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Building production management competencies for building students: academia and construction industry perspectives

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Abstract. The study examined the competencies required by building students for building production management and the barriers to their competency in the practice of building production management in the construction industry. Using a quantitative research method, a total of 302 construction professionals and 35 building programme lecturers completed a set of questionnaires survey. The data were analyzed using descriptive and inferential statistical tools such as mean score and Mann Whitney test. Study findings identified setting out of different building types, interpretation of architectural drawings and specifications, tendering and contract processes, and construction of various components and effective communication on construction sites as the most significant competencies for building production management practice in the construction industry. However, the study discovered a significant difference in the competencies for building production management practice between construction professionals and building lecturers. Also, the study identified poor institutional and industry collaboration, underfunding of institutions, insufficient equipment and infrastructure for training, and theoretical training rather than practical training as the major barriers to the competency of building production management practice in the construction industry. The study suggested a more vital collaboration between the construction industry with tertiary institutions in needs assessment, funding, provision of infrastructures and involvement in the practical training of students

Keywords: Building production management, competence, building students, construction industry.

1. Introduction

The construction industry's ever-changing nature has prompted a requirement for highly skilled graduates for a future in the construction industry in order to accomplish its objectives of timely completion of projects within budget, quality, and clients' satisfaction. According to [1], having the right competencies is now required for graduates to succeed in the construction business industry. One profession in the construction industry that requires highly trained and competent graduates, with a unique role in the execution and management of all building



works and supervision of workers on-site as prescribed in the Nigeria National Building Code [NBC] [2], is the building profession. Building graduates are also expected to be competent to render services in project management, direct labour building project management, maintenance management, building survey, resident supervision, report on abandoned projects, and reactivation of abandoned projects, among other services in the construction industry. However, one of the core areas of practice in the building profession is Building production management. Building Production Management (BPM), according to [3], involves the management of construction processes and resources (human, material, financial and plants) in construction. [4] [5] confirmed that BPM plays a significant role in achieving the projects goals and the survival of construction firms. However, lack of competence in the BPM process results to cost overrun, poor workmanship, poor supervision, project rework, project abandonment and building failure. Consequently, because of the builder's crucial role in the BPM process, it is essential for building students and new entrants to the construction industry to be aware of the competencies required for a BPM practice in the construction industry. The information is critical since a lack of awareness of industry demands has been identified as a barrier to graduates' employability and success in the construction industry [6] [7] [8]. Although the building production management process involves several activities that competent builders must carry out for the project to be successful, there is a lack of literature on the major competencies required for building production management practice in the Nigerian construction industry. Similarly, [9] [10] discovered a disconnect in construction stakeholders and academia perceptions on the competencies required by graduates entering the construction industry. Hence, this study examined the competencies needed by building students for building production management practice to bridge the Nigerian construction industry's competency needs and identify the likely barriers to building students' competency in building production management practice in the construction industry.

2. Literature Review

2.1. Building Production Management

Despite the construction industry's significant role globally, the industry is still confronted with various challenges resulting in its underperformance [11]. [5] observed that one of the critical areas affecting the construction industry's performance is the ineffective construction procedures and management of the construction processes. Resulting in poor workmanship, poor specifications, rework, unethical practices [12]. [5] also revealed that one way to address these challenges is through an effective building production management practice in the construction industry. [3] describe building production management as the management of building production information, labour, materials, equipment, and other resources to actualize the building project and adhere to building regulations, and contractual conditions project success. Building production management is the primary duty of the building profession [13][14].

[14] revealed that building production management could be conducted in 3 stages; the first stage entails a design process where buildability and maintainability are carried out on the construction documents to ensure the construction of the building is achievable, and all construction documents are free of errors and omissions. This stage also ensures that the building will be maintainable and sustained during the useful life. The second stage involves construction planning. The builder plans for the project by preparing building production

documents such as construction project programme, construction project methodology, health and safety plan, project information required schedule, project quality management plan, and project early warning system chat. The third of building production management involves managing the actual construction processes and resources such as the material, human and financial need for the project's success. Nigeria Institute of Building [NIOB] [15] admitted that the objectives of building production management are time optimization, cost optimization, and getting the construction procedures right without errors or repetitions. Therefore, competencies in Building production management are needed in the construction industry to achieve project objectives in terms of quality, increase efficiency, and reduce costs, time, and avoid project delays. However, despite the significance of building production management in the Nigerian construction sector, [5] identified an inadequate practice due to negligence and a lack of awareness of the process. Therefore, the knowledge of required competencies for building production management practice will assist building graduates in becoming conversant with the construction industry's competencies and performance expectations.

2.2. Training of Building Students in Building Production Management and Competence

The essence of tertiary education training is to imbibe knowledge and skills needed for the industry [16]. The training in Building technology in tertiary institutions in Nigeria aims to produce students that will be academically trained and professionally licensed to carry out the roles of building production management, construction administration, and maintenance of building for the use and safety of humanity [15]. The training also prepares students to specialize in any of the following options in the study of building. The options include construction management and economics, construction technology, building maintenance, building services, and building structures and material. The curriculum of the building programme is designed to train students in various courses in general studies and professional courses to be competent in the science and management of the building production process. National Board of Technical Education [17] identified some areas of competence for building students upon completion of study in polytechnic as (i) supervision of all sizes of buildings from the beginning to the end (ii) interpretation of all types of construction drawings and documents (iii) design and preparation of structural drawings for medium-size structures (iv) preparation of realistic cost estimating for resources for the construction of building and maintenance (v) determination of material quality for construction work (vi) building surveying and preparation of the schedule of dilapidation for building maintenance (vii) preparation of cost-effective post-tender report for building works.

In the same vein, Nigeria University Commission [NUC] [18] expects building graduates in university to be competent in the following areas (i) carrying out feasibility and viability study for building projects (ii) construct and assembly various types of building (iii) management and coordination of building projects (iv) monitor and regulate the activities at different levels of works on building site (v) analyze bill of quantities and suggest the materials, labour resources needed for construction (v) prepare building documents such as project quality plan, health and safety plans during the building construction. [19] also categorize areas of competence required by building students to practice in the construction industry into academic skills, responsibility skills, personal skills, work ethics skills, entrepreneurship skills, and teamwork skills. Although, there have been criticism of the competency of graduates in the construction industry [6][7][8]. Therefore, it is expected of

building students to be conversant and well-grounded in competence areas from their study in building to perform effectively in the construction industry.

2.3. Barriers to the Competency of Students in the Construction Industry

Despite the training received by students in tertiary institutions, employers have complained that graduates of tertiary institutions are unemployable because they do not possess the needed workplace competencies. Several factors have been attributed to graduates' incompetency in the workplace, especially in the construction industry. From academia point of view, [20] identified a lack of partnership between university and industry, lack of active learning, inadequate knowledge of industry needs, lack of agreement on skills required by graduates, internship challenges, and faculty development and training as the barriers to the performance of graduates. According to [6], one of the major causes of graduates' underperformance in the construction sector is a faulty education structure. They indicated that higher education curricula are outdated or that the material is more theoretical than practical.

Similarly, [21] asserted that most courses of study curriculum are inadequate and do not meet the industry's present and future demands. [22] discovered a disparity between the number of students enrolled and the number of available competent instructors and lecturers. They reported that the low student-to-lecturer ratio at most tertiary institutions impedes proper student engagement and training. In addition, from the perspectives of construction professionals and academia, [5] identified several barriers to graduate performance in Nigeria, including a lack of qualified personnel, indiscipline in academic training, slow adoption of innovation, and a short duration of the student internship programme.

Furthermore, [23] found that the poor government funding support for institutions, resulting in poor infrastructure development, lousy working conditions, and insufficient equipment to teach students, all of which would impair their productivity at work.

3. Material and Methods

This study adopted a quantitative approach in the collection of the needed data for the study. The study population consisted of construction industry professionals in Lagos state, Nigeria and building programme lecturers from Covenant University Ota, The Polytechnic Ibadan, Obafemi Awolowo University Ile- Ife and Yaba College of Technology Lagos. The study was conducted using well-structured closed-ended questionnaires distributed to building programme lecturers and construction industry professionals. A purposive sampling technique was used in the selection of construction professionals and tertiary institutions. The tertiary institutions were selected from the state, federal government and privately-owned institutions in Southwestern Nigeria based on Webometric (2021) higher institution ranking in Nigeria. At the same time, the building lecturers were selected from the Departments of Building in the selected institutions using a simple random technique. The questionnaire distributed to the respondents consisted of three sections. The first section obtained the background information of the respondents. The second section identified competencies needed for building production management practice by building students. The section provided the respondents with a total of 16 competencies from the expected learning outcomes in building programme to rank based on their level of importance on competence areas using a five-point Likert scale

with 5 = Very Important, 4 = Important, 3 = Moderately Important, 2 = Less Importance and 1 = Not Important [24]. At the same time, the third section examined the barriers to the competency of building students in building production practice. A total of 400 questionnaires were distributed to construction professionals and 47 questionnaires to building programme lecturers. However, 302 responses were collected for construction industry professionals and 35 responses for building programme lecturers, representing 76% and 74% response rates for construction industry professionals and building programme lecturers, respectively. The responses obtained were analyzed using descriptive statistics and inferential statistics. Mann-Whitney test was used to test the difference between the responses of construction professionals and building lectures on the competencies required for building production management practice.

4. Results and Discussion

4.1. Respondents' Profile

Table 1: Profiles of Respondents

CONSTRUCTION PROFESSIONALS CHARACTERISTICS	Frequency	Percentage
Highest Educational Qualification		
Bachelors' Degree	127	57%
Higher National Diploma	61	20.2
Masters' Degree	37	12.3
Post Graduate Diploma	30	9.9
Ph.D.	2	0.7
Total	302	100.0
Professions		
Civil Engineers	82	27.2
Architect	75	24.8
Quantity Surveyor	73	24.2
Builder	69	22.8
Others	3	1.0
Total	302	100.0
Position in the Organization		
Project manager	147	48.7
Site Managers	75	24.8
Others	55	18.2
Managing Director	25	8.3
Total	302	100.0
Industry Working Experience		
1 -10	89	29.5
11 - 20	183	60.6
21 - 30	27	8.9
31 - 40	2	0.7
Above 40	1	0.3
Total	302	100.0
BUILDING LECTURERS PROFILE		
Institution		
Yaba College of Technology Lagos	10	28.6
Covenant University Ota	9	25.7
Obafemi Awolowo University Ile-Ife	9	25.7
The Polytechnic Ibadan	7	20
Total	35	100.0

Table 1: Profiles of Respondents Continues

Highest Educational Qualification	Frequency	Percentage
PhD	17	48.4
Master's degree	13	37.1
Bachelor's degree	3	8.6
HND	1	2.9
PGD	1	2.9
Total	35	100.0
Academic Working Experience		
11 - 20	9	25.7
6 - 10	9	25.7
1 - 5	5	14.3
16 - 20	5	14.3
Above 25	4	11.4
21 - 25	3	8.6
Total	35	100.0

Of the 302 construction professionals respondents, 57% possessed a Bachelor's Degree, 20.2% possessed Higher National Diploma (HND), 12.3% possessed a Master Degree, while the respondents with Post Graduate Diplomas, Ph. Ds' constituted 9.9% and 0.7% of the total % of the population as shown in Table 1. Therefore, it can be deduced that 77.7% of the total population possessed at least a first degree in their profession which boosted the reliability of the responses. Concerning the professional qualification majority of the respondents were Civil engineers, which constituted 27.7% of the total population, while Architects, Quantity surveyors, Builders and other professionals constituted 24.8%, 24.2%, 22.8% and 1% of the total population, respectively. The respondents also occupied various positions in their organization as 47% were Project managers, 23% were Site managers, 18.2% occupied other positions, while 8.2% occupied a Managing Director. The construction professionals possessed sufficient working experience as 60.6% of the respondents had 11-20 years of experience, 29.5 had 1-10 years of experience, 8.9% had 21-30 years of experience, while 0.7% and 0.3% of the total population had 31-40 years and above 40 years of experience. Furthermore, as shown in Table 1, of the 35 building programme lecturers, 38.6% were from Yaba College of Technology Lagos, 25.7% were from Covenant University Ota and Obafemi Awolowo University Ile-Ife, respectively, while 20% of the respondents were from The Polytechnic Ibadan. The majority of respondents possessed PhDs with 48.4%, 37.1% possessed Master's degrees, 8.6% possessed Bachelor's degrees, while 2.9% of respondents possessed HND and PGD degrees. Concerning the academic working experience of respondents, 25.7% had between 11-20 years and 6-10 years of experience each, 14.3% had between 1-5 years and 16-20 years of experience each, while 11.4% had above 25 years of experience and 8.6% had between 21-25 years of experience. Therefore, it can be deduced that 60% of the respondents had over 10 years of working experience, indicating that they possessed sufficient teaching experience in teaching and training building students.

4.2 Competencies for Building Production Management Practice

Table 2 shows the significant competency required by building students for building production management practice from the perspectives of construction professionals and building programme lecturers. The 16 competency areas were chosen from the building programme's required learning competencies. Results were interpreted by adopting the mean scores range of 1-1.49 for Not Important, 1.50-2.49 for Slightly Important, 2.50-3.49 for Moderately Important, 3.50-4.49 for Important, and 4.50-5.00 for Very Important. The result revealed that most competencies identified are important for building production management practice from the perspectives of construction professionals and building lecturers. However, five competence areas were identified as very important in building production management practice in the construction industry. These competencies are setting out of different types of building, interpretation of architectural drawings and specifications, tendering and contract processes, construction of various building components, and effective communication on construction sites.

Table 2: Competencies Required for Building Production Management Practice

Competencies	Construction professionals		Building lecturers		Overall		Remark
	Mean	Rank	Mean	Rank	Mean	Rank	
Setting out of different types of building	4.60	3	4.80	1	4.80	1	Very Important
Interpretation of architectural drawings and specifications	4.59	4	4.60	2	4.60	2	Very Important
Tendering and contract processes	4.57	5	4.46	5	4.52	3	Very Important
Construction of various building components.	4.52	8	4.49	4	4.51	4	Very Important
Effective communication on construction site	4.49	13	4.51	3	4.50	5	Very Important
professionalism and ethics on construction sites	4.70	1	4.17	6	4.44	6	Important
Understanding and interpreting contract documents	4.55	6	4.14	7	4.35	7	Important
Construction standards and practices	4.65	2	4.03	8	4.34	8	Important

Coordination of skilled and unskilled workers activities	4.52	9	3.97	9	4.25	9	Important
Health and safety practices on construction sites	4.51	11	3.89	10	4.20	10	Important
Project progress report writing	4.55	7	3.74	12	4.15	11	Important
Forecasting and estimating resources for construction work	4.45	16	3.77	11	4.11	12	Important
Use of computer applications for project planning and scheduling	4.51	12	3.49	13	4.00	13	Important
Building regulations and laws	4.52	10	3.46	14	3.99	14	Important
Conflict management on construction site	4.48	14	3.40	15	3.94	15	Important
Use of different instruments for construction work	4.47	15	2.89	16	3.68	16	Important

These findings aligned with [5] findings, who discovered that while working as site supervisors on construction sites, building students must understand construction drawings and carry out setting out of building structures; this competency will assist building students in converting building plans into physical buildings and aid in conducting buildability and maintainability analyses and preparing documentation for construction production. [2] [25] agreed with the findings that construction students must grasp contract processes and communicate well on construction sites. This is because the construction industry is dependent on contractual agreements and interactions with both professionals and non-professionals on building sites. Therefore, understanding the tendering and contracting procedures is critical for any professional who wants to continue in the construction industry.

Furthermore, in line with the study findings, [23] agreed that competence in the construction of building components is critical for effective project execution. The management of the construction process is one of the critical aspects of building production management. As a result, construction students should be familiar with the construction of various building components such as foundations, floors, walls, roofs, as well as and monitoring the construction process.

4.3 Test of Difference in the Competencies for Building Production Management between Construction Professionals and Building Lecturers

One of the significant factors hindering the performance of graduates in the construction industry is the lack of consensus on the skills and competencies required by graduates. The study tested the hypothesis to know whether there is a significant difference between the construction professionals and building lecturers on the competencies required by building students for building production management practice. The hypothesis was tested using the Mann-Whitney test, and the results from the analysis are presented in Table 3.

Table 3: Mann-Whitney U Test on the Difference between Construction Professionals and Building Lecturers Competencies for Building Production Management Practice

Competencies	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)	Remark
Setting out of different types of building	3846.000	49599.000	-3.157	0.002	S
Interpretation of architectural drawings and specifications	4194.500	49947.500	-2.365	0.018	S
Tendering and contract processes	4595.000	50348.000	-1.483	0.138	NS
Construction of various building components.	4219.000	49599.000	-2.250	0.024	S
Effective communication on construction site	4124.000	49877.00	-2.435	0.015	S
professionalism and ethics on construction sites	4825.500	5455.500	-1.079	0.281	NS
Understanding and interpreting contract documents	5165.000	50918.000	-0.254	0.799	NS
Construction standards and practices	4640.500	5270.500	-1.428	0.153	NS
Coordination of skilled and unskilled workers activities	5031.500	5661.500	-0.530	0.596	NS
Health and safety practices on construction sites	4658.500	5288.500	-1.301	0.193	NS
Project progress report writing	4342.500	4972.500	-1.972	0.049	S
Forecasting and estimating of resources for construction work	4606.500	5236.500	-1.392	0.164	NS
Use of computer applications for project planning and scheduling	3752.500	4382.500	-3.162	0.002	S
Building regulations and laws	3517.500	4147.500	-3.653	0.000	S
Conflict management on construction site	3379.500	4009.500	-3.896	0.000	S
Use of different instruments for construction work	1634.500	2264.500	-7.394	0.000	S

Note: NS=Not Significant; S=Significant

The results showed that there is a significant difference between the construction professionals and building lecturers on the competencies required for building production management practice in setting out of different types of building (sig. value 0.002), interpretation of architectural drawings and specifications (sig. value 0.018), construction of various building components (sig. value 0.024), effective communication on construction site (sig. value 0.015), project progress report writing (sig. value 0.049), use of computer applications for project planning and scheduling (sig. value 0.002), building regulations and laws (sig. value 0.000), conflict management on construction site (sig. value 0.000) and use of different instruments for construction work (sig. value 0.000). The variables are considered significant because the significant value falls within the range of 0 – 0.005.

However, there is no significant difference between the construction professionals and building lecturers in tendering and contract processes, professionalism and ethics on construction sites, understanding and interpreting contract documents, construction standards and practices, coordination of skilled and unskilled workers activities, health and safety practices on construction sites and forecasting and estimating of resources for construction work competencies for building production management practice in the construction industry. The result of the analysis infers that there is still a disparity in the competencies required by students and graduates among stakeholders, as revealed in the studies of [20] [26] [27].

4.4 Barriers to the Competency of Building Students in Building production management practice in the Construction Industry

The study identified the barriers to the competency of building students in the practice of building production management in the construction industry. Results of the findings in Table 4 revealed the significant barriers to be poor institutions and the industry collaboration, underfunding of institutions, inadequate equipment and poor infrastructure for training and theoretical training more than practical training.

Table 4: Barriers to the Competency of Building Students in Building production management practice

Barriers	Construction professionals		Building lecturers		Overall	
	Mean	Rank	Mean	Rank	Mean	Rank
Poor institutions and the industry collaboration	3.44	7	4.51	1	3.98	1
Underfunding of institutions	3.52	2	4.31	2	3.92	2
Inadequate equipment and poor infrastructure for training	3.44	9	4.29	3	3.87	3
Theoretical training rather than practical training	3.55	1	4.17	5	3.86	4
Poor Student commitment to self-development	3.47	4	4.23	4	3.85	5
Contact change in technology and ICT innovations	3.39	11	4.14	7	3.77	6
Curriculum content deficiencies	3.45	6	4.06	8	3.76	7

Practical training deficiencies	3.32	13	4.17	6	3.75	8
Training not meeting the requirements of the industry	3.46	5	3.97	10	3.72	9
Wide gap in lecturers to student ratio	3.44	8	4.00	9	3.72	10
Fluctuating academic calendar	3.43	10	3.94	11	3.69	11
Lack of workplace experience	3.47	3	3.89	12	3.68	12
Lack of awareness on the demands of the industry	3.34	12	3.80	13	3.57	13

These findings correspond with [7] [28], which identified poor collaboration between institutions and industry as one of the critical factors impeding graduates' competency in the workplace and resulting in a disparity in the skills and competencies required by students to succeed in the construction industry. [29] study also affirmed that underfunding is another significant factor hampering the provision of the training and infrastructure needed to enhance students' competencies. Furthermore, [30] [31] agreed that inadequate equipment and poor infrastructures for training are a barrier to students' competency in the practice of Building production management. They admitted that the infrastructures and equipment for the training of students are either insufficient or obsolete, thereby restricting the training to theoretical training, as revealed in [32].

5. Conclusion and Recommendation

The study's findings revealed the significant competencies required by building students for building production management practice in the Nigerian construction industry and discovered a significant difference in the competencies required by students in the construction industry among construction professionals and building lecturers. The study also identified the likely barriers to building production management practice competency by building students. Understanding the expected building production management competencies is critical for building students and new entrants into the construction industry to make a smooth transition. Their training could be redirected and tailored towards the significant competencies for building production management. Also, the study can help harmonize the construction industry's needs with academia for their mutual benefit and that of the students. The study concluded that greater collaboration between the construction industry and higher institutions is required to agree on the skills and competencies required for construction students to practice in the construction industry. Furthermore, construction firms should assist tertiary institutions in providing facilities and equipment for student training, as they are the primary beneficiaries of their products. Construction industry professionals should also be involved in practical training at educational institutions to bring students up to date on current construction procedures and practices.

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