

# Impact Model of Communication and Marketing Tools for the Promotion of Family Houses Built by Modern Methods of Construction

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## Abstract

Modern methods of construction (MMC) represent a response to the sustainability trend, since they bring faster construction and better environmental, energy and economic parameters. In Slovak construction conditions MMC are not extremely widespread yet. One of the main barriers of successful implementation of these technologies is non acceptance by client but properly chosen marketing strategy could change potential client thinking. This research discusses issue of impact of marketing and communication tools on potential customers of modern methods of construction. The aim of this paper is find impact model of selected marketing and communication tools for the promotion of family houses built by modern methods of construction. This main aim was supported by partial aims, as analyzing of potential marketing and communication tools in this issue. Next partial aim was quantifying impact in research groups.

**Keywords:** modern method of construction, MMC, marketing tool, impact model, communication tool, marketing strategy.

## INTRODUCTION

The construction industry presents one of the most valuable sectors in the economy. Moreover, the development of mass affordable housing construction is relevant for many countries. In recent years there has been a demand for family houses in Slovakia. People from cities are increasingly moving to nearby villages. The outcome is a competitive industry focused on continuous product development to improve the design and quality of the final product, setting standards for housing generally. Economically it can be justified only as the result of applying modern industrial construction methods that are based on standardization, unification and typification [1]. At the same time, as the sustainability awareness rises globally, the construction industry is also under increasing pressure to improve efficiency and project delivery [2]. Sustainability in construction developments must result in the creation and responsible maintenance of a healthy built environment, based

on ecological principles, and by means of an efficient use of resources [3]. One solution to this problem is the increased use of offsite manufacturing, or modern methods of construction (MMC), of housing components or whole constructions [4].

## MODERN METHODS OF CONSTRUCTION

Modern Methods of Construction (MMC) represent a response to the sustainability trend, since they bring faster construction and better environmental, energy and economic parameters [5]. MMC can be defined as a method in which less or greater extent building blocks (walls, floor slabs, beams, columns and staircases) are mass-produced in the factory under strict supervision with high quality [6]. Other authors [7] argued that the MMC is a continuous system utilization craftsman at each construction activity that uses a manufacturing production to minimize wastage of resources and increased value for end users. The term of modern method of construction was established in the UK as a common label for the construction methods of construction based on the off-site technologies (prefabrication elements or parts of constructions are made off-site and then transported and assembled on site) and innovative on-site technologies (parts of construction elements are produced in the factory, but its functional location is completed on the site). The development of MMC term in UK is shown in Figure 1. Construction industry in Singapore and Hong Kong still prefer term prefabrication. Malaysia considers MMC as the industrialized construction system (IBS). The US and Australia more often use the term off-site construction methods.

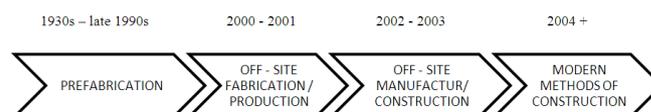


Figure 1: Development of "Modern methods of construction" term in UK [8]

Authors Chen et al. [9] argue that MMC in the construction industry has enhanced productivity and improved quality as well as several benefits as shortened construction time, lowered overall construction cost, improved quality, enhanced durability, improved architectural appearance, enhanced occupational health and safety, material conservation, reduced construction site waste, reduced environmental emissions, and energy and water consumption. Finally, modern methods of constructions are about better products and processes.

The modern methods of constructions can be perceived by various criteria which set the classification of MMC. The main product groups were established by British organization Waste and resource programme [10]. MMC product groups were divided into 11 categories: (i) volumetric modular – presents a key MMC technology for inclusion on the grounds that it substitutes several on-site product applications that typically generate significant waste volumes (e.g. roof and external wall insulation, roof tiling, brick and blockwork, drylining, on-site cladding and all associated packaging); (ii) timber frame and steel frame flat packs these are mainly used in housing and are mainly displacing the use of concrete blockwork used for the construction of external wall inner leafs and party walls; (iii) prefabricated kitchen & bathroom pods; (iv) composite/insulated/sandwich (non load-bearing) panels - used for walls and roofing; (v) light steel frame (LSF) systems used for building façade construction; (vi) pre-cast structural panels - external and party wall panels increasingly being supplied as part of panellised building systems in conjunction with floor components and other components such as pre-cast staircases, basement units and roofing; (vii) pre-cast hollow-core flooring – in the hollowcore flooring on ground floors and second floors in substitution for in-situ concrete flooring and timber flooring; (viii) structural insulated panels (SIPS); (ix) pre-cast concrete cladding; (x) tunnel form construction; (xi) insulating concrete formwork - formwork system comprising twin-wall expanded polystyrene (EPS) blocks or panels, which are assembled to create the external walls of a building. Ready mix concrete is subsequently poured into the gaps. British Urban Regeneration Association [11] classified the MMC according the production place of predominant construction processes as off-site and on-site construction methods. On the other hand, typically MMC involves the manufacture of construction parts off-site in a specially designed factory. Authors of Report by the National Audit Office [12] divided the MMC according the products of MMC are: (i) panels – 2D elements including ready-made walls, floors and roofs, (ii) modules – (3D volumetric elements) – ready-made modules and (iii) hybrids - combination of 2D and 3D elements. A range of materials used for MMC is the most common being wood, steel and concrete [13].

According to many authors, modern methods of construction have a great potential to improve the efficiency of construction production, quality, customer satisfaction, environmental impact, sustainability and predictability of

construction design delivery in particular terms. Engstorm et al. [14] claim, that some stakeholders think that MMC has not yet had the impact they expected or hoped for. Edge [15] found that house buyers are so strongly influenced by the negative perceptions of post-war prefabrication that they will resist any innovations in house construction that affect what a traditional house looks like. The human perception barrier, grounded in the historical failure of offsite practices, also exists among architects and other designers [16]. Also, because of this, the benefits and barriers of using MMC have been mentioned and tested in many studies from around the world. The most mentioned attributes are summarized in Table 1.

**Table 1:** Benefits and barriers of using MMC

<i>Benefits</i>	Minimization/reduction of time [14,16,17,18,19,21,24] Minimization on-site operations [17,18,24] Reduced cost [14,17,19,20,21,24, 25] Increase quality [14,16,17,18,19,24] Fewer people on-site [17,20,24] Less environmental impact [17,18,20,22,24] Improved safety on-site [16,17, 20,24] Reduced defects (better control) [14,17,18,9,20,21,24]
<i>Barriers</i>	Higher cost compared to the traditional methods [16,17,18,21,24] Client resistance [16,18,19,24] Negative image of prefabrication [14,15,16,18,19,21,24] Not locally available <b>Error! Reference source not found.</b> Insufficient worker skills [16,19,24] Inflexible for design changes <b>Error! Reference source not found.</b>

Authors Baldwin et al. [26] have suggest the main advantages of MMC are:

- (i) economic – MMC houses typically have fewer defects and can be built more quickly, components provide a better quality and standards, the construction process can be speeded up by the mass production of prefab components in the factories,
- (ii) environmental – the houses can be more energy efficient, may involve less transport of materials, and produce less waste,
- (iii) social – there may be fewer accidents and less impact on local residents during construction, reduces labour intensive activities and provides a safer working environment, designers from different disciplines can work closely together in the early design state to help to reduce abortive work.

Many of the benefits of using MMC for housing are as yet unproven or contentious. The researchers of Technical

university of Kosice, Faculty of Civil Engineering, Institute of Construction Technology and Management have proved benefits and barriers of MMC application in their research works. The results of research should to engage the stakeholders (investors, architects, constructors, etc) in construction industry to seek improvement, through better processes, in the delivery and performance of construction. The authors of researches [5, 27, 28] deals with the technological, economic and environmental benefits and barriers of timber constructions built by modern methods of construction, the authors [29, 30] deals with the MMC based on concrete or volumetric modern methods of construction [30, 31]. The economic aspects of modern methods of construction were analysed in [32, 33].

Construction industry in western countries has overcome an image of poor MMC quality through developing rigorous quality standards and promoting certification schemes; a similar strategy would assist the Slovak construction sector to address current public perceptions.

In Slovak construction conditions MMC are not extremely widespread yet. One of the main barriers of successful implementation of these technologies is non acceptance by client. Properly chosen marketing strategy could change potential client thinking.

## MARKETING IN CONSTRUCTION SECTOR

The rapid trend of globalization and technological changes have made difficult for construction organization to survive in the competitive world. Particularly, the global economy crises have the very strong impact on a construction sector [34]. Market orientation primarily focuses on securing a permanent inflow of work and realizing a profit for the company by satisfying the demands and needs of clients. We use the term marketing to define and up-to-date market-oriented business strategy [35]. According to Levitt [36] the purpose of a business is to create and keep a customer. Creating a customer means identifying needs in the marketplace, finding out which needs the organization can profitably serve, and developing an offering to convert potential buyers into customers [37]. We can say that marketing is competitive process by which goods and services are offered for consumption at a profit [38]. Promotion and marketing in construction business is definitely very important. Having a solid marketing plan can be the difference between growth and stagnation of construction company. Construction enterprises are aware of the importance of involving marketing in their management functions as a way to adapt themselves not only to the continuous changes in the industry, but also to satisfy their clients' demands, while being competitive and improving their business strategy. Construction industry is a sector characterized by several particularities that make it different from the industrial and service industries: (i) construction enterprises sell a hybrid

between a product and a service, (ii) its production is based on projects, (iii) the product changes in size, location, and complexity, (iv) the company promotes its abilities to fulfill and exceed the criteria of cost, schedule, and quality, (v) there are differences between the demand of public and private clients, (vi) professional training is based on scientific and technological knowledge, instead of managerial education. We can say that construction marketing is a new phenomenon, because clients buy something that does not exist yet [39].

Marketing applied to the construction industry combines existing theories of the industrial and service sectors: (i) marketing mix [40,41,42,43,44,45,46], (ii) relational marketing [46,47,48,49,50,51], (iii) business to business [52], (iv) co-development [53,54], (v) partnering [55,56,57], (vi) customization and differentiation [47,58,59,60,61,62,63]. Specific strategies for the construction sector are: (i) public private partnership [64], (ii) design and construction [65], (iii) pricing strategy [57,66,67,68] and social marketing [48,69,70].

As in any product-based competitive market, suppliers in construction sector should invest heavily in marketing and sales outlets. Modern methods of construction are the most used in the construction of family houses. A distinctive role within promotion of these construction methods should be played by 'show home' parks. These enable prospective customers to view a range of houses on a single visit and thus help the selection process, to the benefit of the MMC generally. Firms also have show homes on their production sites, together with 'customer centres' which exhibit finishes and fittings. Other MMC promotion can takes place through magazines dedicated to housing, social networks, television, radio, etc. Social media are often bent. Social media revolution has provided a number of platforms for use and changed the way of communication worldwide. From the way how people work to how they live [71].

## RESEARCH METHODOLOGY

### Problem statement and research aim

The issue of modern methods in construction is very current topic in context of material point of view. It claims a lot of researches and studies referred in theoretical background. However, this issue has another point of view. Currently, every product must be promoted. According to Kotler and others marketers, products that are well promoted are sold. Marketing and promotion activities are very necessary in every field. Marketing plays one of the most important tasks for successful results of enterprises. Its purpose is to attract and retain customers. But it can possible only get the company to know wishes and needs of their customers. The selection and implementation of an appropriate marketing strategy is accompanied by a variety of decisions and activities that address product issues, price parameters, distribution channels, and overall communication and product promotion

tools. Choosing effective marketing communication tools is an important area in terms of achieving successful business results. From these reasons it is necessary do research in this topic. Construction industry need know effective marketing tools for their marketing and promoting activities.

This research discusses issue of impact of marketing and communication tools on potential customers of modern methods of construction. This issue has very wide range. Process of marketing tool selection is very hardly and their exploitation and implementation is very expensive. Based on the theoretical approaches, analysis and mapping of the current possibilities of using marketing and communication tools, it was set research questions.

- What marketing tools can be used to promote family houses built by modern methods of construction?
- What is impact of selected marketing and communication tools on potential customers?
- Are some differences in view of effectiveness of marketing tools between research groups?

Based on this research questions it was set main research aim. It is find impact model of selected marketing and communication tools for the promotion of family houses built by modern methods of construction. This main aim was supported by partial aims, as analysing of potential marketing and communication tools in this issue. Next partial aim was quantifying impact in research groups.

### Data collection and research sample

One of the most used forms of data collection is questionnaire. The questionnaire can be used as a single form of data collection, as an additional, but also as a field survey. The questionnaire is a research and evaluation tool for the relatively rapid and massive discovery of information about opinions and individual attitudes to the issue [72]. The ability to reach out to a large number of respondents and a quick response are advantages and also main reasons of decision used this method for purpose of this research. Anonymity and also enough time to think of the answer are an advantage from the point of view of the respondent (A).

Structure of questionnaire included three parts. First part was focused on general information of respondents. That means basic research parameters and futures of research sample like age, education, sex and so on. Next part was focused on information about modern methods of construction, material preference, and willingness to accept innovations and, in particular, information on the planning of construction works and the wishes of a family house. Respondents had a choice of family houses built by modern methods of construction: wooden frame system, insulated concrete formwork, blockworks system, prefabricated concrete panels, structured

insulating panels - SIPs, cross laminated timber – CLT, wooden modular house and steel modular house.

Third part of questionnaire was more important from research aim point of view. It included information about marketing tool that are accepted by research sample. That means more information about their activities and meeting with this technology and intensity of media acceptance. After consultations with experts and marketers, there were set of basic research areas and selected monitored marketing tools as: newspapers, tabloid magazines, journals, billboards, posters, leaflets, advertising in public transport, radio spot, TV spot, Social medias (facebook, linkedin, Instagram, other social medias), mobile applications, blogs, e-mail advertisement, youtube channels, advertising in public transport (pens, cups, keyrings and so on), exhibitions / fairs, promoter. More details about this investigated tools are mentioned previously.

An online questionnaire was selected to minimize costs and high return rates. The questionnaire was anonymous, but it prevented the system from being replenished by one person based on the IP address. The research sample was addressed through an email requesting to participate in the research. A total of 11 235 respondents were addressed. The choice of potential respondents addressed was random. 1078 respondents finally participated actively in the survey. It represents 9.60% response rate. Questionnaire research was conducted from November 2016 to March 2017. The survey was attended by 11 235 respondents.

Research sample was divided into several groups based on selected parameters like age, gender, location of living and so on. Research sample divided by gender is shown in figure 2. Men were 41% of respondents, women accounted 59% of respondents.

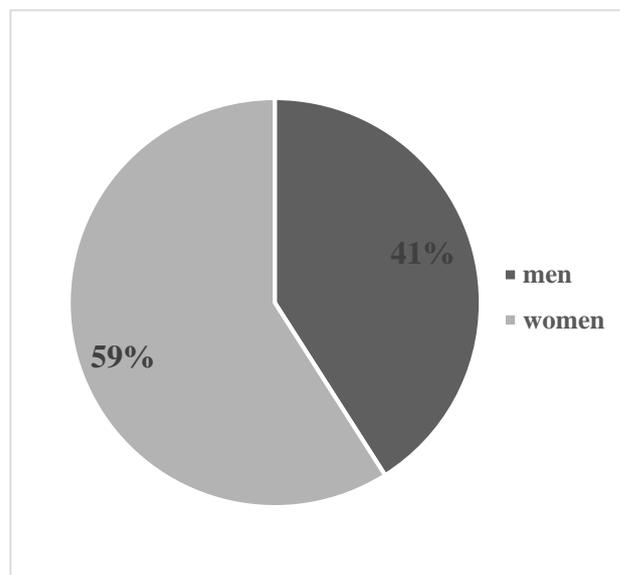
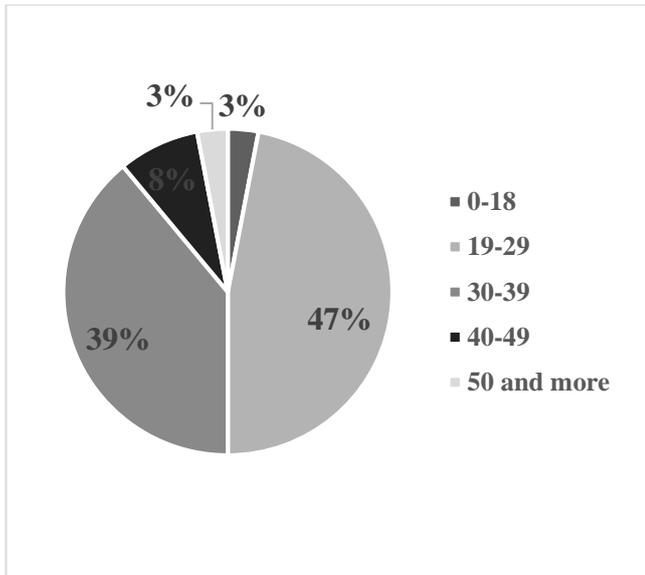


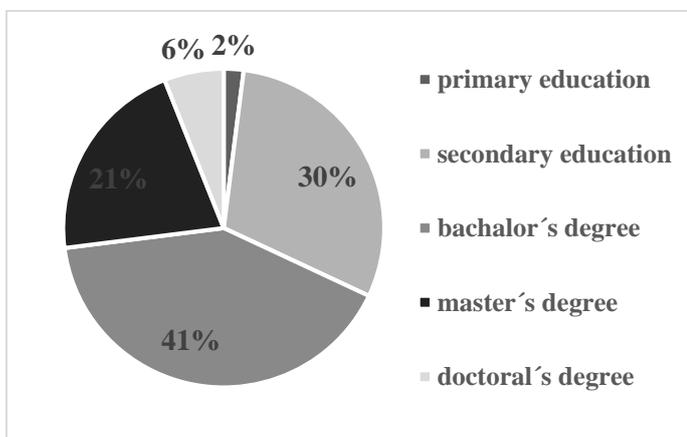
Figure 2: Research sample by gender

Divided of research sample by age is next point of view. 3% of respondents were younger than 18 years old. In spite of this young age, they are potential customers about a few years later. From this reason, they were not excluded from research. 47% respondents were between the ages of 20 and 29. It's strong research group, where is biggest potential for family houses construction enterprises. 39% respondents were between the ages of 30 and 39. This is also a strong group in terms of customer potential as well as for research. Others research groups represented 11% together.



**Figure 3:** Research sample by age

Next figure shown research sample divided by education level. From all respondents, 2% of respondents achieved only primary education, 30% of them achieved secondary education level. The most represented group of respondents achieved bachelor degree, it represents 41% of respondents. 21% of respondents have master's degree and 6% have a doctoral degree.



**Figure 4:** Research sample by education

### Data processing

Data were evaluated and processed to achieve the objectives of the research. This was primarily about processing data from the questionnaire survey. These data were evaluated on the basis of a number of statistical methods using MS Excel and STATISTICA version 12. In the processing of research results carried out in the research, predominantly descriptive and inductive statistics were used.

Statistical significance was tested by the Kruskal-Wallis test at significance level  $\alpha = 0.05$ . The Kruskal - Wallis represents a direct generalization of the Wilcoxon dual test in the case of several independent sample sets [73]. Kruskal - Wallis test is a nonparametric analogy of single factor dispersion analysis [74]. Kruskal - Wallis test is based on a number of lines and is an unparametric method for testing. The essence is to statistically test whether the research samples come from the same distribution. It is used to compare two or more on dependent samples of the same or different sizes [75,73].

The AHP method was used to determine the weights and the resulting model. The Analytic Hierarchy Process is a complex methodology designed for decision-making in choosing from multiple options. The basis for decision making is the empirical decision criteria [76]. The basis for using the AHP method is to sketch the entire decision-making problem as a certain hierarchical structure. This is a classic tree representation and branching of the main problem into sub-areas that affect the main goal. The basis of the AHP method is the comparison of the individual pairs of options, where the two systems compare each with each one [77]. The intensity or weight of the individual criteria (in this case the chosen communication and marketing tool) is determined by a recognized team of experts [78]. In the case of this research, participants of research and marketers were represented by individual construction companies offering family houses built using modern methods of construction. These experts should determine the importance or otherwise of the impact of the use of selected marketing tools for the promotion of family houses built by modern methods of construction. These experts should determine the importance or otherwise of the impact of the use of selected communication and marketing tools to increase the promotion level of family houses built by modern methods of construction. Based on their evaluation and the determination of priorities for individual scales on scales 1 to 5, the MS Excel program has produced a matrix of the number of individual options on the basis of which the AHP method was performed. This method is based on the value of the information obtained. The main purpose of this AHP method is to exclude subjective evaluation and ensure independence when assessing individual criteria based on the amount of data [79]. Entropy measures the information content of a particular set of data [80]. It represents the

criterion for the amount of uncertainty represented by the discrete probability distribution. The method chosen works based on the weighting based on the "amount" of the data it contains. In the calculation we proceeded as follows:

$A = (a_{ij})$  decision matrix

$i=1, \dots, m$  - number of construction enterprises)

$j=1, \dots, n$   $n$  - number of rating categories

$p_{ij}$  normalized values of the  $j$ -th attribute

$E_j$  the entropy of a set of standard attributes

$d_j$  the degree of diversification of the information provided by the attribute

$v_j$  The weight of the  $j$ -th attribute

The calculation is performed according to the algorithm:

$$p_{ij} = \frac{a_{ij}}{\sum_{i=1}^m a_{ij}} \quad \text{for each } i\text{-th, } j\text{-th}$$

Subsequently, we compute the entropy of the standard  $j$ -th attribute:

$$E_j = \frac{1}{\ln m} \times \sum_{i=1}^m (p_{ij} \ln p_{ij}) \quad \text{for each } j\text{-th}$$

We calculate the degree of diversification of information provided by the following attribute:

$$d_j = 1 - E_j \quad \text{for each } j\text{-th}$$

We normalize the result and we get the scales.

$$v_j = \frac{d_j}{\sum_{i=1}^n d_i} \quad \text{for each } j\text{-th}$$

## RESULTS AND DISCUSSION

An economically-mathematical model based on theoretical analysis and research discussed the issue of identifying communication and marketing tools that influence to the promotion of family houses built by modern methods of construction. It presents the selection and weights of selected communication and marketing tools that influence to the promotion of family houses built by modern methods of construction. Within the proposed model, it have been identified the key communication and marketing tools that have a significant impact on the promotion of family houses built with the use of modern methods of construction. Based on the AHP method, individual weights were determined to achieve the greatest possible promotion and impact on the target customers. The proposed economic-mathematical model (impact model) is the main contribution of research, and in practice it can be a tool for selecting communication

and marketing tools to help promote family houses built using modern methods of construction.

The formulation of the main objective resulted from the research questions identified on the basis of a theoretical analysis of the given issue and subsequently identified basic research questions for the given area. The main objective of the model was thus formulated based on the results of the conducted questionnaire survey, where was monitored the impact on propagation of family houses. The model was created in a hierarchical structure. It contained 3 levels, the main objective of the model, the partial objectives in terms of quantifying the impact of selected groups of communitarian and marketing tools and defining and quantifying concrete and quantifying their impact on the promotion of family houses.

1. level: Main objective of impact model – identifying of impact selected communication and marketing tools on promotion of family houses built by modern methods of construction.
2. level: Partial objectives of impact model – quantifying impact level of communication and marketing tools on promotion purposes.
3. level: Quantifying of impact level specifically communication and marketing tools on promotion purposes.

In order to quantify the impact of the use of specific communication and marketing on the promotion of family homes built by modern methods of construction, account was taken of:

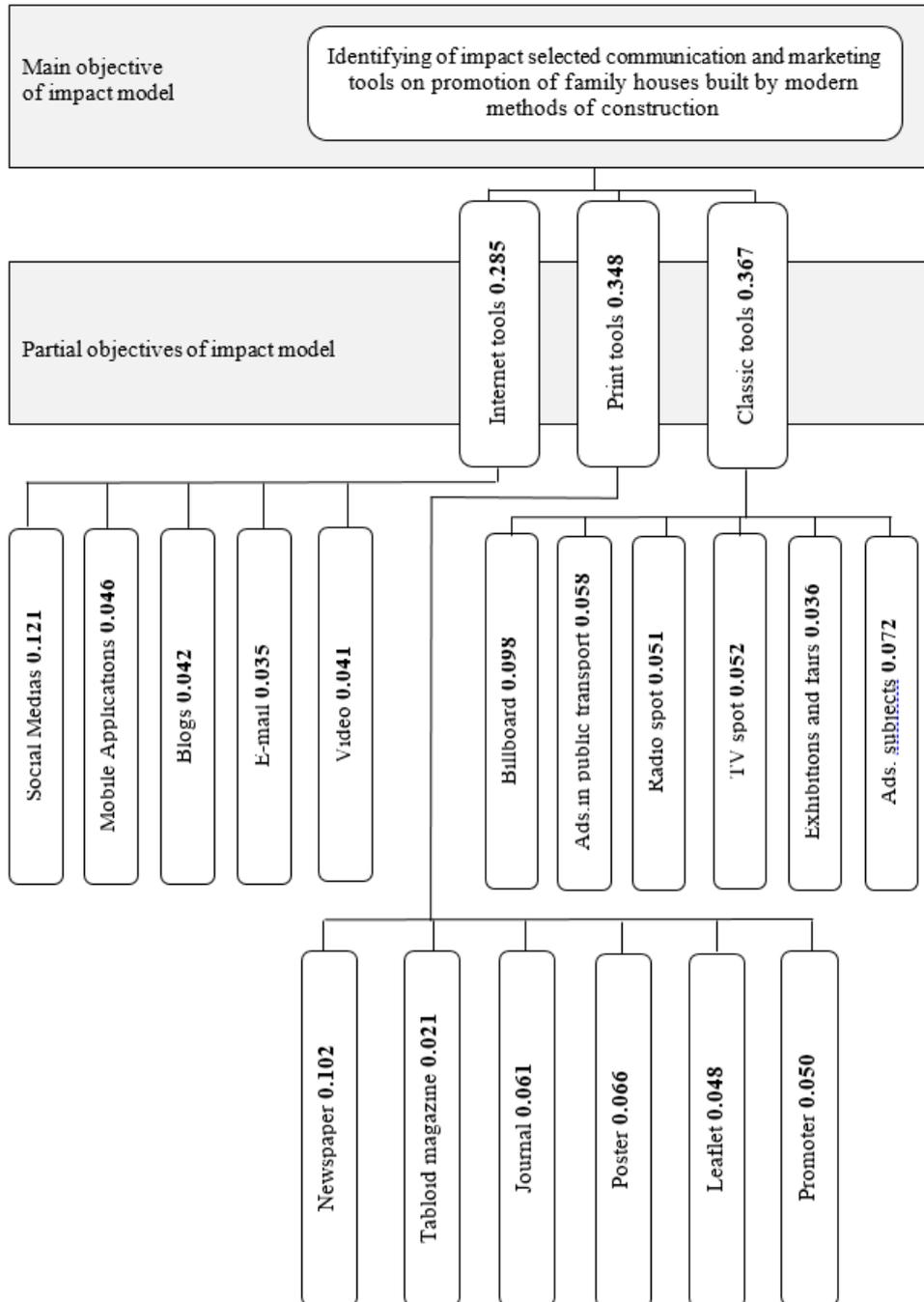
- Internet promotion tools - Social medias (facebook, linkedin, Instagram, other social medias), mobile applications, blogs, e-mail advertisement, video channels.
- Print promotion tools - newspapers, tabloid magazines, journals, posters, leaflets, and promoter.
- Classic promotion tools - billboards, advertising in public transport, radio spot, TV spot, exhibitions or fairs, advertising subjects (pens, cups, keyrings and so on)

Within the research sample separation, the survey results particularly important for two target groups: people from 20 to 29 and respondents from 30 to 39. The reason is simply. These research group divided by age represent the most acceptance level for building family houses for the next 5 years.

Final impact level describes figure 5. According final impact level, Social Medias have the highest impact on promotion of family houses built by modern methods of construction. Impact level is 0,121, what is very significant impact according AHP. Between top three of the highest impact level of communication and marketing tools it can possible take

newspapers with 0.102 impact level and billboards with 0.098 impact level. In this time, respondents (potential customers of family houses) use of social medias mostly. It has impact on their mind and advertisement is efficiency. In spite of internet and ICT increasing, print and classic tools have a significant impact in Slovakia. From print tools it represents newspaper with impact level 0.102 and form classic tool it is billboard. People are still conservative. A lot of people (respondents) still use and believe traditional tools. A lot of respondents read newspaper, watching TV and billboards. A lot of customers

hear radio spot. Generally, internet has significant impact, but Slovak customers see only social media, not all internet tool. Video, blogs, mobile applications have low impact level, in spite of overall big exploitation of them. Customers a lot of time spent on social networks. It is clear in comparison of promotion groups. In spite of internet age, these tools achieved overall impact level 0.285, it is low value as print tool with impact level 0.348 and classic tool with impact level 0.367.



**Figure 5:** impact model of communication and marketing tools for the promotion of family houses built by modern methods of construction

## CONCLUSION

Issue of modern methods of construction is very sensitive topic. On the one hand, it is the use of new materials and trends in construction. This represents the opportunity to accept new forms of housing and acceptance of change. On the other hand, it is conservative customer thinking and support for a traditional form of construction. In any case, there is a need for enlightenment and the need to raise customer awareness. This also confirmed the survey and its results. A good marketing strategy, effective communication and marketing tools can be a way of expanding this awareness and, at the same time, it is an opportunity for construction companies to acquire customers. The results of the survey point to the potential of addressing potential customers with selected marketing and communication tools. The main benefit of the research is the proposed impact model. Impact model of communication and marketing tools for the promotion of family houses built by modern methods of construction is design for conditions of construction enterprises, especially in Slovakia market. The model points to the use of selected tools and quantifies the impact of individual communication and marketing tools on the basis of exact scientific methods. Despite the digital age, many internet tools are not as powerful as we would expect. Minimum for the target group that is relevant to our area of interest. Conversely, social networks have a significant impact on promotion of family houses built by modern methods of construction. Other important communication and marketing tools can be considered newspapers, billboard, and advertisement subjects as a pencil, pen, and so on. The impact model is for the practice recommended primarily for the conditions of the Slovak construction industry or for the construction companies operating in Slovakia. Research has been implemented and adapted to the Slovak construction market, and it's the reason of recommendation. It is likely that the model can be applied with slight modifications in other countries as well. However, the model cannot be considered universal. Here is another scientific question, what impact do these communication and marketing tools have on other markets in other countries? It may be important to monitor and compare the impact model in V4 countries or across Europe. This is the goal of further research in this area.

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