PROCESS PROBLEMS IN FACILITIES MANAGEMENT: AN ANALYSIS OF FEASIBILITY AND MANAGEMENT INDICES

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Abstract:
Investments on construction facilities can be motivated by feasibility and profitability indices of alternative initiatives. However, the potentials of projects to meet prescribed goals are being constrained by risks and uncertainties associated with process challenges and procedural frameworks. This study explores the relationship between feasibility sub-systems and profitability indices of selected case studies. The study concludes with insights into the feasibility indices of project initiation and construction processes as they relate to facility management's goals. From the array of variables provided in the study, analysis shows that design sufficiency, buildability and constructability, operability and sustainability are more responsive to the prospects of profitability.

Keywords:
Client, construction process, Facility Management (FM), feasibility indices and profitability index

1 Introduction

Investments in property development are often motivated by several ideals and incentives. These motivations are not limited to meeting personal and immediate subsistence needs. Interestingly, investments in construction property development are being recognized as one of the most profitable alternatives in the business world. This could be strongly linked with the imperativeness reposed in the indices of global infrastructural development associated with meeting housing and social needs. Moreover, the impact of this phenomenon is being triggered in relation to imbalances in population growth and various economic indices. Therefore, the significance of the viability and profitability of construction investments can not be over-emphasized in global wealth (Hildebrandt, 2000; Ruddock, 2000).

In many parts of the world, property development sustains the ethos of meeting private and public infrastructural needs. It also contributes to major variables of economic development like gross domestic product, fixed capital formation, resource employment and sustenance of systemic innovation, technology and culture (Sullivan et al., 2006). Moreover, global attention to the rapid growth of the economic significance of the real estate sector has been on the increase in last two decades (Chan et al., 2008). Therefore, the performance of construction products is as important as the image or roles of the construction industry in relation to various aspects of larger economy (Egan, 1994).

However, construction facility development processes are characterised by several challenges. These challenges are triggered by the uniqueness of complexities, risks and uncertainties associated with various decision stages in construction facility development and management processes. In the context of this study, construction development process and management are reviewed in two relatively correlated phases, viz; construction process and management; and facility management. Construction process and management include project initiation through functional conceptualization, performance specification and procurement of professional services. Other activities include feasibility analysis, entitlement and approval of concepts by statutory authorities, design drafting and documentation, contracting and construction. On the other hand, facility management entails activities aligned with post-construction utilization and maximization of returns-on-values of construction facilities all through product life.

Arguably, an important challenge of every construction process is to deliver a perfect facility at reasonable cost, within time and without serious operational risks. On the other hand, the management of any facility is aimed at optimising client and end-users' operational and management comfort without jeopardising project goals in terms of economic and structural benefits. However, the economic fulfilment of construction facilities is being threatened as construction processes continue to under-achieve in terms of cost, quality, time, transactional relationship and environmental indices of project performance (Egan, 1994). Therefore, the challenge does not only threaten the image of the construction industry and its capacity to fulfil project goals, it extends to transmitting construction process problems to facility management processes.

This study uses selected case studies to review the efficacies of some of the problems inherited from construction processes which are critical to the performance and capacity of technology, innovation and tools used in facility management processes. Analysis reveals that the values economic benefit, feasibility, profitability and life expectancy of construction facilities and components can be more vulnerable to some critical constraints. Arguably, this may depend on the types of facilities and approach to management because facilities are affected differently under separate variables. For instance, while private commercial facilities can be considered on the merits of returns' propensity, social facilities may only be considered on the bases of public interest. Ustinovichius (2004) also observes that investment facilities can be grouped as residential, commercial, social, industrial and institutional infrastructures.

The study further reviews the indices of feasibility and profitability of privately owned commercial facilities as affected by the challenges in construction processes. The objectives therefore, are: (1) to define feasibility indices of construction property development processes, and; (2) to establish the relationship between feasibility indices and profitability index of private commercial facilities. 10 case studies of recently completed facilities were selected in the Central Business Districts (CBDs) of Lagos (Nigeria) and Sydney (Australia). There is overarching evidence in this study regarding the wide gap between design conceptualizations, client's expectations and end-users' needs. Thus, documented observations on the relationship between feasibility indices and profitability of construction facilities should spur a paradigm change in traditional design and construction management ethos.

2 Literature Review

Analysis and management of risks and uncertainties are critical in the management of processes and procedures in property development system in construction (Gunning and Hanna, 2001; Akbiyikli and Eaton, 2004). This is because the success of property development processes largely depends on the ability to identify and analyse the vulnerability of project variables to definite and unforeseeable negative indicators (Rahman and Kumaraswamy, 2001). However, the capacity to absolutely predict the factors of risk in feasibility matrix of commercial facilities is very challenging because no two projects are identical (Odeyinka et al., 2008). On the one hand, construction products are affected by different variables – like location, business flows, environment and systems, use and social factors. On the other hand, they are managed under different methods, techniques, systems and tools. Thus, it may be possible to view the viability of construction investments from different perspectives – social, economic, political, environmental, legal, technical, cultural and business flows. Ultimately however, a feasible project should overcome risks, fulfil all fundamental requirements and deliver project goals and specific projections within to time and anticipated targets or milestones.

2.1 Indices of Project Feasibility in Construction

Consequently, feasibility appraisal in property development is a vital procedure that is used to determine the sensitivity of the viability of investments when exposed to certain negative indicators. This depends on the capacity and efficiency of certain tools and techniques used in the identification and analysis of tangible and intangible risk indices in project flows. The conceptualization of these feasibility risk indices can be viewed as matrix groups; project's primary requirement matrix and project expectation matrix. Figure 1 shows the concentric presentation of feasibility appraisal of project development processes in construction in relation to primary project requirement matrix and project life expectation matrix.

Consequently, negative indicators can be assessed as an interaction between primary requirement matrix and project expectation matrix. Primary requirements matrix of projects can be a combination of monetary and non-monetary cardinal constraints that relate to financial, marketability, political, cultural, environmental, technical, and social and sustainability of strength through the project life (Ibrahim, and Nissen, 2003). On the other hand, project life expectation matrix could be a combination of basic investment goals and expectations like buildability, profitability (and allied milestones), flexibility for adaptation or modification, functionality, operability, maintainability, design sufficiency, energy efficiency, project capacity for innovation and technology, and cultural value. Figure 2 presents a concise definition of project life expectation matrix sub-variables.

Moreover, traditional property development processes are fragmented into sequences of interrelated structures or processes (Ibrahim, and Nissen, 2003). These processes are composed of tasks or activities and challenges, which can be related to the long-term structure of project life. These procedural flows enhance the capacity of construction facilities to drive cost benefits and lifetime opportunities in relation to risks, uncertainties and economic constraints. Figure 3 shows the link between project development process flow, activity flow and problem flows in construction.

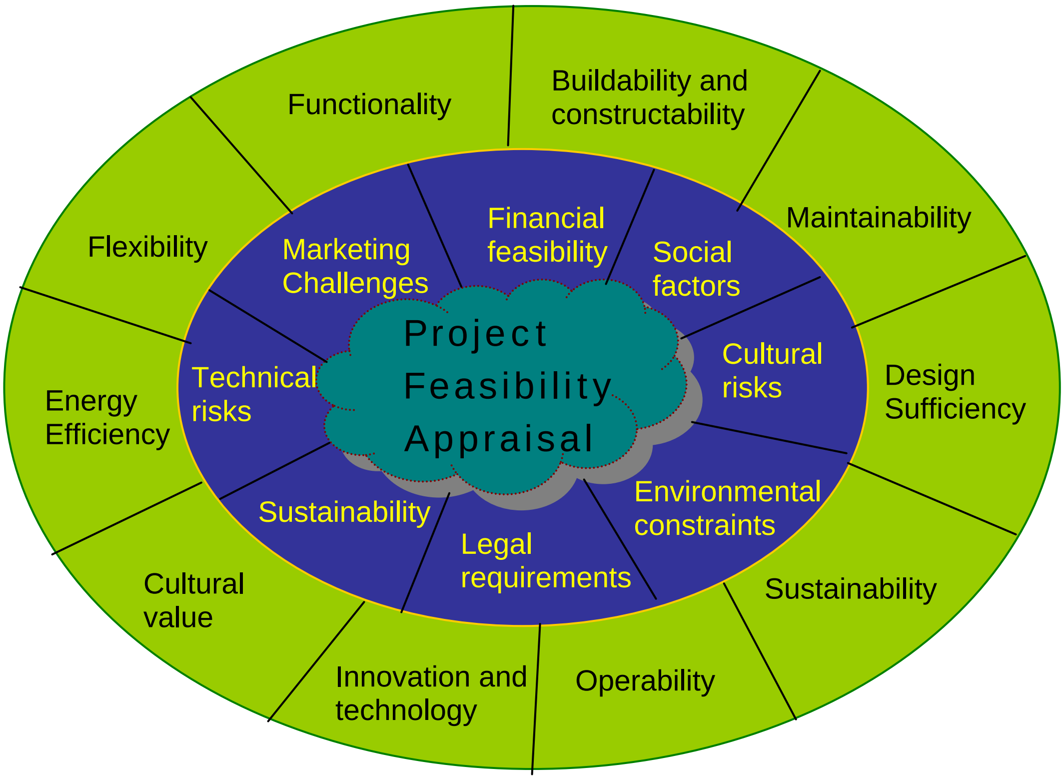

Figure 1: *A concentric presentation of feasibility appraisal in relation to primary requirement matrix and project life expectation matrix*

Core of feasibility

Variables of primary project matrix

Variables of project expectation matrix

Moreover, traditional property development processes are fragmented into sequences of interrelated structures or processes (Ibrahim, and Nissen, 2003). These processes are composed of tasks or activities and challenges, which can be related to the long-term structure of project life. These procedural flows enhance the capacity of construction facilities to drive cost benefits and lifetime opportunities in relation to risks, uncertainties and economic constraints. Figure 3 shows the link between project development process flow, activity flow and problem flows in construction.

However, as much as all projects conceived cannot be seen as viable, many feasible projects may lack the capacity to meet anticipated goals both in terms of cost benefits and the lifetime opportunities they attract (Ankrah and Proverbs, 2005). Consequently, variables of post-construction performance of projects cannot be independent of the significance and justifications of feasibility, sensitivity and cost benefit analyses during appraisal studies. For instance, performances of components are more likely to be affected by environmental changes and variability in use and conversion than expected, due to the implications of global climate change, uncertainty of population and use forecasts. This in turn could affect the facility management processes and business drivers in terms of change in fashion, value, operability, maintainability, planning and sustenance.

Unfortunately, instead of attributing this challenge to problems partly inherited in construction process and the addressed as such, facility managers are not left with many options than to pay more attention to using information technology to create solutions. Evidently, apart from low cost benefits inherent in contemporary IT-based facility management, the resultant component performance of facilities in terms of functional structure may not reflect any improvement. On the other hand, clients and end-users bear the brunt. This could be linked with discrepancies between upsurge in rental values and the level of end-users satisfaction; coherent spirit of business and cost of disputes; anticipated return and cost of maintenance, and; marketability of facility and public interest. Arguably, profitability of investments in construction facilities and the image of the construction industry can be critically affected by this challenge.

1. Design sufficiency *(Acharya et al., 2006; Abrahams and Farrell, 2003)* Efficient design should: •Minimize design errors •Incorporate comprehensive and detailed component specifications •Optimize comprehensive documentation •Maximize capacity for innovation, integrative communication and interoperability	**2. Buildability and constructability** *(Philip, 2002; Cheetham and Lewis, 2001)* Buildable and constructible designs should: •Improve capacity of design to facilitate construction •Motivate capacity of knowledge flow in the construction process to facilitate project goals and building performance •Encourage source-ability of specified components •Facilitate appropriate capacity and resource for construction	**3. Functionality** *(Hammond et al., 2005)* This includes capacity of components to: •Meet the fundamental requirements such as shelter, aesthetics, structural, services, value for money, etc throughout product life •Adequately protect client and end-users against avoidable risks like damp, inclement weather, heat, vegetation etc. •Convey comprehensive identity and purpose of use •Provide structure for space delineation and use
4. Operability *(Bureau of Engineering Project Delivery Manual, 2007)* This can be summarized to mean the capacity of facility components to: •Meet client and end-users' operational needs (like security, stability, firmness etc) •Enhance response to emergencies and operational risks •Enhance sufficiency of space and maximize effective utilization of facility •Enhance optimal accessibility to critical forms of mobility and associated challenges	**5. Maintainability** *(Pheng and Omar, 1997; Kangwa and Olubodun, 2005)* This is considered to include capacity of facility components to facilitate: •The consideration of Diagnostic and retrofitting variables •The provision of reliable benchmark for periodic, scheduled, preventive and corrective measures over time •Sustenance of good maintenance practice •Longer defect susceptibility without compromise to optimize value for money	**6. Cultural value** *(John, 2004)* Culture can be indexical in construction product development processes. However, major indices include the capacity to sustain: •In-use technology and historical sub-systems regarding cultural, experience and practice identities •'Duty of care' to protect public interest •Diversity, social inclusion and responsibility, equity and fairness in public realm and long-term objectives •Fluidity of whole-life values
7. Sustainability *(Adetunji et al., 2003)* This can be summarised as ability of components to optimize, as long-term benefit to client and end users: •Comfort of use and opportunity for re-use •Constructive performance with cost advantage •Safe interaction with the environment and eco-subsystems •Occupational safety and health improvement	**8. Flexibility** *(Gann and Barlow, 1996; Slaughter, 2001)* This implies the whole life capacity of facility to simplify: •Conversion and adaptation •Modernization and improvement •Alteration and extension schemes •Renovation and periodic overhaul	**9. Technology and Innovation** *(Blayse and Manley, 2004; Goyal et al., 2005)* This implies the capacity of innovation and technology to enhance: •The use of appropriate tools for work •Timeliness and value-based delivery of project •Value for money and process objectivity •Total quality performance of all components
10. Energy efficiency *(Bell, 2004)* This includes the capacity of building components to optimize: •Efficient energy use at reasonable cost •Minimization of greenhouse emissions •Performance of services •Adoption of comprehensive approach to energy improvement practices	**Profitability** *(Bello and Bello, 2008)* This includes considerations for: •Low maintenance cost •High gross floor and lettable area ratio •Capacity to attract and enhance business concerns •Location competitiveness and capacity to support basic business functions	

Figure 2: Concise definition of sub-variables of project life expectation matrix

2.2 The Construction Process and Project performance

There is overwhelming empirical evidence justifying the significance of the construction process and associated challenges in property development. These problems affect project performance both at construction and post-construction levels. Unfortunately, there is no empirical evidence that shows strong correlations between poor project performance indices (in term of cost, quality, time, energy, environmental, and health and safety) and post construction performance of construction facilities (considering implication of indices like design sufficiency, buildability and constructability, flexibility, operability, maintainability etc.). However, the implications accumulated inherited problems are evident in the management processes of construction facilities. Therefore, the value and success of Facility Management is better solved as construction processes improve.

In the first instance, the conceptualization of project initiatives are often transmitted by the client to the project team with end-users' requirements or grossly underestimated or not considered at all. This is because, there is little or no evidence of the adoption of a system whereby Facility Managers are dully involved in the current design initiation processes. Unfortunately, the variance between a client's concept of design initiation and end-users' actual requirements are made worse when client's technical brief are overly complex or ambiguous. Kometa et al., 1995) argue the significance of the ubiquitous involvement of client during construction. Therefore, the performance of construction facilities could be very responsive to project initiative. Moreover, the variation between perceived and actual project outlay and performance specification is the single largest factor that is responsible for variation orders, claims, poor cost performance and associated dysfunctional disputes in construction.

On the other hand, there is stochastic evidence regarding the impact of poor design conceptualization in the construction industry. Ordinarily, an effective construction process is expected to comprehensively reflect a client's desire in relation to end-users' requirement and public interest. However, several approaches in current design processes lack the capacity to express detailed project information. Most times, many design methods are not suitable in terms of detailed component specification and application information within the project team. Moreover, basic design information is not extended to facility managers who manage components' performance and application of spaces. Thus, there is gap between actual component performance and documented information due to several factors that could impact on the performance of design components. However, there are rhetoric claims that Building Information Modelling (BIM) processes have the capacity to address these gaps; considering the influence of virtual enterprise, interoperability, automated quantifications, true spirit of collaboration between project team as well as speed and accuracy of design conceptualizations (CRC CI, 2007). Unfortunately, BIM concepts have not yet been fully adopted in the construction industry.

Furthermore, the selection of appropriate contractors to execute projects as designed is another challenge. For instance, contractors are usually prequalified to ensure value-based and objective selection processes. However, this mechanism does not ensure that the successful contractor will perform as predicted (Olatunji, 2008a and 2008b). In addition to major extrinsic and intrinsic factors any contracting organization could be subjected to, poor performance by construction contractors could be worsened by dysfunctional competition between contractors and the effects of lowest-bid-syndrome in the traditional procurement system in construction. Moreover, the implication of climate change is evident on the performance of building components, while the consequences of manufacturer’s evil can only be imagined than experienced. Given this situation, the involvement of Facility Managers in the construction process is further justified because they possess more reliable facts on the actual performance of building components in use. Their perspective of project goals could also help define appropriate selection criteria that would facilitate an improved construction process.

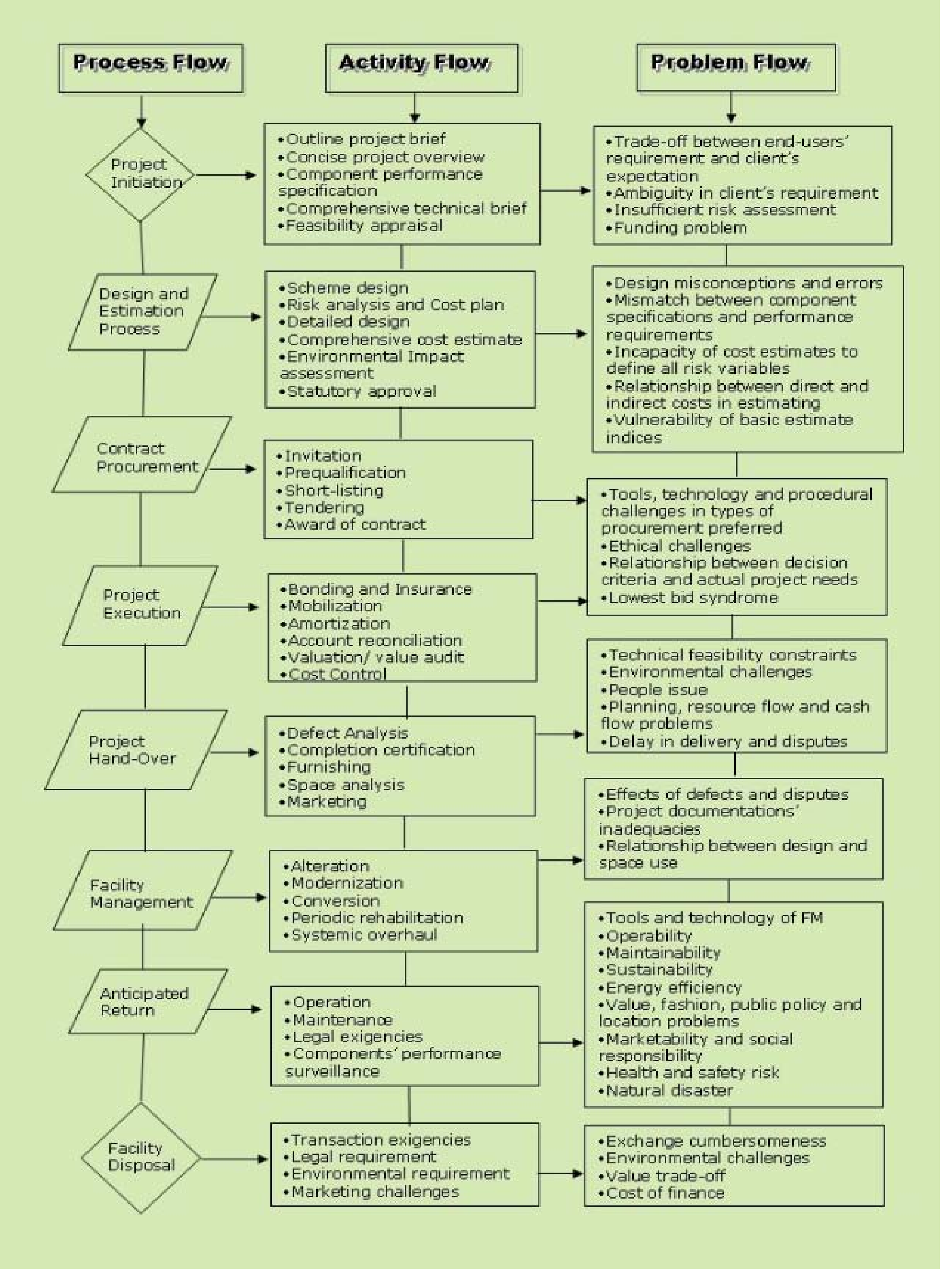

Figure 3: The link between project development process flow, activity flow and problem flow in construction.

3 Research Methodology

Direct observation, in the context of this study, implies the use of case studies to follow rigid protocol in examining limited variables when using in-depth, longitudinal and critical examination of multiple and isolated cases to collect data, analyze information and reports, and at the same time generate and test hypothesis (Marshal and Rossman, 1998). This strategy is more relevant to this study because all construction facilities are not perfectly identical in terms of designs processes and goals. Therefore, to avoid over-generalization, it is expedient that only few specific cases that share basic similarities which are relevant to this study could be considered. Arguably, these attributes are very common to the conceptualization of all construction facilities. Therefore, observations on the case studies would be relevant in generating more conclusive reports on various investigations on complex and technical issues like relationships and gaps between design conceptualizations and achieving projected goals of construction investments. Thus, this study will rely on robust sources of evidence to benefit from the structures of divers opinions and systems in relation to feasibility indices and profitability of construction facilities.

3.1 Study Method

This study is focused on the investigation of the relationship between project performance matrix and the profitability of construction facilities using private commercial assets. Thus, a list of facilities performance variables and sub-variables are identified from literature - as presented in Figure 2. Moreover, 10 case studies of private commercial properties were selected for analysis through direct observation. The selected properties were constructed between 1995 and 2005. Five of the case samples are located within the Central Business District (CBD) of Lagos, Nigeria; while the other 5 are within the CBD of Sydney, Australia. Although, there may be marginal differences between construction industries within the two countries where the study samples are selected, however, all the samples share very relative construction variables and experience.

Both cities are relative in terms of modern cosmopolitan features. Sydney is classified as a ‘beta global city’ (Beaverstock, 1999). Sydney is also one of top 20 most expensive cities in the world. The CBD of Sydney portrays very competitive rental costs of commercial properties relative to other parts of the world, with similar statute. With a population of about 10 million, Lagos has a population density of about 8,000 persons per km^2. According to City Mayor Statistics, Lagos is one of the top 10 fastest growing cities in the world with estimated 4.4% annual population growth rate. Thus, as a responsive national business hub, Lagos has modest prospects for commercial property development investment.

Although, both cities may not perfectly reflect the ideals of holistic conceptualization of property development or the structure of global construction industry, however, the indices reviewed in this study can impact on the performance of similar properties with similar market structure in any part of the world. The case studies are selected based on relativeness in construction features, responsiveness in CBD, gross floor area and total lettable area ratio. All the properties are concrete framed structures with an average of about 5,800m2 in 10 Nos floor and 65% lettable area. With an average age of 8 years, all the structures are suitable or purposed for business tenants, considering the location advantages of the facilities within the CBD.

3.2 Analysis

Each case study was assessed based on the matrix of facility performance and profitability variables and sub-variables presented in figure 2, using a scale of 1 to 4; 1

being poor and 4 being excellent. Markedly, there is strong correlation between innovative practices in the construction processes identified and the performance of the facilities. Construction and post-construction project performance were enhanced by Effective risk analysis, comprehensive project documentation, professionalism, effective communication between parties and information technology. The result of the correlation analysis between project performance matrix and profitability index is presented in Table 1.

Table 1: correlation analysis of project performance matrix and profitability index

Design sufficiency	Pearson Correlation	1.000										
	Sig. (2-tailed)											
Buildability and constructability	Pearson Correlation	.672*	1.000									
	Sig. (2-tailed)	.033										
Functionality	Pearson Correlation	.383	.420	1.000								
	Sig. (2-tailed)	.275	.227									
Operability	Pearson Correlation	.559	.332	-.079	1.000							
	Sig. (2-tailed)	.093	.348	.829								
Maintainability	Pearson Correlation	.566	.603	.570	-.243	1.000						
	Sig. (2-tailed)	.088	.065	.085	.499							
Cultural value	Pearson Correlation	.643*	.564	-.110	.407	.369	1.000					
	Sig. (2-tailed)	.045	.090	.762	.243	.294						
Sustainability	Pearson Correlation	.250	.356	.477	.187	.260	-.145	1.000				
	Sig. (2-tailed)	.487	.312	.163	.606	.467	.688					
Flexibility	Pearson Correlation	.398	.616	.185	.733*	.061	.406	.524	1.000			
	Sig. (2-tailed)	.255	.058	.608	.016	.866	.244	.120				
Technology and Innovation	Pearson Correlation	.417	.545	.662*	.418	.395	.130	.697*	.798**	1.000		
	Sig. (2-tailed)	.230	.103	.037	.230	.258	.720	.025	.006			
Energy efficiency	Pearson Correlation	.496	.327	.155	.206	.287	.241	.515	.270	.329	1.000	
	Sig. (2-tailed)	.145	.356	.669	.569	.421	.503	.128	.451	.353		
Profitability Index	Pearson Correlation	.929**	.753*	.439	.667*	.427	.650*	.292	.571	.515	.323	1.000
	Sig. (2-tailed)	.000	.012	.204	.035	.219	.042	.412	.085	.128	.363	
		Design sufficiency	Buildability and constructability	Functionality	Operability	Maintainability	Cultural value	Sustainability	Flexibility	Technology and Innovation	Energy efficiency	Profitability Index

4 Findings and Discussion

From the analysis presented in Table 1, there is significant correlation between profitability index and design sufficiency, buildability and constructability, operability and cultural value. Moreover, there is strong correlation between Technology and Innovation and functionality, sustainability and flexibility of facility components. There is also strong correlation between flexibility and operability. The correlation coefficients of flexibility and innovation and technology are also fairly responsive. Surprisingly, energy efficiency, sustainability, maintainability and functionality are not very relative to profitability index, as presented in the analysis. Even though there is rapid improvement in global concern for climate change, this study further confirms that there is little attention in terms of business concerns in relation to the implications of climate. Moreover, business relationships in construction property development investments are usually fragmented and short-term in nature. Therefore, the ideals of sustainability in construction have fundamental implementation constraints in commercial properties.

Moreover, the prospects of competitive investment profile in construction may be a good motivator for short-term maintenance efforts. However, as long as maintenance culture in facility management is only motivated by shallow business concerns and not as major construction concern, the performance of construction facility may be under-achieving. Arguably, comprehensive consideration of maintenance variables in the design process could be the best way to improve the cost and schedule of maintenance in facility management. In addition, the poor correlation coefficient between profitability index and function as reflected in the analysis is a further confirmation of Bello and Bello (2008) survey. The structure of time limitation between transaction parties in facility management, competition and population pull can motivate the choice of any facility for business. Fortunately, to some extent, tenants can be allowed to enhance the temporary functionality of certain facility components. Thus, as long as minimum functional requirements are met, there could be limitations to how this can affect the profitability profile of some commercial facilities.

5 Conclusion and Further Research

This study has established the relationship between construction processes and profitability index of some randomly selected commercial properties. Evidently, Construction and post-construction project performance could be enhanced by effective risk analysis, comprehensive project documentation, professionalism, effective communication between parties and information technology. Moreover, there is significant correlation between profitability index and design sufficiency, buildability and constructability, operability and cultural value. Also, the analysis presented in this study shows that there is strong relationship between Technology and Innovation and functionality, sustainability and flexibility of facility components; while maintainability and energy efficiency could not reflect any relationship with any other variable in the analysis. This further indicates the need to reduce the gap between design conceptualizations in construction and global concerns for energy efficiency and more responsive maintenance culture in future construction facilities. Further studies are thus recommended as follows:

1. There is the need to establish the relationship between rental values of construction facilities and the components of satisfaction derived by end-users
2. There is the need to further establish the benefits of the involvement of Facility Managers early in the construction process
3. There is also the need for stochastic analysis and appraisal of performance information on construction components, sustainability and energy efficiency, considering raising concerns for global change.

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