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Bridging stakeholder perspectives to improve residential construction quality in growing urban environments

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Abstract. This study aims to identify the most important quality factors in various phases of residential construction projects, as perceived by internal stakeholders – referred to in construction terminology as participants in the project implementation process – including construction engineers, site managers (construction site supervisors), contracting specialists, and company executives. To the authors' knowledge, this is the first study to consider the individual perceptions of various residential construction project stakeholders and to explore the differences among them. Quality is understood as the absence of defects identified in the final acceptance process of the residential building, which constitutes the final product of the project. The research was based on questionnaires administered to 56 internal participants of eight residential construction projects. Respondents were asked to rate the importance of each of 33 proposed potential quality factors for attaining quality, as defined above. Most of the proposed factors were seen as significant by all or most project participant groups. However, several important differences among groups were identified. In some cases, they may be due to biases or emotions linked to the group's direct involvement in a factor and implicit criticism. The implications of the findings, including the identified differences, for the management of individual phases of residential construction projects were outlined. Study limitations were acknowledged, and directions for future research were proposed.

Keywords: construction project management; quality factors; residential construction; stakeholders.

1. INTRODUCTION

In the face of rapid urbanization and evolving demographic patterns, cities around the world are undergoing profound transformations. Urban sites are becoming denser, more complex, and increasingly strained by a growing demand for high-quality, affordable, and sustainable housing. As municipalities strive to accommodate expanding populations, residential construction projects have become critical components of urban development strategies. However, the pressure to deliver housing quickly and cost-effectively often collides with the imperative to maintain high standards of construction quality. This tension is particularly evident in the final stages of project delivery, where the presence of defects can significantly undermine resident satisfaction, safety, and long-term building performance.

For this reason, this paper focuses on quality defined as the absence of defects in the residential building, as verified by the final building acceptance. Hence, the effort to maximize quality in a residential construction project is interpreted here as an effort to minimize the number of defects in the residential building, particularly those identified during the final building acceptance.

Consequently, for efficient management of residential construction projects, understanding the factors that help minimize the number of defects in the final product of the project is essential. A residential construction project, like any other project, consists of several stages, all of which are important for the final quality of the product. Therefore, this paper aims to identify quality factors in residential construction projects, understood here similarly to the definition proposed by [1] as "any circumstance, fact, or influence which contributes to the deterioration of quality in the project" at various stages or phases of the project. Due to the various definitions of quality factors, the literature review will also consider quality factors as "any circumstance, fact, or influence which contributes to the increase of quality in the project." However, for the remainder of the paper, quality factors will be understood in the "negative" sense, as factors that potentially deteriorate quality.

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Each project has various participants, also known as stakeholders. It is accepted that the most important participants in a residential construction project are the clients, the future residents. The quality definition assumed here stems from this assumption. However, the enhancement (or deterioration) of quality occurs throughout the entire process of project implementation, in which the client is rarely directly present. This process involves several participants who should be aware of quality factors and consider them in their decisions and actions. As participants of the same project, their potentially different perceptions of what is important in achieving the final quality should be identified, discussed, harmonized, and integrated into a cohesive project management approach.

First and foremost, these factors need to be identified. The literature contains several proposals for lists of quality factors in residential projects, which will be summarized later in the paper. The issue is that some of these factors have been identified based on different quality definitions, and none have been created considering the various participants in the residential construction project implementation process. This represents a significant research gap, as different participants have distinct perspectives, roles, expertise, and backgrounds, leading to varied perceptions of quality factors. All these perspectives should be considered; otherwise, important quality factors may be overlooked. The differences in perceptions can also be valuable, fostering an enriching exchange of views on what is essential for the project. Subsequently, the potentially different sets of quality factors need to be aggregated into one common set after a transparent discussion, helping the entire project team implement each project stage and phase in a manner that ensures the highest likelihood of success. Therefore, the ultimate aim of this paper is to identify quality factors in residential construction projects at various stages or phases, as perceived by different internal stakeholders, called participants in construction nomenclature (i.e., those directly involved in the project), in the residential construction project implementation process.

The methodology applied in this study is based on a survey conducted among participants of several residential construction projects in Poland. The presentation of the survey and its results is preceded by a literature review on the topic of residential construction projects, their stages and participants, as well as the quality of residential construction projects and the factors influencing it.

2. RESIDENTIAL CONSTRUCTION PROJECTS – DEFINITION, IMPLEMENTATION PROCESS, AND PARTICIPANTS

Residential construction projects are defined in international literature as "projects involving the construction, alteration, or repair of single-family houses or apartment buildings of no more than four floors in height" [2]. Other definitions also exist, such as in Polish regulations, which define them as "projects that result in the construction of buildings where at least half of the total floor space is used for residential purposes" [3]. There are many different ways to classify residential construction projects and categorize residential buildings. They can be classified according to the size and type of the building, the owners, the materials used, or the structure types. For example, depending on the size and type, buildings can be divided into detached single-family buildings, semi-detached buildings, low-rise multi-family buildings, and blocks of flats with multiple flats [4].

As shown in Fig. 1, each residential construction project, regardless of the type of building being constructed, consists of three stages:

Stage 1. Preparation of the residential building documentation.
Stage 2. Construction of the residential building.
Stage 3. Acceptance of the residential building for occupation.

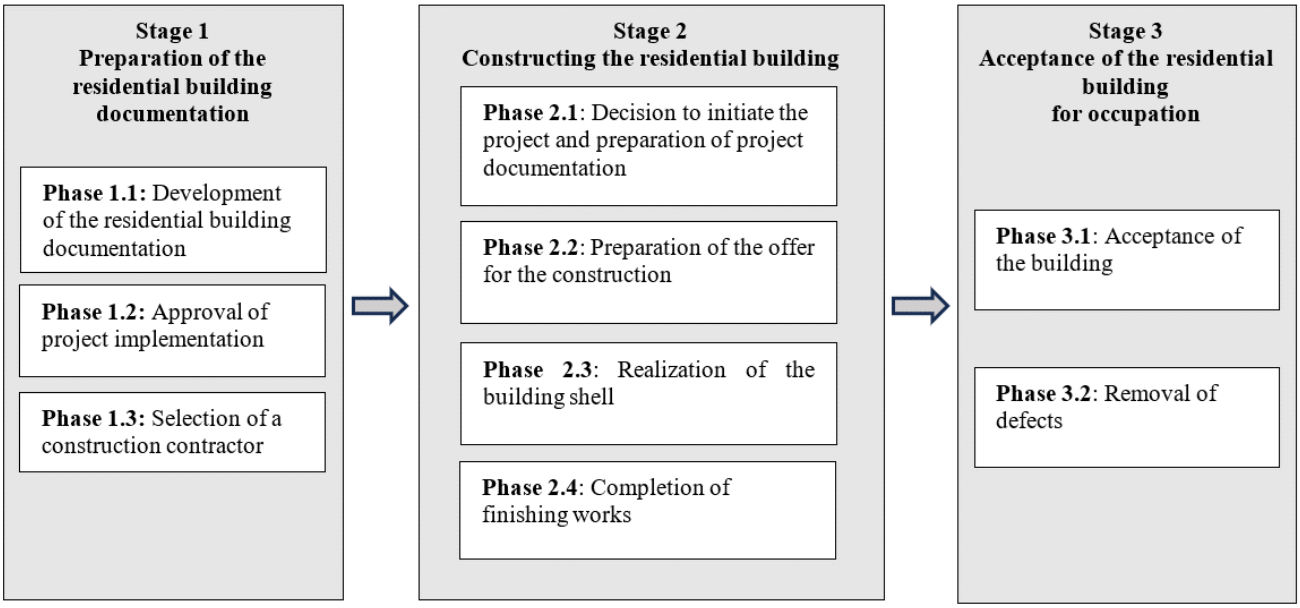

Fig. 1. Main stages of residential construction projects. Source: own elaboration

In Stage 1, detailed residential building documentation is developed, including technical designs, drawings, specifications, and cost estimates. Approval for project implementation is obtained from the relevant building supervision authorities, and a contractor for the residential building is selected. Within this stage, three phases can be distinguished:

Phase 1.1: Development of the residential building documentation.

Phase 1.2: Approval of project implementation.

Phase 1.3: Selection of a construction contractor.

Stage 1 is conducted off-site. It is only in Stage 2 that the project enters the construction site, and the physical creation of the facility takes place. While the quality of the final product of the project can also be compromised in Stage 1, this typically occurs indirectly through errors in the concept and documentation. Assuming that the building documentation has been thoroughly checked before Phase 1.2, all defects revealed during the final acceptance of the building originate in Stage 2, when the contractor constructs the designed residential building.

This stage consists of four phases:

Phase 2.1: Decision to initiate the project and preparation of project documentation (it differs from the residential building documentation prepared in the previous stage).

Phase 2.2: Preparation of the offer for the construction.

Phase 2.3: Realization of the building shell.

Phase 2.4: Completion of finishing works.

Stage 3 involves the acceptance of the completed building and rectification of any identified defects. This stage can be divided into two phases, which may be completed in a cycle:

Phase 3.1: Acceptance of the building.

Phase 3.2. Removal of defects.

A project stakeholder (or a participant) is any person or organization that can affect, be affected by, or perceive themselves to be affected by the project [5]. The role of participants in the execution of residential construction projects is crucial [6]. Many of them are enshrined in local legal regulations for the conduct of construction projects, such as [7] in Poland.

Various typologies of project participants can be used. The most commonly used typology is based on the participant's relationship with the project, dividing them into internal participants, who directly participate in the project, and external participants, who constitute its ecosystem [8].

In the implementation process of residential construction projects, both internal and external participants are involved (Table 1). Internal participants primarily include construction engineers, site manager (construction site supervisor), contracting specialists, company executives, construction supervisors or foremen, and construction workers performing various tasks. External stakeholders primarily consist of investors, who are individuals or entities commissioning the investment; investor supervision inspectors (if such oversight is established); designers/architects (external firms), as well as building users, in this case, residents [6].

It is important to note that internal participants are not involved in Stage 1 of the residential construction project.

Table 1
Main participants of the residential construction projects

Internal participants	External participants
• Construction engineers • Site managers • Contracting specialists • Company executives • Construction supervisors or foremen • Construction workers performing various tasks	• Investors • Investor supervision inspector (if such supervision was established) • Designers • Architects • Residents

3. STATE OF THE ART – QUALITY IN RESIDENTIAL CONSTRUCTION PROJECTS AND FACTORS INFLUENCING IT

In publications on the quality of residential construction projects, the concept of quality is defined in various ways. In Table 2, we present a list of different definitions of quality in residential construction projects found in the literature, along with the corresponding quality factors.

Commenting on Table 2, it is important to note that quality factors are described either in a positive or negative way; some factors are intended to contribute to quality, while others may detract from it. In this paper, we use the "negative" definition of quality factors in residential construction projects: they are "any circumstances, facts, or influences which contribute to the deterioration of quality in the project." However, it is acknowledged that the literature uses both approaches.

Analyzing the factors in Table 2, we notice that some relate to the entire project, meaning they should be controlled and possibly mitigated or reinforced throughout all project phases (e.g., managerial errors). Others pertain to specific project phases and cannot be controlled or modified outside those phases (e.g., the architect's design concept or the presence of lifting mechanisms). In this paper, we are not interested in factors unique to Stage 1 or the period preceding it (e.g., building type, location, architect's design concept) because the aim is to analyze the perspective of different internal project participants who are not involved in Stage 1. We focus here on factors specifically related to Stages 2 and 3. This approach to analyzing residential construction projects has not been identified in existing literature.

In [22], the authors proposed a list of quality factors for individual project stages and phases, with quality understood as the absence of defects in the residential building, according to the results of the final building acceptance procedure (Table 3).

It is important to note that the factors in Table 3 (contrary to Table 2) are all "negative," meaning their influence on quality, if present, will be detrimental. In [22], the factors from Table 3 are analyzed without any reference to individual project participants. In our survey, we examined the perception of these quality factors by various internal participants of residential construction projects, maintaining the relationship to individual project stages and phases.

Table 2
Different definitions of quality in residential construction projects and the corresponding quality factors

Quality definition	Quality factors
Project management success (thus completion of the project within the planned time and cost, implementing the planned scope) [9–13].	• Size of project, project complexity • Realistic cost and time estimates, adequate resource allocation • Contractor and subcontractor selection, logistics requirements, procurement • Client or end-user participation/ client consultation, client's analysis • Top management support, competency of the project team, project manager's authority and leadership skills, quality of control and monitoring • Quality of the design phase, technology applied in the construction phase, and supervision of the construction phase • Governmental and municipal construction policies, rules and regulations, fluctuation in the price of construction material, economic conditions
Meeting the requirements of the residents: with respect to aspects such as environmental safety, public services, landscaping, sociocultural environment, housing economics, physical housing quality, location, open space, routes and movement, unit size, unit layout, unit noise control, light quality, services, accessibility within the unit, sustainability, system building for life, respect for the environment, aesthetics, visual impact [14–19].	• Architect's design concept • The implementation of national and local design standards, laws and regulations • Usage of new materials and new technologies in the design process • The ability of residents to identify and express their requirements
Lack of defects in the residential building [16, 20–28].	• Building type and change in use, location • Material or equipment behavior, use of defective construction materials, reliable and complete volume of materials • Lack of maintenance, poor quality control on site, lack of commitment by supervising team shouldered with the responsibilities of ensuring compliance to approved standards • Poor supervision • Unskilled and incompetent contractors • Faults in the technical specifications for the facilities • Compliance with specifications, poor planning and scheduling, compliance with organizational and technical decisions, compliance with the sequence of work • Inadequate knowledge, training and skills of construction workmen • Geotechnical monitoring, presence of lifting mechanisms, application of industrial formwork systems, use of modern equipment with high performance • Execution failures, faults during design and construction • Managerial errors • Corruption • Climatic conditions

4. RESEARCH PROCESS AND RESULTS

4.1. Context of the research

Given that many participants with potentially different perceptions are involved in the implementation of residential construction projects [29], our research focuses on identifying the differences in the assessment of the impact of potential factors on the quality of residential building among internal participants. No study in the literature has been identified that addresses the different perceptions of quality factors by various residential construction project participants.

Quality was understood as the absence of defects in the residential building, according to the results of the final building acceptance procedure. The study considered the factors listed in Table 3, in which they are related to project stages and phases. This is because the study aimed to identify quality factors related to specific project stages and phases. The research is based on a survey conducted among the participants of several completed residential construction projects in Poland.

4.2. Data collection and research method

To achieve the aim of the study, information was collected from eight companies in Poland implementing residential construction projects, along with their internal participants. The research targeted participants of residential construction projects, thus considering eight different residential construction projects implemented between 2017 and 2020 in Poland. Each project resulted in one residential building, all of which had been completed. Two buildings had seven or eight storeys, while the others

Table 3
Factors potentially affecting quality in a residential construction projects

Factor no.	
	Stage 2
	Phase 2.1
F1	Insufficient internal control of the project documentation prior to commencement of construction of the facility.
	Phase 2.2
F2	Errors in the preliminaries (poorly executed preliminaries, not including a number of contract items).
F3	Design errors in the documentation.
F4	Lack of a database of high-quality construction contractors.
F5	Failure to analyze the bids for the works and confront them with the investor's cost estimate.
F6	No production preparation department.
	Phase 2.3
F7	Changes to the design of site elements during construction, generating additional technical problems to be solved, (e.g., optimization of structures, installations, etc.).
F8	Delays in reinforced concrete works.
F9	Lack of experience of the site manager in organizing large construction sites.
	Phase 2.4
F10	No interior design of common sites - works carried out based on current arrangements during construction.
F11	Lack of involvement of the construction manager in the contracting process of finishing contractors.
F12	Contracting companies without experience, without verification of competence, references.
F13	Lack of a prepared contract team capable of conducting dozens of tenders in a short time interval.
F14	No designated person from the contracting department liaising with the site manager on an ongoing basis.
F15	Lack of team stability (high turnover) to run contract tenders.
F16	Unpredictability of contractors' skills, especially unskilled workers from across the eastern border.
F17	Pursuing a 'one company' policy (i.e., the same contractor carrying out several projects for the same investor).
F18	Lack of experience of the site manager in enforcing site engineering tasks related to site organization.
F19	Difficulties in cooperation between the site manager and the contract team.
F20	Low experience (or lack thereof) of contract team members.
F21	Delays in contracting individual scopes of work (e.g., contracting a particular scope of work several months after the planned date).
F22	Contracting the companies offering the lowest prices.
F23	Contracting a given scope of work several times (due to the need to introduce substitute performance).
F24	Contracting companies without analyzing their capacity to carry out a given scope of work.
F25	Lack of complete contracts covering the entire scope of work to be performed – need to complete orders when incompleteness of scope of work to be performed is discovered.
F26	Lack of financial capacity to carry out large-scale construction by contractors.
F27	Expectation of advances by contractors without financial backing.
F28	Loss of liquidity for subcontractors (who also carry out other investments).
	Stage 3
	Phase 3.1
F29	No internal acceptance of completed works.
F30	Lack of executive capacity to prepare the facility for acceptance.
F31	Too few engineering staff involved in the preparation of housing for acceptance.
	Phase 3.2
F32	Lack of responsibility of the site management (site manager, site engineers) for the removal of defects in the project.
F33	Lack of enforcement capacity to remedy defects in a short time frame.

had four storeys. The taller buildings were of reinforced concrete construction, and the lower buildings were of mixed reinforced concrete and brick construction. The buildings contained between 34 and 141 residential units, with floor sites ranging from 1907 to 6682 m^2.

As mentioned above, the main groups of internal participants in residential construction projects are construction engineers, the site manager (construction site supervisor), contracting specialists, company executives, construction supervisors or foremen, and construction workers performing various tasks. Our respondents represented the following quantities of individual residential project participant groups (Table 4).

Table 4
Number of respondents representing each group of internal participants of the projects

Internal participants	Number of respondents	% of respondents
Construction engineers	16	28.6%
Site managers	8	14.3%
Contracting specialists	8	14.3%
Company executives	24	42.9%
Construction supervisors or foremen	0	0%
Construction workers performing various tasks	0	0%
	56	**100%**

The research was implemented in the form of a questionnaire, which took approximately 15 minutes per participant to complete. Prior to the survey, participants consented to the research and were informed about data anonymization. The questionnaire was originally in Polish, reflecting the context of organizations operating in Poland. For the aim of the study, it was translated into English by construction specialists. Participants responded to questions using a five-point Likert scale (ranging from 1 to 5), where 1 indicated a very low impact of the factor on quality, 2 – a low impact, 3 – difficult to say, 4 – a high impact, and 5 – a very high impact.

The questionnaire was structured in the same way as the factors in Table 3. Respondents were asked to assess the extent to which individual factors influence quality, as defined earlier. They were also asked general questions regarding the type of residential construction they were involved in, their role in the projects, and their professional experience.

4.3. Results

Table 5 presents the results of the analysis of the collected data using selected descriptive statistics. The mean is denoted as M, and this notation will be used throughout the rest of the paper.

We can see that company executives were the most generous in assigning high values to the influence of factors on quality (they have the highest minimum and maximum values), while a similar statement can be made about the site manager (construction site supervisor) (they have the highest mean). Construction engineers were the least generous in giving high values, but overall, the differences across all the factors are not significant. We performed the ANOVA analysis to check whether there are statistically significant differences in the means of the perceived importance of quality factors among the four internal stakeholder groups. The obtained values – F-statistic: 0.514, p-value: 0.676 – imply that we do not reject the null hypothesis. There are thus no statistically significant differences in the group means. A correlation analysis gave the following results:

Table 5
Descriptive statistics of the results (assessment of the influence of the proposed quality factors on quality by different project participant groups)

	Construction engineers	Site managers	Contracting specialists	Company executives
Mean (M)	3.92	4.16	3.89	4.12
Standard deviation	0.73	0.85	0.82	0.58
Minimum	2.27	1.75	1.67	2.71
Maximum	4.94	4.88	4.88	5.00

The highest agreement is between contracting specialists and company executives (r = 0.82), the lowest correlation is between company executives and the site manager (construction site supervisor) (r = 0.60). All correlations are relatively high (above 0.6), suggesting general agreement among stakeholder groups about which factors are important. Nevertheless, important differences were identified.

Table 6
Correlation between individual stakeholders

	Construction engineers	Site managers	Contracting specialists	Company executives
Construction engineers	1.00	0.80	0.72	0.64
Site managers	0.80	1.00	0.66	0.60
Contracting specialists	0.72	0.66	1.00	0.82
Company executives	0.64	0.60	0.82	1.00

Individual factors were then presented graphically using charts for each internal participant group, sorted from the most to the least significant according to the average rating (denoted as M) of the impact of each factor as assessed by the respondents. On the charts, the factors were classified and marked for each internal participant as follows:

- Very significant ones – marked in green, for which the average rating was in the range of 4.01 to 5.

- Significant ones – marked in orange, for which the average rating was in the range of 3.01 to 4.
- Those of little significance – marked in red, for which the average rating was in the range of 0 to 3.

We begin with the results obtained for construction engineers (Fig. 2).

Fig. 2. Ranking of factors according to their average rating by construction engineers. Source: own elaboration

- Fourteen out of 33 factors were rated as very significant by individuals working as construction engineers, with an average rating in the range of 4.01 to 5.00.
- The highest-rated factors were: F30 (Lack of executive capacity to prepare the facility for acceptance, Phase 3.1) with M = 4.94, F33 (Lack of enforcement capacity to remedy defects in a short time frame, Phase 3.2) with M = 4.88, as well as F7, F22, F12, F31, F23, F24, F14, F16, F15, F29, F11, and F19.
- The lowest-rated factors were: F27 (Expectation of advances by contractors without financial backing, Phase 2.4) with M = 2.27 and F32 (Lack of responsibility of the site management (the site manager, i.e., construction site supervisor, and site engineers) for the removal of defects in the project, Phase 3.2) with M = 2.33, as well as F6, F18, and F26. The average rating for these factors ranged from 2.00 to 3.00, indicating they are of little significance according to construction engineers.

Based on the results, we can conclude that, according to the assessment of construction engineers, ensuring the execution potential both in terms of preparing objects for acceptance and rectifying defects in an organized manner has the greatest impact on the quality of the residential building (factors F30 and F33, both in Stage 3).

The results for the site manager (construction site supervisor) are as follows (Fig. 3).

In the case of the site manager (construction site supervisor):

- The majority of factors (20 out of 33) were rated as very significant, with an average rating in the range of 4.01 to 5.00.
- The highest-rated factors were: F4, F7, F11, F12, F16, F22, F24, F30, and F33, each with M = 4.88. Additionally, factors F14, F17, F23, F31, F3, F1, F26, F29, F13, F20, and F19 had average ratings ranging from 4.00 to 4.88.
- The lowest-rated factor was F9 (Lack of experience of the site manager (construction site supervisor) in organizing large construction sites, Phase 2.3) with M = 1.75, as well as F32, F5, and F6. According to this group of respondents, these factors are of little significance, with average ratings in the range of 2.00 to 3.00.

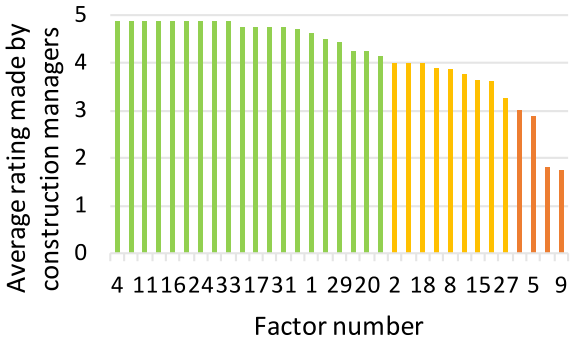

Fig. 3. Ranking of factors according to their average rating by site managers. Source: own elaboration

In the case of the site manager (construction site supervisor), eight factors, covering all the stages and phases of the projects, turned out to have the highest average rating.

Let us continue with contracting specialists (Fig. 4):

- Similar to the site manager (construction site supervisor), contracting specialists rated the majority of factors (20 out of 33) as very significant, with an average rating in the range of 4.01 to 5.00.
- The highest-rated factors were: F14 (No designated person from the contracting department liaising with the site manager (construction site supervisor) on an ongoing basis, Phase 2.4) with M = 4.88, F22 (Contracting companies offering the lowest prices, Phase 2.4) also with M = 4.88, as well as F11, F15, F12, F3, F30, F31, F5, F16, F19, F23, F9, F29, F32, F33, F7, F13, F24, and F28.
- The lowest-rated factors, considered by contracting specialists to be of little significance, were: F6 (No production preparation department, Phase 2.2) with M = 1.67, F10 (No interior design of common sites – works carried out based on current arrangements during construction, Phase 2.4) with M = 2.00, as well as F8, F26, and F21.

We can summarize the assessment made by contracting specialists by noting that the two highest-rated factors are related to contracting construction works. Interestingly, factor F30 (Lack

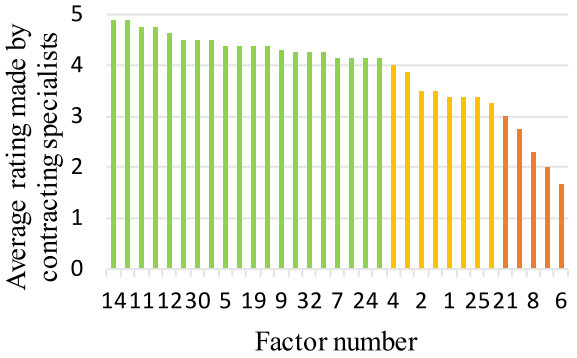

Fig. 4. Ranking of factors according to their average rating by contracting specialists. Source: own elaboration

of executive capacity to prepare the facility for acceptance, Phase 3.1), which was rated highest by both the site manager (construction site supervisor) and construction engineers, occupies the 7th position according to contracting specialists.

Finally, let us present the results for the group of company executives (Fig. 5).

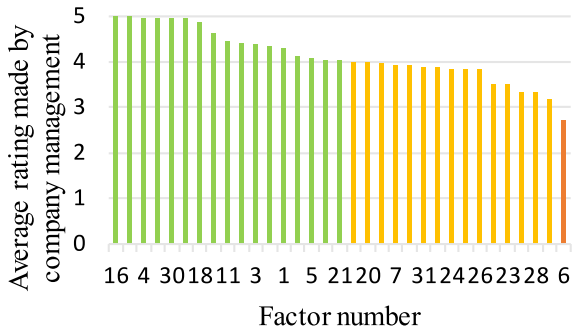

Fig. 5. Ranking of factors according to their average rating by company executives. Source: own elaboration

For the respondents from the group of company executives, we obtained the following results:

- Seventeen out of 33 factors were rated as very significant.
- The highest-rated factors were F16 (Unpredictability of contractors' skills, especially unskilled workers from across the eastern border, Phase 2.4) and F29 (No internal acceptance of completed works, Phase 3.1), both with a maximum M of 5. Other highly rated factors included F4, F22, F30, F32, F18, F12, F11, F10, F3, F33, F1, F2, and F5, with average ratings ranging from 4.01 to 5.00.
- Only one factor was rated as being of little significance: F6 (No production preparation department, Phase 2.2) with M = 2.71.

According to company executives, the two highest-rated factors are directly related to the organization of the company's work: employing craftsmen with unpredictable skills and conducting internal acceptance of work performed by the company's employees each time.

4.4. Summary of results

A summary of the results on factors influencing quality in residential construction projects, depending on the respondent's membership in internal stakeholder groups, is presented in Table 7.

Factors rated as very significant by individual internal participant groups are as follows:

- Construction engineers: F1, F7, F11, F12, F14, F15, F16, F19, F22, F23, F24, F29, F30, F31, F33
- Site managers: F1, F3, F4, F7, F11, F12, F13, F14, F16, F17, F19, F20, F22, F23, F24, F26, F29, F30, F31, F33
- Contracting specialists: factors F3, F5, F7, F9, F11, F12, F13, F14, F15, F16, F19, F22, F23, F24, F28, F29, F30, F31, F32, F33
- Company executives: F1, F2, F3, F4, F5, F10, F11, F12, F14, F16, F18, F21, F22, F29, F30, F32, F33

The following factors were rated as very significant (green) by all the internal participant groups:

- Lack of involvement of the construction manager in the contracting process of finishing contractors (F11, Phase 2.4)
- Contracting companies without experience, without verification of competence, references (F12, Phase 2.4)
- No designated person from the contracting department liaising with the site manager (construction site supervisor) on an ongoing basis (F14, Phase 2.4)
- Unpredictability of contractors' skills, especially unskilled workers from across the eastern border (F16, Phase 2.4)
- Contracting companies offering the lowest prices (F22, Phase 2.4)
- No internal acceptance of completed works (F29, Phase 3.1)
- Lack of executive capacity to prepare the facility for acceptance (F30, Phase 3.1)
- Lack of enforcement capacity to remedy defects in a short time frame (F33, Phase 3.2)

Additionally, F25 (Lack of complete contracts covering the entire scope of work to be performed – need to complete orders when incompleteness of scope of work to be performed is discovered, Phase 2.4) was rated as significant (orange) by all internal participants. Conversely, F6 (No production preparation

Table 7

Classification of factors according to their significance for the quality of the residential building, as perceived by various participants of residential. Source: own elaboration

Type of internal participants	Factor number																															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Construction engineers																																	
Site managers																																	
Contracting specialists																																	
Company executives																																	

Green – very significant, orange – significant, red – of little significance

department, Phase 2.2) was considered to be of little significance (red) by all participants of the residential construction project.

The highest differences in assessment (indicated by the presence of both green and red in the respective column of Table 6) have occurred for the following factors:

- Failure to analyze the bids for the works and confront them with the investor's cost estimate (F5, Phase 2.2)
- Lack of experience of the site manager (construction site supervisor) in organizing large construction sites (F9, Phase 2.3)
- Lack of experience of the site manager (construction site supervisor) in enforcing site engineering tasks related to site organization (F18, Phase 2.4)
- Delays in contracting individual scopes of work (F21, Phase 2.4)
- Lack of financial capacity to carry out large-scale construction by contractors (F26, Phase 2.4)
- Lack of responsibility of the site management (site manager (construction site supervisor), site engineers) for the removal of defects in the project (F32, Phase 3.2)

5. DISCUSSION

The analysis of factors influencing the quality of residential construction projects highlights the varying perceptions among different participant groups, underscoring the complexity of achieving consensus on what influences the quality of the building, understood as the lack of defects identified during the final acceptance procedure. The analyzed factors affecting quality were categorized into six phases of the residential construction projects: 2.1: Decision to initiate the project and preparation of project documentation, 2.2: Preparation of the offer for the construction, 2.3: Realization of the closed shell, 2.4: Completion of finishing works, 3.1: Acceptance of the building, and 3.2: Removal of defects. Each factor was evaluated for its importance by different internal project participants, including construction engineers, the site manager (construction site supervisor), contracting specialists, and company executives.

5.1. Phase-related analysis of the results

The results reveal a nuanced perception of the importance of quality factors. Out of 33 factors, all participant groups were unanimous regarding only 10 factors: they agree that F6 is not significant, F25 is significant, and the other eight factors (F11, F12, F14, F16, F22, F24, F30, F33) are very significant. For six factors, all three rating categories are present (i.e., some residential construction project participants consider the factors extremely significant, while others consider them insignificant).

Let us examine some implications of the findings on the project management phase by phase, considering the different ratings given by various residential construction project participants.

- Phase 2.1: Decision to initiate the project and preparation of project documentation

Only one factor was assigned to this phase: "Insufficient internal control of the project documentation prior to commencement of construction of the facility" (F1). This factor is considered at least significant by all participant groups, and very significant by three of the four groups. This consensus indicates the importance of this factor, suggesting that steps to increase the efficiency and completeness of the internal control of project documentation should be incorporated into project management.

- Phase 2.2: Preparation of the offer for the construction

The only factor that all participant groups consider insignificant, "No production preparation department" (F6), belongs to this phase. Thus, project management should marginalize this aspect. The factor "Design errors in the documentation" (F3) is seen as at least significant by all participant groups, and very significant by three of the four groups. Therefore, special attention should be paid to verifying the design documentation. There is disagreement over the factor "Failure to analyze the bids for the works and confront them with the investor's cost estimate" (F5): the site manager (construction site supervisor) thinks it is not significant, while the other groups consider it at least significant, with two groups rating it as very significant. Site managers may underestimate this factor, as they are not directly involved in the cost process. Therefore, during discussions, they should probably be convinced that this factor is indeed significant and should be treated as such in the project management process.

- Phase Phase 2.3: Realization of the closed shell

There is almost complete agreement on the factor "Changes to the design of site elements during construction, generating additional technical problems to be solved" (F7). The only group that considers it merely significant is the company executives, who are not often present on the site and may be unaware of the importance of this aspect. Therefore, change management should become an important element of project management.

A very interesting case is the factor "Lack of experience of the site manager (construction site supervisor) in organizing large construction sites" (F9). This factor concerns the site manager (construction site supervisor), yet it is the only group that considers it insignificant. Here, we face an important managerial problem: convincing the site manager (construction site supervisor)s that it is in the common interest to consider their experience and possibly introduce the position of "senior site manager (construction site supervisor)" or "site manager (construction site supervisor) adviser" when employing inexperienced site manager (construction site supervisor). All this should be done with transparency and sensitivity to ensure that no one feels offended.

- Phase Phase 2.4: Completion of finishing works

In the case of the following factors, all participant groups are unanimous or almost unanimous (with three groups seeing the factor as very significant and one as significant) that they should be given special attention during the project management process:

F11: Lack of involvement of the construction manager in the contracting process of finishing contractors.

F12: Contracting companies without experience, without verification of competence, or references.

F14: No designated person from the contracting department, liaising with the site manager (construction site supervisor) on an ongoing basis.

F16: Unpredictability of contractors' skills, especially unskilled workers from across the eastern border.
F19: Difficulties in cooperation between the site manager (construction site supervisor) and the contract team.
F22: Contracting the companies offering the lowest prices.
F23: Contracting a given scope of work several times (due to the need to introduce substitute performance).
F24: Contracting companies without analyzing their capacity to carry out a given scope of work.

Factors F11, F14, and F19 relate to internal project participants on site: the lack of involvement of the construction manager in the contracting process, and improper communication and cooperation between the contracting department and the site manager (construction site supervisor) are seen by everyone as important issues that should be incorporated into the project management process. In fact, all the above factors are linked to the contracting department. It seems that everyone sees the problem of who is contracted and in what way as crucial for the quality of the residential building. This is an important conclusion for the contracting department.

There is disagreement regarding the importance of three factors: "Lack of experience of the site manager (construction site supervisor) in enforcing site engineering tasks related to site organization" (F18), "Delays in contracting individual scopes of work" (F21), and "Lack of financial capacity to carry out large-scale construction by contractors" (F26). The problem of the lack of experience of the site manager (construction site supervisor) (F18) came up in the previous phase, so the measures proposed there should be maintained in this phase as well. The problem of contracting delays (F21) is seen as insignificant only by contracting specialists, who are directly involved in the process. Therefore, it seems necessary to propose some project management measures in this respect, with all transparency and sensitivity, to avoid offending contracting specialists. As for the problem of financial capacity (F26), it is seen as significant only by the site manager (construction site supervisor). They should be asked for the reasons. If they can convince the other participants of the significance of this factor, relevant measures should be incorporated into the project management process.

- Phase 3.1: Acceptance of the building

All project participant groups are unanimous: all three factors are at least significant, and in the eyes of most groups, they are very significant. They all refer to the acceptance process and imply concrete measures to modify it: ensuring internal acceptance (F29), changing the preparation process (F30), and assigning more staff to the process (F31).

- Phase 3.2: Removal of defects

In this phase, there are only two factors. There is unanimous agreement on one of them: "Lack of enforcement capacity to remedy defects in a short time frame" (F33) is seen by everyone as very significant, indicating a clear improvement path for this project phase. At the same time, there is strong disagreement over the other factor: "Lack of responsibility of the site management (site manager (construction site supervisor), site engineers) for the removal of defects in the project" (F32). Again, the participants mentioned in this factor, whose lack of experience is seen by the other participants as a problem, do not seem to realize it and claim the factor to be insignificant. A high level of communication skills will be needed to address the issue of lack of experience without offending anyone. However, some steps in this respect will be necessary.

5.2. Recommendations for residential construction project management

Based on experience in implementing construction projects and the research conducted, key conclusions were drawn regarding the broader implications for managing the investment process at every stage of a project's development:

- Project documentation should be thoroughly analyzed before being used for bid preparation and project execution. Failure to sufficiently review project documentation, especially if it contains numerous technical errors, will result in the need to resolve problems during the construction phase. Furthermore, during the contracting stage, changes to the documentation that require verification or design/quantity checks should be avoided as they may cause delays.
- When commissioning construction work quantity take-offs, the selection should be based on the quality of the documentation, not price. Lack of precise take-offs, coupled with no analysis of design documents and quantity control, leads to underestimated construction budgets, ultimately making it impossible to complete the investment within the planned budget.
- Investors should maintain their own database of contractors, built from previously completed projects. If the number of planned projects exceeds the available contractor base, a longer timeframe should be allowed to find reliable contractors. Investment planning should be done well in advance, as skilled structural contractors often schedule work several months ahead. Construction should not commence without trusted contractors for key work sites.
- No project should begin without a preparatory phase. The construction manager should be hired in advance to oversee the production preparation process. They should also participate in the contractor selection for specific work scopes.
- Each bid should be compared to the investor's cost estimate. Offers that significantly deviate from the estimate should be carefully analyzed for feasibility. Contracts should not be awarded based solely on the lowest price.
- Contractors hired to perform the crucial structural reinforced concrete work must be experienced and have references. Again, price should not be the sole deciding factor in contractor selection.
- In multi-family residential investments, only complete documentation should be used for execution. It is unacceptable to begin construction without an approved interior design project for common sites.
- A construction manager cannot effectively oversee all subcontractors without specialized supervision. Subcontractor selection should not proceed without verifying references, experience, and technical and organizational capabilities. Price alone is not a sufficient criterion.

- For the simultaneous execution of several major investments, experienced and proven contract management personnel must be in place. Each contract specialist should be assigned to and responsible for a single investment.
- Employee compensation should be aligned with their qualifications and competencies. Two well-paid workers can deliver better results than four underpaid ones.
- Only organized and verified companies should be contracted (individual workers should be hired only in exceptional cases). A recent decline in craftsmanship quality in construction trades directly impacts the quality of finished residential units.
- Stability in management staffing is essential to effectively complete investment projects.
- To ensure proper collaboration between the site manager (construction site supervisor) and the contract management team, procedures should be developed that clearly define roles and responsibilities for both parties.
- To avoid errors from inexperienced staff, the contracting team should be built around trusted and proven personnel, especially when multiple investments are being carried out concurrently.
- Only contractors with a verified market reputation can guarantee proper execution and prevent the need for repeated contracting of the same work. Avoid contractors willing to sign any contract under unfavorable terms if they lack the capacity to deliver the agreed scope.
- Lump-sum contracts should only be signed based on verified and complete scopes of work.
- Contractors must be financially, technically, and organizationally prepared to perform the work. Avoid contractors who require advance payments just to function unless they are proven and recognized for quality and on-time delivery.
- Before signing significant contracts, the contractor should be checked through a business intelligence agency for liens, debts to suppliers, and similar issues.
- The investment handover process should include an internal acceptance procedure.
- Preparing apartments for client handover should be a separate budget item in the construction contract. A steady collaboration with companies specializing in this task should be maintained. Often, small construction works such as plaster touch-ups after door installation or repair of minor damage are not covered by any subcontractor and yet generate a high number of defects. Therefore, it is necessary to ensure execution capacity for these final preparations. A solution may be to enter into long-term framework agreements with subcontractors focused solely on preparing apartments for handovers, ensuring high quality.
- A motivational system should be implemented for the engineering team to ensure quality in units delivered to clients. For example, bonuses could be awarded for handing over defect-free apartments. Additionally, the management team's schedule should extend at least three months beyond the occupancy permit date to supervise defect rectification.

5.3. Recommendations for future research

The study presented here has obvious limitations. First of all, the number of stakeholders examined was relatively low. Secondly, no other sources of information apart from the questionnaires were used. Future research should, as a minimum, consult project documentation. Our study investigated subjective opinions, which are of a certain theoretical and practical value, but certainly these findings should be examined on a larger sample and be accompanied by objective data. This indicates the direction of future research. Future research should also focus on:

- Considering other potential quality factors: this study considered only one possible list of factors. Other factors, adapted from the literature on construction projects (not necessarily residential construction, see, e.g., [8] for a literature review), should be considered.
- Considering other project quality definitions: only one definition related to the number of defects in the residential building was considered, but other perspectives on quality in a residential construction project should also be considered (again, [8] can serve as a source of ideas).
- Considering two groups of internal participants who do not perform managerial functions: construction supervisors or foremen, construction workers performing various tasks (which were not the subject of the research presented in this article).
- Considering possible biases of individual participant groups: differences in the "generosity" of assigning ratings to individual actors were observed. The specific culture and background of a project participant group may lead to different ratings for the same assessment. Also, the size of the sample was small; bigger samples must be examined in the future.
- Longitudinal analysis: assessing how perceptions of quality factors evolve throughout multiple projects. This study analyzed single projects, but the problem may become more complex in the case of programs or portfolios composed of several related projects.
- Cross-cultural comparisons: investigating how cultural differences impact quality perceptions in residential construction projects. This study only investigated residential construction projects implemented in Poland by Polish companies, so the results may not be representative of other nations or international projects.
- Technology integration: evaluating the role of digital tools in harmonizing project and project quality management among participants. Certain issues might become less controversial if project participants, who form a spatially dispersed team (with some participants working on site and others in the office), use modern communication tools to discuss each issue continuously.
- Policy impact: analyzing the effect of regulatory frameworks on stakeholder alignment and project quality factors. For example, some factors identified as very significant in this study refer to the contracting process, which is highly dependent on regulation, local policy, and the current political

and social situation. However, we have not analyzed these dependencies.

- Using triangulation methods, e.g., anonymous peer evaluation, or project documentation reviews.

6. CONCLUSIONS

Achieving high-quality residential construction is a multifaceted challenge that requires integrating diverse stakeholder perspectives. By recognizing and addressing the distinct priorities of each project participant group, project managers can foster a more collaborative and effective construction process. This study underscores the importance of tailored management approaches and continuous participant engagement to enhance the quality of residential construction projects. The main practical conclusion of the study can be formulated as follows:

There is no unanimous perception of what is important for constructing a high-quality residential building. Various internal project participants have diverse views on the subject, partially because some potential quality factors concern them (and implicitly criticize them) directly. It is essential to identify factors that are important in the eyes of each group, analyze the differences, and build an efficient project management process transparently and sensitively, using advanced communication techniques.

From a research perspective, the findings without doubt indicate that internal project participants – even within the same organization – differ significantly in their assessment of the impact of various factors on construction quality. This highlights the need for further research that takes into account the perspectives of multiple roles and functions within project teams and considers the mechanisms underlying these perceptual differences.

Furthermore, the study shows that the role and responsibilities of the respondent influence the perception of factors affecting quality. Future research should integrate subjective data (e.g., surveys, interviews) with objective project performance indicators (e.g., number of defects, resolution time, documentation reviews) to increase the reliability of findings.

In addition, most of the existing research focuses on the perspective of customers, investors, or residents. This study shows that civil engineers, construction managers, contracting specialists, and company management have a significant impact on quality performance, and perceive their roles differently. Future research should focus more on the internal organizational dynamics of residential construction projects.

Finally, the study confirms that different phases of the construction process (from documentation to delivery) are associated with different sets of critical quality factors. This requires phase-specific research that can inform targeted quality management interventions at each stage of the project life cycle.

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