assets higher than those from urban backgrounds. This is reflected in the higher average ranks and medians across both time periods. The importance of proximity to natural assets increased for both groups

during the COVID-19 pandemic, as seen in the higher average ranks and medians in the "during" period compared to the "before" period. However, this increase does not change the fundamental difference between the two groups.

The effect sizes (η2 = 0.76 and 0.65) indicate that the origin (rural vs. urban) explains a substantial amount of the variance in the importance placed on proximity to natural assets.

Given the results presented, it was examined whether gender and place of origin differentiate the level of preference in the study area. For this purpose, MANOVA was used in a 2×2 plan. Detailed results are presented in Tables 9 and 10.

Table 9. Descriptive statistics by condition for preference for need for contact with natural goods before and during the pandemic

gender	origin	Before the pandemic COVID-19		During the COVID-19 pandemic	
		M	*SD*	*M*	*SD*
female	village	11.13	1.20	6.54	0.94
	town	7.47	1.05	3.35	0.61
man	village	11.46	1.14	6.46	0.95
	town	7.28	1.02	3.21	0.49

Table 10. Relationship of gender and place of origin on the need for contact with nature before and during the pandemic

Effect	Preference for the need to contact nature	Means quare	df	F	p	eta
permanent	before a pandemic	266.29	3	241.05	<0.001	0.76
	during the pandemic	4526.75	1	9302.82	<0.001	0.98
gender	before a pandemic	<0.01	1	684.31	0.951	<0.01
	during the pandemic	0.57	1	1.17	0.280	0.05
origin	before a pandemic	755.97	1	684.31	<0.001	0.75
	during the pandemic	490.40	1	1007.81	<0.001	0.81
sex * origin	before a pandemic	5.661	1	5.12	0.025	0.02
	during the pandemic	0.04	1	0.09	0.770	<0.01

A significant main effect of origin was shown (Table 9). Those from rural areas had a higher level of preference for the need to contact nature at their place of residence both before and during the pandemic. The strength of this effect is high.

Analysis of variance also showed a significant interaction effect. It turns out that women from rural areas have a higher level of preference for the need to contact nature's goods, while women from urban areas have a lower level compared to men (Table 9, 10). The strength of this effect is low and is only found in the stated preferences when experiencing pandemonium.

Discussion

In order to observe the social impact of the actions taken by housing market decision-makers, the results obtained from consumers were compared with the trends promoted by developers. The analysis presented clearly shows the changes taking place in the residential real estate market. They become apparent both in the offers published by developers and in the declared needs of consumers. It is noted that the needs of consumers coincide with the trends promoted by developers. At the same time, it can be observed that these changes are moving in a common direction, i.e. developers are implementing investments with green buildings in mind, and consumers are revealing the need for greater contact with nature's goods at home than in the past. The intensification of these trends can

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be clearly seen in recent years, likely due to the experience of the COVID-19 pandemic and its aftermath. These results are consistent with other studies that have shown an increased desire for green spaces and natural amenities in residential areas, particularly in the wake of the pandemic (Robinson & McIntosh, 2022; García-Lamarca et al., 2022).

While the obtained result revealed important factors of consumers' choices, they are insufficient to confirm the assumed direction of social influence. However, they allow us to observe that the social influence of this group of investors is probably secondary to the individual needs revealed by consumers. Indeed, factors such as origin and having children appear to be little sensitive to temporary changes. This would imply that a need emerges first, and in response, developers adjust their investments to be able to emphasise the qualities currently recognised and sought by residents. For example, the trends observed in the market in recent years have indicated an increase in investments by developers in line with the concept of sustainable development, as has the increase in environmental awareness and the increasing preference of consumers for green surroundings. The pandemic period allowed respondents to observe a marked increase in the need for proximity to nature's goods. At the same time, the number of apartments equipped with balconies, terraces and gardens increased in the offers promoted by developers in locations where developers could not provide easy access to green surroundings. Thus, it can be assumed that it is the needs of individual consumers that shape the residential real estate market, in which developers respond to people's needs and thus have a secondary effect on the level of satisfaction with the place of residence. These findings align with research by Stankowska and Stankowska-Mazur (2022), who found that individual preferences and economic factors play a significant role in shaping housing choices.

Changes in the validity of the need for contact with the goods of nature and civilization at the place of residence are perhaps the result of reflection undertaken as a result of experiencing landmark events, allowing the expansion of the previously dominant pragmatic criteria for housing choices. After the third wave of the pandemic, the need for proximity to natural green spaces (up 54.4%) and urban green spaces (up 44.63%) increased strongly. In contrast, the need for proximity to shopping centres, for example, decreased (much of the commerce moved to the Internet). It can also be interpreted as a consequence of a more strongly experienced behavioural swamp, in which nature is a symbol of freedom, freedom from congestion and stimulation overload. In this regard, it seems interesting to note the dynamics of the change in the need for neighbours in close or greater proximity, which may confirm the conclusion of Hall (1966), analysing John Calhoun's experiment, that even a rat cannot tolerate confusion and, like humans, sometimes needs solitude. This observation is supported by research by Cackowski and Nasar (2003), who found that urban greenery can increase frustration tolerance and reduce aggression, suggesting a psychological benefit to proximity to nature.

The image of a prolonged pandemic, on the other hand, reveals a tendency to return to goods located closer to home (urban green spaces) and those that humans cannot easily replace (educational and learning institutions). This may mean that, in the long run, choices are based more on pragmatic criteria, in which the economy of time and effort put into tasks is crucial. The importance of a green environment may also be the result of respondents overestimating this need, influenced by the experience of restrictions in this area during the pandemic. This finding is consistent with the work of Song et al. (2016), who demonstrated the physiological relaxation effects of spending time in green spaces, which may have been amplified during the pandemic due to limited access to such areas.

Analysis of the data showed significant differences between those with rural and urban backgrounds in terms of their preferences for the need for contact with goods, as well as a significant main effect of background. Those from rural areas had higher levels of preference for the need for contact with nature at home, both before and after the pandemic. The results can be interpreted as a strong need for contact with nature for those raised in close proximity to it, which does not cease even after moving to the city. This is associated with identity cohesion and echoes the identity built in contact with nature. It is likely that contact with nature where one lives is motivated by an aroused longing for the lost landscape, an appreciation of tranquility, an attachment to the attributes of the place one comes from, the importance of a healthy environment, and a sense of freedom and space. This observation aligns with the meta-analysis by Abraham et al. (2017), which highlighted the positive effects of contact with nature on various aspects of human well-being, including physical and mental health.

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Conclusions

Analysing the strategies of developers and the preferences of housing market customers is a complex process. It requires simultaneous consideration of many psychological, social and economic factors, as well as factors related to the state of housing infrastructure. It also requires taking into account the constant trends shown in the study, as well as the variability of needs, and the fact that the development strategies of the residential real estate market are a direct result of the development strategies of cities, so it is certain that, at least in part, developers influence real housing choices with their investment location decisions.

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The results obtained can be useful in architectural design considering social design. They clarify human preferences for the use of designed spaces, indicating the relevance of selected infrastructure elements. They make it possible to tailor developers' offerings to a specific consumer. In addition, they can be important in achieving the goal of sustainable development.

At the same time, it should be pointed out that developers focus not only on the characteristics of green buildings and consumer choice but also on higher returns on properties based on green designs and greening of urban areas (García-Lamarca et al., 2022; Conway et al., 2010; Immergluck & Balan, 2018; Zhang et al., 2018). At the same time, an attempt to answer the question of who the future green city is for and to explore the relationship between its affordability and social justice considerations is also indicated (García-Lamarca et al., 2021).

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The contribution of the authors

Conceptualization, A.S. and I.S.-M.; literature review, A.S. and I.S.-M.; methodology, A.S. and I.S.-M.; formal analysis, A.S. and I.S.-M.; writing, A.S. and I.S.-M.; conclusions and discussion, A.S. and I.S.-M.

The authors have read and agreed to the published version of the manuscript.

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ZRÓWNOWAŻONY ROZWÓJ MIESZKALNICTWA W POLSCE – CZYNNIKI PSYCHOLOGICZNE A WYBORY EKONOMICZNE W ASPEKCIE POTRZEBY KONTAKTU Z DOBRAMI NATURY I DOBRAMI CYWILIZACJI W MIEJSCU ZAMIESZKANIA

STRESZCZENIE: Celem badania było sprawdzenie czy trendy promowane przez deweloperów na rynku nieruchomości mają wpływ na preferencje mieszkaniowe konsumentów, koncentrując się na potrzebie zarówno natury, jak i udogodnień miejskich w rezydencjach miejskich (miasta > 50 000). Aby odpowiedzieć na postawione pytanie badawcze, przeprowadzono analizy statystyczne z wykorzystaniem pakietu IBM SPSS Statistics 27. Z jego pomocą przeprowadzono analizę podstawowych statystyk opisowych, eksploracyjną analizę PCA z testem wiarygodności, test t-Studenta, test U Manna-Whitneya, analizę korelacji r Pearsona, analizę wariancji, drzewa klasyfikacyjno-regresyjne (CRT) oraz analizę krzywej ROC. Wyniki badań mogą przyczynić się do lepszego zrozumienia tego zjawiska i wpłynąć na projektowanie społeczne w architekturze, biorąc pod uwagę preferencje użytkowników dotyczące projektowanych przestrzeni.

SŁOWA KLUCZOWE: preferencje mieszkaniowe, aspekt społeczny, potrzeba kontaktu z naturą i dobrami cywilizacyjnymi

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