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# The Factors that Influence Human Resources on Affordable Housing Delivery within Restraint of Budget

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**Abstract:** The study aims to establish the factors influencing human resources on cost, since the construction cost of housing delivery is often above budgeted cost. The challenges occurred due to unsustainable practices in the use of human resources, design-related issues, matching resources availability with cost and time frame problems. The methodology used is a sequential mixed method to achieve the aim and objective of the study, for this purpose, construction managers and stakeholders were considered as research respondents. Data collected was analysed on SPSS software version 25, with the application of a descriptive statistics analysis technique. Findings deduced are involvement of all team members in the planning and implementation process will enhance mutual relationships, less conflict and fewer controversies on design, while documenting delivery roles and responsibilities among construction team members will increase the satisfaction of interest and efficient resources utilisation. This study establishes “factors regulating human resources management on construction cost and “strong component factors influencing human resources on cost”. The study then assembles the factors to develop an operational framework that will control construction resources management on cost, as a guide to improve competency and sustainable techniques for affordable housing delivery within the income limit of the poor people in South Africa.

**Keywords:** affordable; budget; construction; housing; resources

## 1. Introduction

Construction industry and production process are significant for the economic growth of a nation, especially if the intent is that of achieving cost-efficient project production. In that case, the use of resources on-site must be proficiently controlled. Effectiveness in the management of cost in construction during housing production hinges on the adequate implementation of the initial construction resources plans on-site [1]. This is negatively impacted through lack of competencies and knowledge of the construction operators in sustainable design, matching resources availability with design, and controlling construction cost during production [2]. In effect, this denies low-income earners, who are supposed to have access to affordable housing within their income levels, leaving them with no option but to live in slums on the urban peripheries [1,3].

The high cost of construction and expensive housing delivery call for the need to address issues of affordable housing in South Africa, to ensure availability and affordability of housing to the people irrespective of their income level [4]. The objective of this study is to establish factors influencing construction resources management on cost towards affordable housing delivery. A sequential mixed method, with a combination of qualitative and quantitative techniques, was applied to evaluate data collected through questionnaires and interview surveys. The questionnaires were administered

to construction managers, and the data collected was studied, assembled, and analysed with the application of descriptive statistics analysis on SPSS software version 25 [5]. Quantitative results attained were appropriately validated using the qualitative interviews conducted among the selected respondents, with the objective of ascertaining whether the instruments used measured what they were supposed to measure.

Construction industry production processes are impeded through unaffordable housing delivery, unsustainable practices in housing designs, inadequate information on methods and practices for affordable housing delivery [6]. Stakeholders are not appropriately enlightened about the uses of construction resources for affordable housing delivery despite the fact that such housing will have a positive effect on society [7,8]. Sustainable construction seeks to support effective management in efforts to achieve comfortable, safe, productive, and secure housing [3,9].

Effective management of labour resources is one of the most critical functions affecting the performance of the construction industry [10]. This is particularly true in an industry, where labour cost is high, either because the production operations are labour intensive or require highly skilled labour. Due to this effect, the construction companies are constantly looking for ways to decrease labour cost and having changed their workforce management strategy from the one that implements perfect division of labour to one that takes advantage of various forms of workforce agility [11]. However, among all strategies supporting the construction firm's flexibility and agility, only the development of human resources versatility is guaranteed to yield cost benefits [8].

As a result of the emerging fact that many companies are craving for innovation and increase in productivity, there is thus a need to improve the skill of the personnel working in the construction industry [12]. In support of this claim, the growing need of responsiveness for manufacturing companies that are facing market volatility, raises a strong demand for flexibility in their organisations. Since the company personnel are increasingly considered as the core of the organisational structures, the effective management of human resources and skills is essential to improve industrial performance [13].

In addition, stakeholders' involvement is crucial to efficient housing project production process. Therefore, an organisation's commitment, senior management involvement, and team involvement are expected to have a positive impact on the realisation of strategic planning objectives. That is, more commitment and involvement should produce greater success [11]. This literally implies that every hand must be on the decks. In other words, people must be involved. On this basis, the successful implementation of an enterprise resources planning system is a task of herculean proportions, but it is not impossible. If an organisation is to reap the benefits of enterprises resources planning, it must first develop a plan for success. The implementation of this planning must be viewed and undertaken as a new business endeavour and a team mission, not just an individual mission. Companies must involve all employees, and unconditionally and completely educate on the concept of enterprises resources planning for it to be a success [14].

Teamwork on-site defines the successful implementation of strategies. However, team is defined as a group of people with complementary skills who are committed to a common purpose and hold themselves mutually accountable for its achievements [15,16]. Essentially, teamwork enhances productive site meetings. It is known that different patterns of communication occur in different types of meeting. Specifically, in the problem-solving meetings, there was a richness of interaction that was largely missing from progress and technical meetings. Team members expressed greater satisfaction with this problem-solving meeting where enriched exchanges took place [16].

To achieve successful productivity in the construction industry, staff inducement is one method to increase workers' performance on-site [12]. However, recent resurgence of interest in the productivity of workers in the developed nation remains an issue of the central concern of business and public policy [17]. Traditionally, efforts to strengthen competitiveness have frustrated technological advance and investment in physical and human capital [18]. Most recently, however, attention has been turned to the behavioural dimension of labour productivity, variations in the quantity, and quality of labour inputs that stem from the complexity of financial and non-financial motivations. To give this effect,

using a carefully, crafted group incentive compensation system perhaps, workers may be induced to work both harder and smarter, and to even use existing technologies in new and better ways that could enhance their productivity [17].

Appropriate technical skills are scientifically significant in defining the effective techniques required to attain affordable housing project objectives. It is presumed that the construction manager is one who directs the activities of other workers and undertakes the obligation for achieving certain objectives through these efforts. Within this definition, successful supervision appears to rest on technical skill [19]. Technical skill denotes an interpretation of proficiency in a specific kind of activity, particularly one involving methods, processes, procedures, or techniques. It is relatively easy to envisage the technical skill of the project manager when performing a special function. Technical skill involves specialised knowledge, the analytical ability within that speciality, and proficiency in the use of the tools and techniques of the specific discipline [19,20].

One aspect that the construction industry can improve is an accurate determination of the client's requirements and successfully transform these requirements into plans and specifications to construct a facility/housing that is affordable [21]. Consequently, construction industries of African nations, including South Africa, are expected to learn the significance of interpreting and incorporating strategic sustainability objectives into affordable housing production processes [22]. This has been considered as an extremely challenging task by the construction managers. Effective housing delivery has been aggravated by the multi-faceted perspective of sustainability known as economy, society, and environment, including a lack of structured methodology and ineffective communication among the stakeholders at various levels of management [22,23]. Therefore, the construction industry has a responsibility to redirect its actions and opinions towards sustainable housing delivery, to alleviate widespread poverty and lack of decent housing for dwellings among the communities in South Africa [24].

The challenge of integrating sustainability into the housing production process objectives are particularly acute in South Africa, a country needing extensive affordable housing delivery to stimulate economic growth, poverty alleviation, institutional strengthening, capacity utilisation building, and socio-cultural dimensions that will sustain peace, harmony and co-existence [22]. Nevertheless, many studies have been conducted on human resources usage. Studies that fully concentrate on the factors influencing human resources usage on cost towards affordable housing delivery are needed. This study has contributed in tackling the gap, through establishing "factors regulating human resources management on construction cost at mean value (MV) above 4.0000" and Strong component factors loading above 0.600 influencing human resources on cost. Thus, the study congregated the factors to develop a simple operational framework of factors that influence human resources towards managing affordable housing delivery. It can be used as a guide for the provision of inexpensive housing for the people of low income in South Africa.

## 2. Literature Review

### 2.1. Human Resource Management towards Affordable Housing Delivery

Human resource management in sustainable housing delivery means organising and managing a team that can achieve affordable housing delivery. This team comprises the construction operators with assigned responsibilities for the completion of affordable housing delivery [25]. The type and number of team members can change frequently as the housing production process advances [26]. Importantly, the involvement of all team members in sustainable housing delivery planning and decision making can be beneficial because the early involvement of the team members enhances effectiveness in productivity [11]. They incorporate expertise during the planning process which strengthens their commitment towards the housing production process. A human resource management plan must be developed to foster the acquisition of a sustainable delivery team, then develop and manage the

team [27]. In that case, significant characteristics attributed to human resource management in order to attain affordable housing delivery are outlined in the subsequent sections.

## 2.2. *Improve Human Resource Management Plan for Housing Production Process*

This involves identifying and documenting affordable housing delivery responsibilities among construction team members, identifying required skills, reporting relationships among team members, and a staffing management plan [27]. To achieve effective productivity from such a team, a human resource management plan should include scarce human resources, identification of training needs, team building strategies during the production process, and compliance for sustainable integration and safety issues. A plan to recognise and reward team members, who effectively implement sustainable practices during housing production should be established, including the importance of a staffing management plan specifically for affordable housing delivery [25].

## 2.3. *Procurement of Affordable Housing Delivery Team*

This involves the process of recruiting and confirming the availability of human resources and the formation of a housing production team to complete the processes in order to engage in affordable housing delivery. The factors outlined below are considerably essential for the formation of an effective construction team [25,27,28].

- a. A project manager is expected to acquire required human resources, such as skills, knowledge, experience, etc to participate in the attainment of affordable housing delivery [12]. If the process of engagement is not executed effectively, it will frustrate timely delivery, budgeted cost, client satisfaction, quality and increase the risks involved [19,29]. An additional effect of this factor is that the probability of success could be affected, which would result in inadequate housing delivery [28].
- b. The project manager is expected to demonstrate the ability to negotiate and influence other members, while teams formed are expected to demonstrate required skills competently [27,30].
- c. Unavailability of skilled people, due to time constraints and economic reasons, could pressurise the project manager to seek elsewhere or, prefer to organise and train personnel for such sensitive positions [2,17]. For this reason, the protocol has to be executed in accordance with the regulatory and mandatory procedures established in the contract documents [27].

## 2.4. *Creations Affordable Housing Delivery Team*

This process involves improving the competencies of the team members and thereby enhancing the team's productivity. Teamwork is a critical factor in sustainable housing delivery and an effective team is essential towards the reduction of construction costs. A project manager assigned to manage the housing production team on affordable housing delivery is expected to always provide support on any site challenges and to be keen to offer a reward for solid performance [9]. In addition, other attributes to be demonstrated by the project manager are open and effective communication, trust, collaborative problem solving, and decision making [1,31].

## 2.5. *Efficient Utilisation of Labour*

Labour utilisation in a housing production process is conceptualised by way of demonstrating the appropriate use of employees in the construction industry in order to facilitate efficient delivery of projects at the planning stage of the production process within specified aim and objectives [32]. In essence, this concept is considerably crucial to the construction industry during the evaluation of the utilisation of its manpower. In addition, the process includes evaluation of the employees' educational level—in line with the construction industry employment policy, employees' competency, and payment of salaries and other remunerations. All this must be adequately established during production processes for the enhancement of productivity [2].

Generally, human resource effective utilisation is very prominent to the construction industries in terms of its budgeting and financing [2]. It is mandated in construction industries that training and seminars must be organised for the employees, including health and safety insurance, across all departments in order to raise the performance quality of the industry [4,9]. It is understood that these outlays impact employees' performance output in enhancing the production process towards attaining sufficient affordable housing delivery [12].

Effective labour management is an important technique in the construction industry. This technique is often applied by the construction professionals in housing production process management [18]. However, as additions to this particular technique, project management professionals are advised to engage in the efficient utilisation of labour, with adequate labour management [33]. In that case, skilled labour will sufficiently be made available to execute, complete, and deliver housing within the stipulated time. This process will reduce the cost of production and lessen time consumption [26].

Managing a project team is different from managing a team of employees [11]. These two administrative roles are different because of the unique nature of a project and the variety of project management duties [28]. Housing projects are strictly defined by result requirements, cost and time constraints, and confined by physical site environment [18].

### 3. Methodology

The aim of the study is to determine the factors that impact human resources control on sustainable housing delivery, with the objective of producing sufficient affordable housing within the capacity of all income earners. In the literature, factors with the predominant impacts on the control of the human resources in achieving cost-efficient, affordable and available housing delivery were determined. The methodical approach used is a mixed-methods approach, which involves the integration of both quantitative and qualitative techniques. Mixed methods research is defined as research designed with philosophical assumptions that guide the collection and analysis of data, with the mixture of qualitative and quantitative data in a single study or series of studies [34]. Its central evidence is the integration of quantitative and qualitative approaches to demonstrate a clear interpretation of the research problems. Construction professionals such as architects, contractors, project managers, quantity surveyors, contract managers and site engineers were interviewed on the factors that influence human resources and inflate construction cost on their sites. A purposive sampling technique was used for the selection of the respondents among the large population [35] since these professionals occupy crucial positions on their respective construction sites in South Africa.

Many construction site activities are managed by the aforesaid construction professionals, hence, this defines the reason behind their participation in the interview exercise. Purposive sampling techniques allow an extraction of a fraction from a larger population to study, while quantitative research is more suited to the study of larger populations [36]. For this study, registered contractors with the Construction Industry Development Board (CIDB) in South Africa of grade-level 3, 5, 9 general building (GB) were selected to facilitate the collection of accurate information. The number of registered professionals in South Africa targeted for this research study was 2934.

A questionnaire developed for the quantitative aspect of this study was divided into related sections to derive relevant responses about the influence of human resources on sustainable housing delivery. The researcher contemplated many options for administering the questionnaires to the selected professionals working in the construction companies registered under CIDB. After careful consideration of the options available, the researcher adopted two approaches for data collection. For the first-approach, questionnaires were delivered to the respondents by hand, while for the second approach, the questionnaires were emailed to respondents working in other provinces.

The administering of questionnaires through email was done in two ways. The researcher sent questionnaires directly to the respondents' emails. Some of the respondents helped the researcher in locating other respondents specializing in sustainable housing delivery who were working in another province. Thereafter, the first respondents forwarded the questionnaires to the emails of second



respondents. The first respondents collated the questionnaires after answers had been entered and returned these to the researcher in a technique referred to as chain sampling. The data was collected in three batches of first, second and third. In the end, the number of questionnaires retrieved from respondents totalled  $65 + 42 + 7 = 114$ . Ultimately one hundred and fourteen (114) questionnaires were reclaimed and collected as data by the researcher.

From the responses indicated, the researcher was able to determine the factors that influence affordable housing delivery within budgeted cost specified. These factors are considered most influential in the effective management of human resources. The facts are presented in Tables 1–5 below according to the evaluation of the responses indicated by the respondents. The tabulated results illustrate the order of influence of component factors on the cost of construction and delivery of sustainable housing. However, evaluation of responses indicated was made possible with the use of Likert scales in form 1 = Perfectly unacceptable, 2 = Unacceptable, 3 = Quite acceptable, 4 = Acceptable, and 5 = Perfectly acceptable. This process aided the determination of the level at which these factors have influenced human resource management towards cost-efficient housing delivery.

One hundred and fourteen (114) viable questionnaires were retrieved and evaluated from the total number of questionnaires distributed to the respective participants. In the evaluation process, necessary fundamental observations were appropriately considered in attaining quality data. In addition, the reliability of the questions was measured with the Cronbach's alpha coefficient [36–38], wherein an estimate of 0.9 was obtained. Data assembled was analysed with the use of two statistical analysis tools called correlation and regression analysis within the SPSS version 25. The quantitative findings were validated with the qualitative findings derived from the interview exercise executed. In general, data collection was based on four case studies that involved interview processing with four construction managers that are registered with CIDB in South Africa. Afterwards, data was transcribed in order to interpret and accurately express participants' opinions and situation under investigation.

Sample Size Calculator-Check Market was applied to compute a representative sample size of 340 from an overall population of 2934. The sample size generated was set at a confidence level of 95% and an error margin of 5%, where 20% response rate is required for sample size, but 30% response rate will be good. In that case, for this study, 34% of the sample size was deemed to be good at a response rate of 114.

#### 4. Data Analysis Results and Discussion of Findings

##### 4.1. Respondent's Professional Affiliation

In this subsection, Table 1 shows the sample of professionals working in construction firm specialised in housing provision registered under CIDB. These professionals are selected on the basis of perceived ability and experience to answer relevant questions pertaining to human resources usage on-site toward affordable housing delivery. The architects used in this study were able to respond to the questionnaires competently based on the good knowledge acquired in affordable housing design. The quantity surveyors were able to provide answers to the questionnaires successfully as a result of good ability to interpret the influence of human resources on construction cost estimating. Further understanding indicates that contractors and contract managers are responsible for site administrative management and thus, could certainly provide answers to the questionnaires, and beam more light on the influence of human resources management on cost. While the project managers and site engineers specialising in decision implementation on-site answered the questionnaires with assent that human resources supervision does have an impact on cost. Convincingly, the information provided by these professionals helped to determine the practical influence of human resources on budgeted cost for affordable housing delivery in South Africa.

**Table 1.** Tabularised illustration of respondents' professional affiliation.

Variable (Respondent Professional Affiliation)	Frequency	Percentage (%)
Architects	12	10.5
Project managers	33	28.9
Site engineers	7	6.1
Contract managers	6	5.3
Contractors	6	5.3
Quantity surveyors	50	43.9
G-Total	114	100

#### 4.2. Analysis of Factors That Influence Human Resources Management on Cost in Affordable

Results displayed in Table 2 illustrate that the first twelve (12) factors yielded mean values (MVs) within the range of 4.0000 above other factors. This range indicates the degree of impact of these factors on the human resources towards attaining affordable housing delivery within the budgeted cost. The remaining factors with the MVs below 4.0000 categorically influence human resources supervision. Observably, regular training of construction workers improves workers' skills and subsequently raises productivity rate. This stimulates the reduction in production cost and time towards adequate delivery of affordable housing to the people. In addition, other improvements can be realised through the involvement of all stakeholders in the housing production process. This in effect, will enhance reliable satisfactory planning based on the client briefing to ease implementation. Other factors within the range of 4.0000 MV will offer such benefits as a free flow of information among stakeholders—resolving communication issues and efficient housing production—by raising productivity, while in some cases, outside the range of 4.0000 MV, appropriate scheduling of construction activities and human resources management will be improved.

**Table 2.** Descriptive statistics analysis of factors that influence human resources.

Coding	How Human Resource Management Have an Effect on Cost in Delivery of Sustainable Housing	Mean	Std. Deviation	Variance	Rank
ICMCR23	Workforce productivities affect cost	4.1404	0.75113	0.564	1
ICMCR1	Involvement of all team members in planning and implementation	4.1316	0.79281	0.629	2
ICMCR4	Regular meetings on-site for promoting efficient productivity	4.1140	0.76145	0.580	3
ICMCR10	Team-building strategies for production	4.0877	0.90780	0.824	4
ICMCR21	Prompt payment of wages by contractors will enhance productivity	4.0789	0.85336	0.728	5
ICMCR2	Develop staffing management plan	4.0789	0.70579	0.498	6
ICMCR29	Flexibility of construction operators in making timely management decisions on production	4.0702	0.78390	0.615	7
ICMCR28	Skill to define effective techniques for achieving objectives	4.0702	0.73736	0.544	8
ICMCR24	Skill to apply techniques for a reduction in the cost of construction during production	4.0526	0.83974	0.705	9
ICMCR9	A sound knowledge of quality design decisions and implementation	4.0526	0.82914	0.687	10
ICMCR27	Knowledge of good safety practices and awareness of personal safety during production	4.0351	0.85113	0.724	11
ICMCR30	Constant emphasis on making maximum usage of the local labour force to achieve housing production	4.0263	0.86690	0.752	12
ICMCR3	Document delivery roles and responsibilities among construction team members	3.9912	0.73467	0.540	13
ICMCR26	Ability of the workforce to develop willingness in sustainability practices	3.9912	0.88743	0.788	14
ICMCR13	Build trust among construction team members	3.9912	0.92646	0.858	15
ICMCR15	Ability to define a plan for effective use of resources available for production	3.9649	0.86146	0.742	16
ICMCR25	Wastage of workforce input during the production process	3.9649	1.00380	1.008	17
ICMCR14	Reduction in delivery time through proper job allocation to the workforce	3.9649	0.87168	0.760	18

Table 2. Cont.

Coding	How Human Resource Management Have an Effect on Cost in Delivery of Sustainable Housing	Mean	Std. Deviation	Variance	Rank
ICMCR20	Aptitude to work under pressure to meet tight deadlines and adapt to changes affect the cost of construction	3.9561	0.85590	0.733	19
ICMCR11	Ability to carry out the effective implementation of techniques on housing production	3.9474	0.81840	0.670	20
ICMCR22	Ability to safeguard safety consciousness during housing production	3.9298	0.93808	0.880	21
ICMCR12	Emphasis on constant encouraging construction operators on skill advancement and development	3.9211	0.81082	0.657	22
ICMCR16	Steadfastness in carrying out commitments and obligations	3.8947	0.88616	0.785	23
ICMCR18	Skill in oral and written communication for keeping subordinates, associates, superiors and others adequately informed during production	3.8860	0.92897	0.863	24
ICMCR8	Constant training of workers for the use of techniques	3.8772	0.97890	0.958	25
ICMCR5	Define quality accomplishment for housing production	3.8684	0.82562	0.682	26
ICMCR7	Skill to establish requirements, methods and techniques for housing production	3.8070	0.85058	0.682	27
ICMCR6	Time wastage by workforce during production	3.7105	1.02813	1.057	28
ICMCR19	Improper planning of workforce activities on-site	3.6754	1.02617	1.053	29
ICMCR17	Shortage of experienced worker on-site	3.5965	1.17284	1.376	30

#### 4.3. Principal Component Analysis of Human Resources Management on Cost

Principal component analysis (PCA) was used to reduce a large number of factors to a smaller size and identify factors that influence human resources management on cost towards sustainable housing delivery. The results derived are shown in Table 4 to illustrate the thirty (30) factors that influence human resources. The factors were tested for “fittingness for factorial analysis” and the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) values were 0.877, which exceeds the value of 0.6 recommended by [39]. Bartlett’s “Test of Sphericity” showed results significant at  $p = 0.000$  ( $p < 0.005$ ), which conforms with the factorability of the correlation matrix, as shown in Table 3.

**Table 3.** Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) and Barlett’s Test of Sphericity to confirm fittingness of factors for analysis.

Test	Value and Remark
Kaiser-Meyer-Olkin measure of sampling adequacy (KMO)	0.877 Significant and adequate for principal component analysis (PCA)
Bartlett’s Test of Sphericity	Approx. Chi-Square 2474.668
	df 435
	Sig. 0.000 Significant and adequate for PCA

In addition, the results of the PCA are shown in Table 5, to illustrate the components with an Eigenvalue that exceeds 1 on the factors that influence human resources. It is observed that component 1 and 2 yielded variance estimates of 43.745% and 7.458% respectively. Components/variables to retain for further analysis were determined with the use of the MonteCarloPA, and the Oblimin rotation was used to interpret the components that were retained and for the loading of variables. The pattern and structure matrix have weak and strong components with loadings above 0.6 and 0.3 as shown in Table 4. Factors with communalities above 0.4 are indicated in bold, in accordance with [39] recommendation. They are established as the factors that influence human resources on cost towards sustainable housing delivery.



**Table 4.** Pattern matrix and structural matrix for principal component analysis (PCA) with Oblimin Rotation of ICMCR (human resources) variables.

Coding	Variable Name	Pattern Matrix Coefficient		Structural Matrix Coefficient		Communalities
		1	2	1	2	
ICMCR1	Involvement of all team members in planning and implementation	<b>0.675</b>	0.507	0.641	0.482	0.414
ICMCR2	Develop staffing management plan	<b>0.701</b>	-	0.651	-	0.431
ICMCR3	Document delivery roles and responsibilities among construction team members	<b>0.713</b>	-	0.620	-	0.409
ICMCR4	Regular meetings on-site for promoting efficient productivity	<b>0.790</b>	-	0.708	-	0.520
ICMCR5	Define quality accomplishment for housing production	0.438	0.392	0.525	0.395	0.298
ICMCR6	Time wastage by workforce during production	-	0.553	-	0.522	0.275
ICMCR7	Skill to establish requirements, methods and techniques for housing production	<b>0.669</b>	-	0.719	0.438	0.524
ICMCR8	Constant training of workers for the use of techniques	<b>0.674</b>	-	0.768	0.528	0.615
ICMCR9	A sound knowledge on quality design decisions and implementation	<b>0.671</b>	-	0.718	0.434	0.522
ICMCR10	Team-building strategies for production	<b>0.629</b>	-	0.716	0.491	0.534
ICMCR11	Ability to carry out effective implementation of techniques on housing production	<b>0.671</b>	-	0.766	0.529	0.613
ICMCR12	Emphasis on constant encouraging construction operators on skill advancement and development	<b>0.704</b>	<b>0.697</b>	0.713	0.376	0.509
ICMCR13	Build trust among construction team members	<b>0.856</b>	<b>0.667</b>	0.778	-	0.623
ICMCR14	Reduction in delivery time through proper job allocation to workforce	<b>0.745</b>	<b>0.660</b>	0.706	0.303	0.502
ICMCR15	Ability to define plan for effective use of resources available for production	<b>0.603</b>	-	0.679	0.457	0.478
ICMCR16	Steadfastness in carrying out commitments and obligations	0.336	0.430	0.555	0.601	0.445
ICMCR17	Shortage of experienced workers on-site	-	<b>0.782</b>	-	0.707	0.516
ICMCR18	Skill in oral and written communication for keeping subordinates, associates, superiors and others adequately informed during production	-	<b>0.662</b>	0.489	0.737	0.563
ICMCR19	Improper planning of workforce activities on-site	-	<b>0.776</b>	0.392	0.767	0.589
ICMCR20	Aptitude to work under pressure to meet tight deadlines and adapt to changes affect cost of construction	0.413	0.421	0.628	0.632	0.525
ICMCR21	Prompt payment of wages by contractors will enhance productivity	<b>0.700</b>	-	0.740	0.435	0.552
ICMCR22	Ability to safeguard safety consciousness during housing production	0.527	<b>0.713</b>	0.652	0.514	0.469
ICMCR23	Workforce productivities affect cost	0.332	0.515	0.595	0.684	0.550
ICMCR24	Skill to apply techniques for reduction in cost of construction during production	0.353	0.497	0.607	0.677	0.551
ICMCR25	Wastage of workforce input during production process	-	<b>0.734</b>	0.445	0.770	0.596
ICMCR26	Ability of workforce to develop willingness in sustainability practices	-	<b>0.702</b>	0.476	0.762	0.591
ICMCR27	Knowledge of good safety practices and awareness of personal safety during production	0.475	0.305	0.631	0.547	0.467
ICMCR28	Skill to define effective techniques for achieving objectives	<b>0.679</b>	-	0.740	0.473	0.560
ICMCR29	Flexibility of construction operators in making timely management decisions on production	<b>0.700</b>	-	0.743	0.442	0.558
ICMCR30	Constant emphasis on making maximum usage of local labour force to achieve housing production	0.441	0.415	0.652	0.639	0.552

**Table 5.** Principal component of factors that consist of initial Eigenvalue and Extraction sums of squared loadings to determine factors to be retained for further analysis.

Component	Initial Eigenvalue			Extraction Sums of Squared Loading			Rotations Sums of Squared Loadings <sup>a</sup>
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	13.123	43.745	43.745	13.123	43.745	43.745	12.038
2	2.227	7.423	51.168	2.227	7.423	51.168	8.442
3	1.641	5.470	56.638				
4	1.495	4.983	61.621				
5	1.229	4.098	65.719				
6	1.057	3.524	69.244				
7	0.970	3.233	72.477				
8	0.869	2.898	75.374				
9	0.713	2.376	77.751				
10	0.681	2.270	80.020				
11	0.621	2.070	82.090				
12	0.594	1.980	84.071				
13	0.562	1.875	85.945				
14	0.541	1.803	87.748				
15	0.472	1.574	89.322				
16	0.420	1.400	90.722				
17	0.362	1.206	91.927				
18	0.341	1.137	93.065				
19	0.306	1.020	94.085				
20	0.269	0.896	94.981				
21	0.231	0.771	95.752				
22	0.209	0.698	96.450				
23	0.190	0.632	97.082				
24	0.172	0.575	97.657				
25	0.157	0.524	98.181				
26	0.138	0.459	98.640				
27	0.124	0.415	99.055				
28	0.109	0.363	99.418				
29	0.096	0.320	99.738				
30	0.079	0.262	100.000				

<sup>a</sup> When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

#### 4.4. Qualitative Analysis

Analysis of qualitative data was done across four construction organisations namely “GHKQ”. Each construction organisation has proficient respondents, who were capable of responding satisfactorily to the specified interview questions. The interview questions were centred on validating the veracity of the quantitative findings derived from the analysis of the factors that influence human resource management on cost in sustainable housing delivery in South Africa.

##### 4.4.1. G-Case Study 1

In G-case study 1, a project manager was considered for the interview, and the question was based on ‘workforce productivity effect on cost: involvement of all team members and regular meeting on-site toward affordable housing delivery’.

In written interpretation, the respondent stated that “efficiency of the workforce on site will influence good output. A project manager must manage construction resources effectively, most especially, the human resources aspect in order to efficiently use other resources to a maximum. Redundancy of workforce on-site means inefficiency in the use of materials and equipment. From this simple ideology, my conclusion is that a workforce is the driver of materials and machinery for effective housing production processes. Therefore, effective management of workforce will cause a reduction in wastage of materials on-site, and idleness of machinery on-site will be prohibited by workforce energetic actions. What I am saying is that the effectiveness of workforce on-site is totally pivoted around a good welfare package on site. A project manager should understand the principle of how to use incentives to increase workforce productivity. Increase in productivity on-site will constantly reduce the cost of sustainable housing delivery, affordability of housing will constantly be improved”. Furthermore, the project manager made a remark on the involvement of all team members, “confirm that if every stakeholder in a project was allowed to participate fully, his influence will be positive. Constant arguments causing delay and abandonment of housing projects will be drastically reduced. Teamwork is essential for effective use of human resources, I have been working in the construction industry now for over two decades, and I have never seen any technique as perfect as teamwork on site among the construction operators. I believed that teamwork enhances unity, reconciliation and harmony among the stakeholders on-site. It allows settlement of rift and discord which cause nuisance or impediment toward effective project production. I see regular meetings on-site as a means for promoting efficient productivity through free communication amongst all stakeholders. I say that communication is vital in achieving effective project production processes. Communication is a powerful tool that enhances mutual relationships between construction stakeholders. On my site, every interest is considered and implemented, as free communication allows the free flow of ideas, and every stakeholder is fully involved in decisions taken in order to have a sense of belonging”.

##### 4.4.2. H-Case Study 2

Similarly, in H-case study 2, a quantity surveyor was interviewed on ‘workforce productivity effect on cost: involvement of all team members and regular meetings on-site toward affordable housing delivery.’ The respondent stated that “the increase in workforce productivity is an equivalent diminishing to the increase in the cost of construction, therefore, management of workforce productivity is significant at planning and in the implementation phases of production. I always make sure that the welfare of the workers is adequately taken care of during the preparation of the bill of quantity. The welfare package includes salary, overtime charges, hourly charges, safety and health-related issues, and incentives and bonuses. These are the basic things I do for the well-being of site workers, and I make sure these are adequately entrenched into the bill of quantity. Thus, effective implementation of workers well-being on-site is a yardstick to increase workforce productivity on-site. As a quantity surveyor, I discovered that the involvement of all team members will enhance a process of matching stakeholder interest in requirements that have an influence on affordable housing delivery. In every

project production, stakeholder interests are diverse. This generates different opinions at every phase of housing production and creates arguments which in turn causes contempt and division among construction operators, influencing delay, changes in design, and breaking and pulling down of an already completed job. I foresee a need to document all stakeholder interests at the design planning stage and implement accordingly for their satisfaction. The habit of teamwork enhances the satisfaction and productivity of stakeholders. It is paramount for every construction operator to identify stakeholders and understand their relative degree of influence on project production processes. In so doing, the measurement of success criteria is established for affordable housing delivery. Site meetings are significant for achieving efficient production., It is essential to note that constant reporting on housing production processes will keep all construction operators informed, therefore every hand must be on deck to deliberate issues that challenge the cost of production”.

#### 4.4.3. K-Case Study 3

In K-case study 3, an architect was interviewed based on similar questions. The respondent stated that “workforce is the manager of the other construction resources. Workforce efficiency determines the productivity of other resources, as the efficient management of human resources enhances production processes and company productivity. If workforce productivity is efficient, similarly, management of cost of construction will be effective as well. Hence, sustainable housing delivery is achieved. As an architect on site, I always ensure that the majority of labour needed on my site is recruited from the environs of the construction site and trained for enhancement. Teamwork is essential virtually in all stages of housing production processes, as teamwork is an antidote for management of cost efficiency and enhances the division of labour among the construction operators and free communication. In the course of my supervision role on-site, I discovered that teamwork encourages cooperation among construction team members toward achieving the aim and objectives of the client. Adequate planning for the use of construction resources can only be realised if there is effective collaboration among design, construction, monitoring, controlling and the quality assurance group. Through this process, affordable housing delivery is sustained within the budgeted cost”. On my side, I see regular meetings on-site as a way to care for stakeholder’s interest. Through this process, the free flow of communication will influence the adequate decision on client and user’s requirements”.

#### 4.4.4. Q-Case Study 4

In the last case study, Q-case study 4, a project coordinator was interviewed. The construction organisation has branches in each province in South Africa and is actively and effectively involved in the implementation of governmental policies on housing delivery across the country. In addition, the organisation’s construction activities operate on one policy across the nine provinces in the country. The respondent commented on the same questions as the others by stating that “workforce productivity enhances the smooth running of housing production processes; productivity is a medium of measuring efficient use of human resources. Our organisation was able to succeed with housing production processes based on the fact that we have a formidable construction team. This team has ground-breaking ideas for planning and implementation. The abilities and experiences possessed by this team enhance the workforce productivity we are experiencing in our organisation. Workforce motivation brings about productivity, with incentives for the workers on-site sufficiently provided by our organisation. The satisfaction of stakeholders is our primary concern. Their interest is paramount and important. Stakeholders include clients, users and construction managers, however, workers’ interests are also very important to consider. As a project coordinator, I ensure stakeholders are involved in the production and their interest is protected, through critically enquiry and inclusion of their interests into every stage of a housing production process. I discovered that the major anxiety of the users is that housing must be comfortable and maintenance cost efficiency in use. To achieve clients’ and users’ interests, we always have regular site meetings that involve all stakeholders. Every interest is considered before

a decision is taken on project cost. At the same time, workers' interests are considered at every meeting, in order to improve on workers' ability to achieve affordable housing delivery".

#### 4.4.5. Qualitative Findings

Findings gathered from the analysis of the responses affirmed the need to increase productivity through efficient use of the workforce. In addition, the findings further show that all team members should always be involved in any activities or regular meetings happening on-site, with the intention to influence human resources supervision toward affordable housing delivery within budget. It is understood that this action will improve the impact of workmanship quality on the construction site, and in effect, it will reduce wastages. Additional factors emphasised on by the respondents is the high cost of transportation of equipment and materials to the construction site. It is suggested that this effect can be managed by locally sourcing materials and labour. In essence, it will significantly contain construction cost within budget. Ultimately, the respondents further accentuated that human resources play a huge part in attaining cost cut in every aspect of the housing production process. Areas like workers' welfare should be given more attention to improve workforce productivity and reduces construction cost.

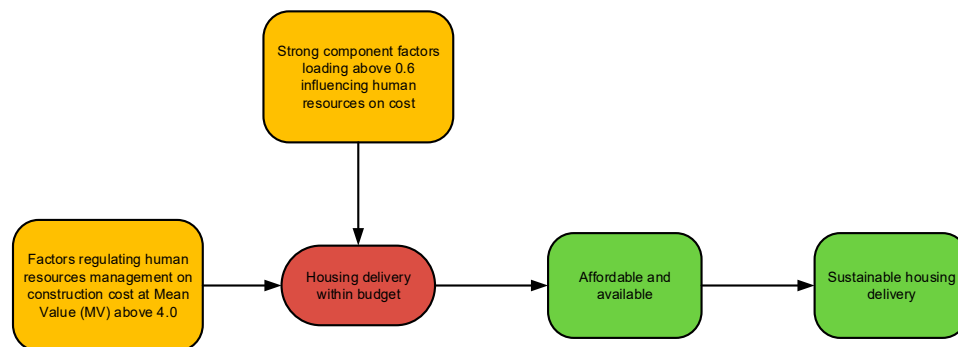
#### 4.5. Discussion of Findings

Human resources impact on the delivery of affordable housing within the budget cannot be underestimated because of its huge part in attaining cost cuts in every aspect of the housing production process. Clearly, the determination of the factors preventing the attainment of housing production within the cost budget is significant to this study. In the process, data gathered through a mixed-methods approach were carefully evaluated and validated. Findings show that some factors demonstrate a higher degree of influence ( $>4.0000$  MV) on human resources than other factors, with a further verification assessment by applying PCA to categorise factors into pattern and structure matrix that have strong factors (loaded at  $>0.600$ ) and weak factors (loaded at  $>0.300$ ), and strong factors were determined on communalities loaded at  $>0.400$ . These factors are workforce productivity, team members participation in construction activities, regular consultations to foster productivity, team production strategy, timely payment of wages, staffing management plan, timely management decisions, skills improvement towards effective techniques, and others such as skill acquisition towards cost cut, knowledge on quality design, knowledge on good safety practices, and maximum use of local labour force are identified as most influential on human resources towards the delivery of affordable housing within budget [8,10,11,13,14].

From the aforesaid factors, it is understood that adequate managing of human resources will influence productivity rate during a construction project, because productivity rate of the construction industry can be used to quantify efficiency in the production process. This effect could reduce construction cost and lead to timely delivery of affordable housing. Thus, it is validated by the qualitative and quantitative findings that with an improved workforce, productivity amongst other factors can drastically cut the cost of production in the construction industry. This can be attained if project managers with the required skills are allowed to plan and manage workers' performances towards the effective delivery of affordable housing within a set budget [16,17,19,21,22,24]. The planning and management of workers can be improved through regular training and seminars on new technologies and technical approaches towards the acquisition of relevant skills within the construction sector [2,12]. Having all stakeholders involved in planning, managing, design and construction processes is a plus to raising effective delivery of affordable housing within a set budget. Generally, this could easily promote adequate punctuality and scheduling of site meetings towards defining practical ways of attaining industrial targets. Other benefits will be to source local materials and labour to encourage inexpensive materials, cheap labour and transportation. In effect, a nation's economy will benefit hugely from this suggested improvement.



To buttress these findings a simple framework was developed to demonstrate the advantage of improving the identified factors. As displayed in Figure 1, the diagram indicates that the impact of the improvement of these factors, based on the quantitative and qualitative findings, will yield or deliver affordable and available housing within a set budget, leads to long term sustainable housing delivery. This diagram can serve as a simple guide to construction operators in planning and implementing construction resources usage at each stage of the production process, with the intention of attaining the aims and objectives set at the briefing stage. In addition, the framework established by this study will have improvement on outcomes of previous studies conducted by [40–44] through the enhancement of human resource usage for affordable housing delivery in South Africa.



**Figure 1.** Framework of factors that influence human resources management on cost towards affordable housing delivery.

## 5. Conclusions and Recommendation

In South African construction industries, human resources control still remains a huge challenge among the construction managers, with a view to improve productivity rate towards affordable housing delivery for the low-income earners. This idea is considered relevant, because in South Africa housing is regularly delivered at construction cost that is higher than the budgeted cost. In effect, houses are produced and delivered at a costly rate for the people. Other contributing factors like poor skills acquisition and inadequate knowledge in sustainable design approach render the efforts of the construction industry in providing adequate housing to the people unyielding. In that case, the construction manager is expected to be pragmatic enough to develop a technique suitable to manage human resources uses to stimulate effective production cost, waste reduction, and nurture the capacity to deliver sufficient affordable housing to the people.

Factors thwarting the capacity of a construction industry in managing human resources to propel adequate delivery of affordable housing within budgeted cost were determined. These factors are categorised as “human resources regulators”, while others are categorised as “strong component factors” that is, factors with high degree of impact on the construction activities. The human resources regulating factors are considered as tasks to be implemented or executed by construction management to alleviate construction employees, while the strong component factors are tasks to be implemented or executed by construction managers to alleviate allocated construction employees. Thus, it is recommended that the construction managers should adopt the option of sourcing local materials and labour services within the locality of their site, in order to deter high cost of materials, transportation, and labour-intensive activities. However, further research will be essential in determining the level of influence of materials and equipment resources on cost of producing affordable housing delivery. In addition, skills acquisition should be perceived as a significant factor in cutting cost and raising productivity. Policy makers are advised to involve developers and construction managers when drafting new housing construction policies. Due to this, a simple framework that illustrates the benefit of enhancing these identified factors in the construction industry was developed. The operational framework will influence human resources towards managing affordable housing delivery. It can be used as a guide for provision of inexpensive housing for the people of low income in South Africa. The

outcome of this study is restricted to time, location and data, though, the method employed can be implemented in any country provided the scientific procedure involved are strictly followed.

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