Factors Influencing Technology Transfer Processes in Build-Operate-Transfer (BOT) Projects in Nigeria

A. Dahiru
Quantity Surveying Programme,
School of Environmental Technology
Abubakar Tafawa Balewa University, Bauchi

Abstract

In Nigeria, the National Policy on Public-Private-Partnership (PPP) has created a demand for private sectors to transfer technology to the public sector organizations especially in Build-Operate-Transfer (BOT) projects. Technology Transfer Processes (TTP) in BOT projects faces many challenges in the country. This paper explores some of the key factors influencing TTP in BOT projects through extensive literature review, survey with clients, developers, and lenders. The aim is to contribute to the understanding and development of technology transfer through BOT projects development. Questionnaire was used to obtain the relevant data from the appropriate respondents and analyzed using severity and reliability indices and, subsequently ranked. The findings show that the main problem of TTP in BOT projects is related to time constraint, lack of trust, lack of effective value management system, fear of losing the competitive edge, and inadequate policies, procedure and guidelines. Furthermore, the findings have also revealed that TTP can be enhanced by emphasizing the value and importance of a policy relating to technology transfer, clearly articulated goals and strategies, effective communication, willingness to embrace new technology, and experienced government authority. These findings have considerable relevance to understanding the mechanism of technology transfer between private and public sectors within the BOT context in overcoming the problems and improving the processes. Furthermore, government and BOT concessionaires can use the findings to efficiently design technology transfer frameworks that can be used to overcome the problems encountered while improving TTP in BOT infrastructure projects development in Nigeria.

Keywords: Build-Operate-Transfer, Development, Infrastructures, Nigeria, Technology, Transfer.

Introduction

One of the key development challenges constraining the growth of the Nigerian economy is the huge deficit in basic infrastructure services (National Policy on PPP, 2009). In addressing these challenges, the federal government has therefore recognized the imperative of leveraging on private sector investment and capacity to bridge the country's enormous infrastructure gap through an effective Public-Private-Partnership (PPP) framework. It is in pursuance of this objective that the federal government established the Infrastructure Concession Regulatory Commission (ICRC) as a legal and regulatory avenue for PPP to provide the requisite regulatory framework within which all Ministries, Departments, and Agencies (MDAs) can effectively enter into partnership with private sectors in the financing, construction, operation and maintenance of infrastructure projects. However, this partnership usually comes in the form of Design & Build (D&B), Build-Operate-Transfer (BOT), Build-Own-Operate (BOO), Design Build Maintain (DBM), Design Build Finance Operate (DBFO), and Build Own Operate and Transfer (BOOT), etc. Based on these categorizations, the study is critically concerns with the BOT infrastructure projects development.

BOT is an integrative procurement approach designed to provide unique opportunity for developing public infrastructure facilities and boost the economic growth of the country without utilization of government finances (Tiong, 1990; UNIDO, 1996; World Bank, 2005). This offers incentives to the private sectors to finance, design, construct, operate, and maintain public infrastructure facilities on long term contracts for efficient and effective service delivery. The concept also provides significant attractive opportunities to foreign investors, which in turn can generate substantial foreign exchange for economic growth and sustainable development (Nkado, 2010). Furthermore, technology transfer as well as variety of other benefits such as effective utilization of resources is also being promoted. Similarly, more skillful management in the private sector and its capacity to innovate can lead to increased efficiency. This in turn should translate to higher quality and/or lower cost of services.

In terms of technology transfer processes, BOT sponsors and contractors make advance technology available because it helps the project company to more precisely meet the project technical specifications, as well as to maximize the economic advantage of the project. Dahiru (2011) suggested that such technology should be upgraded throughout the

long concession period in order to increase revenue. The challenge to Nigerian environment is to ensure that the project agreement and other contracts require the project company to fully transfer the technology and all its improvements to the local economy during the concession period. This offers great opportunity by employing and training nationals in the development, construction, and operation of the infrastructure facilities. It is therefore important for a project agreement to stipulate that such training must be carried out throughout the concession period. Typically, a project agreement and the associated contracts insist on participation by those local companies that are internationally competitive in the project development. Such a requirement contributes to capability building and enhances the competitiveness of national industries and services. Similarly, provision may be made to transfer the project technology to the government at the end of the concession period. In particular, the operation and transfer obligations of the project company may include the obligation to use up to date technology on the project.

Accordingly, the subject of technology transfer in BOT projects has become a core area for investigation in the Nigerian construction industry (National Policy on PPP, 2009; Gidado, 2010; Dahiru and Bustani, 2011). Experience suggests that the boost in innovation can be facilitated by the capture and transfer of expertise knowledge and skills among the project stakeholders. Furthermore, several researches have been conducted in PPP projects (Nkado, 2010; Ibem and Aduwo, 2012; Awodele et al., 2012) but less is known about the level of technology transfer process in BOT projects development in Nigeria.

The study therefore identified and evaluated the relative importance of the factors associated with Technology Transfer Processes (TTP) in BOT projects in the Nigerian construction industry.

Literature Review on Technology Transfer Processes in BOT Projects

The context of technology transfer depends on the nature of the particular BOT project and the care taken by the government in structuring the project. A number of legal mechanisms should be considered in formulating a practical and progressive technology transfer strategy. UNIDO (1996) pointed out that one mechanism is to have in place legal and regulatory requirements such as:

- Minimum technical, safety and environmental standards for infrastructure projects.

- Protection and acquisition of technological innovations throughout the concession period, and transfer of the project technology at the end of the period.
- Competitive national companies as suppliers of goods and services to the BOT project.
- Training programmes for nationals at all levels throughout the concession period.
- Obviously, legislation and regulations can do no more than provide a framework for promotion of technology transfer, with the details being left to the drafting of the project agreement and other related contracts.

The bidding procedures themselves may be structured so as to include criteria that promote the transfer of technology. Both the government's tender documents and the bidders' proposals can be made to address the government's technology transfer requirements (Dahiru, 2011). In addition, a bidder's past record for transfer of technology has in some countries been a factor in awarding the BOT concessions. Another essential mechanism for realizing the potential of BOT projects for transfer of technology is the project agreement (Nkado, 2010). The technology to be used for the project development and use of national companies requirements, capability building through training and employment, and protection of innovations should be set in a project agreement (Tiong, 1990).

Selection of Technology Transfer Suitable for Local Conditions

In principle, it is the government that sets the rules for selecting the technology for a BOT project. Gann et al. (1998) emphasized that, the selection process usually passes through several stages. This ranges from the feasibility study through the preliminary and detailed designs of the project to the drafting of project specifications in the tender document and finally to the evaluation of bids. Similarly, Carrillo et al. (2004) made the assertion that, where a technology is fairly well known to the government detailed instructions may be given in its tender documents. Otherwise, if the government is not fully aware of all the technological solutions and wants to draw on the prospective bidders' knowledge and innovative skills, the project requirements may be set out only broadly in the tender documents (Davis, et al. 2007). In any case, it is important for the government to ensure that the technology most appropriate to local conditions is adopted (World Bank, 2005). Therefore, the technology applied to an infrastructure project must be compatible with nationally available inputs and with the present and projected demands of the country (Nkado, 2010).

Reliability of the Technology

Experience suggests that lenders to a BOT project usually insist that the project uses well established technologies and engineering practices. The lack of experience with innovative and experimental technologies, the uncertainty associated with them and the risks they pose to the reliable operation of a project normally make lenders hesitant to finance them (Tiong, 1990). New and unproven technologies are therefore unlikely to be financed in the absence of a guarantee from a strong and credible sponsor. This consideration aside, the selection of the most appropriate technology is still a key issue in BOT projects, because there are important differences even among standard and proven technologies that may have considerable impact on the Nigerian environment. In addition, there may always be some potential for innovative steps to be introduced to standard and proven technologies. Carlile and Rebentisch (2003) noted that every innovative and advanced technology available has been applied to some projects financed by BOT arrangements. In the final analysis, the critical issue for the lenders may not so much be whether a technology is established or innovative but whether it can be proven to be reliable.

Technology Transfer Processes

The term technology denotes the sum of knowledge, experience and skills necessary for planning, engineering, implementation and operating an infrastructure project, including the managerial and marketing aspects (UNIDO, 1996). Technology transfer can be described for the purpose of this paper as a change process involving the movement of technology or skills from private sector to public sector organizations (Kwawu, et al. 2010; Carlile and Rebentisch, 2003; Nonaka, 1994). A successful technology transfer implies that a transfer results in the receiving unit accumulating or assimilating new technology. To be of value to both the private and public sectors, the transferred technology should lead to changes in behaviour and the development of new ideas, processes and practices. Although, the mechanisms for transferring any type of technology from private to public sectors, include learning, training programme, communication, observation, dissemination, implementation, translating, diffusing, activities (Kwawu, et al. 2010). The performance of these mechanisms is context based and therefore influenced by several factors. This is due to the fact that as the transfer processes begin in one context and moves in to another context performance of the processes are influenced by these factors.

Technology Transfer Challenges in BOT Projects

In Nigeria, the main sectors in which BOT was designed to deliver public infrastructure facilities include: power; roads & bridges; water; ports; airports; railways; inland container deports; gas & petroleum; solid waste management; educational facilities; urban transport systems; housing; and healthcare facilities (National policy on PPP, 2009). It is expected that through technology sharing among the purposely created consortia for the BOT project, the private sector will promote innovation, manage the risks, and provide value for money for the government. These expectations were to be achieved through harnessing the financial, managerial, and technical skills and expertise of the private sector to provide efficient and effective public facilities and services (Li, et al. 2005; Akintoye, et al. 2003). Despite the little progress of BOT projects in Nigeria, several challenges in the procurement, construction and operation have been highlighted in several publications. For instance, Dahiru and Bustani (2010) evaluated constraint factors limiting the BOT projects implementation and these include: political, economic, legal, and technical and social factors. Based on these challenges, Ibrahim (2005) observed the need for the development of an efficient model for the design, implementation, financing and promotion of BOT project delivery system that will incorporate the experiences of other nations. Similarly, three important factors; favourable legal framework, well organized public agency to negotiate on behalf of government, and strong private consortium were suggested as being the major factors hindering the development of successful BOT projects in Nigeria (Ibrahim et al. 2006). These challenges have lead to inefficiencies in the BOT project delivery processes such as communication and information sharing among BOT participants and in the transfer of best practices among stakeholders and projects. Consequently, Technology transfer processes are essential in overcoming these inefficiencies. Kwawu et al. (2010) reported that for better performance, appropriate technology transfer frameworks in order to facilitate innovation and continuous improvement in several aspects of BOT projects has become imperative. Such framework consists of three stages that will explore BOT participation and opportunities, mapping the organisation's technology and creating an action plan for transferring technology. Furthermore, BOT projects will only be prudent for government and service providers by identifying, assessing, evaluating and ranking the factors that influence technology transfer processes, in order to improve existing technology transfer processes.

Factor Influencing Technology Transfer Processes

There is still considerable debate on the factors that negatively affect technology transfer processes in general. The lack of time to receive and apply new technology as a characteristic barrier to technology transfer was identified by Szulanski (1996) and Kwawu et al. (2010). Certainly, the times available to participants to transfer their technology in ways meaningful to recipients are timely and situated in the recipients' real world context. Moreover, other factors include: confidentiality, reliability, copyright, fear of losing one's unique value, and the absence of trust among the participants (Carrillo, et al. 2004; Renzl, 2008; and Kwawu, et al. 2010). Certainly a climate of trust and willingness is necessary to achieve technology sharing within the organisation or project. However, trust and willingness are built on good communication between the relevant parties. Policies, procedures, rules and regulations attached to projects, especially when these are treated as static sets of technical requirements were identified as barriers of technology transfer processes (Gann, et al. 1998). Other issues such as lack of management support and commitment and motivation of staff to share technology have been emphasized as barriers to technology transfer (Carrillo, et al. 2004). While these factors have been identified, their relative importance to BOT projects received less attention. In terms of factors that can positively influence a successful technology transfer, organisational culture, incentive structure, interpersonal trust in general, trust in management, supportive leadership and supportive structures such as clearly articulated goals and strategies were identified by several researchers such as Goh (2002) and Renzl (2008). Reliability of the source of information is also important to the technology transfer process among other factors (Davis, et al. 2007). Policies, procedures, rules and regulations when used as part of a portfolio aimed at improving performance, the presence of management support, commitment and motivation of staff to share technology through incentive or reward structure and the willingness to learn from others, organisational and individual capabilities and competencies were found to be essential in facilitating technology transfer processes (Szulanski, 1996; Gann, et al. 1998; Carrillo, et al. 2004; Kwawu, et al. 2010). Clearly due to the complexity of BOT projects, some of these factors must be important than others. Therefore it is prudent to attempt to rank them from the perspective of BOT participants, in terms of the consideration that should be given to them in the technology transfer process.

Research Method

This section presents the procedures which were followed in achieving the objectives set for this study. The study population was defined to include the major BOT participants and the sample survey consisted of a self-reported questionnaire which was completed by the appropriate respondents (clients, developers, and lenders). These respondents were either senior managers or partners with responsibility for BOT projects in their respective organisations. Systematic sampling technique was used in getting the appropriate respondents from: Abuja, Lagos, Kano, Port Harcourt, and Kaduna as been the areas where BOT projects are commonly found. Using such a data collection technique saves a considerable amount of time and effort and normally a generalised fair sample is achieved (Churchill 1999; Lavelle and Bardon, 2009). The questionnaire used was designed to obtain the respondents' views on specific technology transfer processes and its content was informed by literature reviews which identified success factors for technology transfer. Eighteen factors relating to technology transfer barriers (Table 1) and twenty-six factors enhancing technology transfer processes (Table 2) were identified and formed part of the questionnaire. A total of 140 questionnaires (clients 45; developers 47; lenders 48) were returned out of the 185 distributed, which represents 76% effective response rate. The respondents to the questionnaire were asked to rank the identified barriers and drivers of technology transfer processes on a scale of 1 (very important) to 5 (very unimportant). The responses that were received from the survey participants were tabulated and analyzed individually. Severity Indices (SI) are calculated on participants' perceived barriers where a lower value indicates a lower level of severity. On the other hand, Reliability Indices (RI) were also used to rank the factors found to be relevant in improving the technology transfer processes where upper value indicates strongly important factor. These calculations put the factors in rank order and indicate how much the top ranked is more important than the next in terms of severity or reliability as the case may be.

Findings

Factors that negatively affect Technology Transfer processes

Table 1 shows respondents' view of the most important as well as the least important barriers to the technology transfer process in BOT projects.

Table 1: Severity Index and Ranks of Factors that negatively affect Technology Transfer

Factors responsible in limiting technology transfer process	Severity index for the responses						Weighted Average for all Respondents	
	Clients		Developers		Lenders			
	SI	R	SI	R	SI	R	WASI	WAR
Time constraints	2.92	8	3.07	2	3.24	1	3.08	1
Lack of trust between the parties	3.01	6	2.90	7	3.14	2	3.02	2
Lack of effective value management system	2.87	9	3.00	5	3.11	3	2.99	3
Fear of losing the competitive edge	3.11	1	2.77	12	2.99	7	2.96	4
Problems of inadequate procedure and guidelines	3.06	4	2.89	8	2.87	8	2.94	5
Lack of transparency and accountability	3.09	2	2.94	6	2.74	13	2.92	6
Developers' lack of willingness to share knowledge	2.81	10	2.86	9	3.04	4	2.90	7
Lack of knowledge capture management/dissemination	3.03	5	2.84	10	2.80	9	2.89	8
Reluctance to change the industry routines	2.81	10	3.01	4	2.79	10	2.87	9
External influence (political, economic and social)	3.00	7	2.80	11	2.75	12	2.85	10
Reluctance to embrace new ideas	2.74	12	3.00	5	2.78	11	2.84	11
Organizational context and structure	2.77	11	2.72	13	3.00	6	2.83	12
Unnecessary influence made by other parties in BOT	2.66	13	3.11	1	2.56	15	2.78	13
Potential conflict of interest	3.07	3	2.68	14	2.52	16	2.76	14
Unwillingness to adapt idea originated elsewhere	2.48	16	3.04	3	2.66	14	2.73	15
Clients representative constantly change	2.62	14	2.44	15	3.02	5	2.69	16
Poor use of feedback systems	2.58	15	3.01	4	2.42	18	2.67	17
Lack of motivation of staff to share knowledge	3.00	7	2.40	16	2.52	17	2.64	18

Table 1 indicates that clients have ranked five most constraints limiting technology transfer processes in BOT projects. These factors include: fear of losing the competitive edge (R1); lack of transparency and accountability (R2); potential conflict of interest (R3); inadequate procedure and guidelines (R4); and lack of knowledge capture management/dissemination (R5). Clients believed that these factors are crucial to the successful technology transfer processes in BOT projects development. However, developers have different perceptions with the clients as they ranked different factors of been the most constraints: unnecessary influence (R1); time constraints (R2); unwillingness to adapt idea originated elsewhere (R3); poor use of feedback systems (R4); and reluctance to embrace new ideas (R5). These indicate that developers

have different perceptions with their counterpart clients on the most constraint factors limiting technology transfer processes. Similarly, lenders perceptions are also different from that of clients and developers as they ranked different factors of been the most constraints: time constraints (R1); lack of trust between the parties (R2); lack of effective value management system (R3); developers' lack of willingness to share knowledge (R4); and client's representative constantly change (R5).

However, on the Weighted Average Ranking (AR) of all the category of respondents, ten most ranked factors that negatively affect technology transfer in order of importance include: time constraints (AR1); lack of trust between the parties (AR2); lack of effective value management system (AR3); fear of losing the competitive edge (AR4); problems of inadequate procedure and guidelines (AR5); lack of transparency and accountability (AR6); developers' lack of willingness to share knowledge (AR7); lack of knowledge capture management/ dissemination (AR8); reluctance to change the industry routines (AR9); and external influence such as political, economic and social factors (AR10). Furthermore, the eight less important factors that negatively affect technology transfer include: lack of motivation of staff to share knowledge (AR11); poor use of feedback systems (AR12); clients representative constantly change (AR13); unwillingness to adapt idea from different company (AR14); potential conflict of interest (AR15); unnecessary influence made by other parties in BOT (AR16); organizational context and structure (Ar17); and reluctance to embrace new ideas (AR18).

Factors that positively affect technology transfer processes

Similarly, Table 2 shows respondents' view of the most important as well as the least important factors positively affecting the technology transfer process.

Table 2: Reliability Index and Ranks of factors that positively affect technology transfer

Factors responsible for improving technology transfer process	Reliability index for the response						Weighted average for all respondents	
	Clients		Developers		Lenders			
	RI	R	RI	R	RI	R	ARI	R
Policies relating to technology transfer	2.90	4	3.05	1	3.22	1	3.06	1
Clearly articulated goals and strategies	3.00	3	2.85	4	3.07	2	2.97	2
Effective communication between the relevant parties	2.82	5	3.00	2	3.02	3	2.95	3
Organization willingness to embrace new technology	3.03	1	2.72	6	2.92	5	2.89	4
Experience government authority	3.00	3	2.82	5	2.80	6	2.87	5
Willingness to learn from others	3.01	2	2.90	3	2.50	8	2.80	6
Stakeholders capability and competencies	2.62	7	2.66	7	3.00	4	2.76	7
Supportive leadership	2.62	7	2.44	9	2.72	7	2.59	8
Commitment from the relevant parties	2.81	6	2.12	12	2.36	9	2.43	9
Compliance with contractual agreement	2.11	12	2.56	8	2.36	9	2.34	10
Performance measurement	2.46	8	2.10	13	2.32	10	2.29	11
Lack of networking	2.06	13	2.32	10	2.36	9	2.25	12
Good process management	2.26	9	2.02	16	2.30	11	2.19	13
Environmental influences (political, economic, social)	2.01	15	2.22	11	2.26	12	2.16	14
Training and development	2.24	10	2.00	18	2.20	13	2.15	15
Support from other partners	1.89	17	2.04	15	2.19	14	2.04	16
Reward mechanism	2.16	11	2.01	17	1.64	17	1.94	17
Use of information technology	1.44	21	2.06	14	2.00	15	1.83	18
User friendly technology	2.02	14	1.34	22	1.88	16	1.75	19
Acting consistent with objective	2.00	16	1.68	20	1.30	21	1.66	20
Commitment to continuous improvement	1.26	22	1.87	19	1.60	18	1.58	21
Ensure reliability of the source	1.78	18	1.22	25	1.56	20	1.52	22
Reliable concessionaire consortium	1.46	20	1.68	20	1.20	22	1.45	23
Capacity to learn	1.14	24	1.42	21	1.58	19	1.38	24
Feedback mechanism	1.54	19	1.32	23	1.10	23	1.32	25
Individual capacity and competencies	1.22	23	1.23	24	1.06	24	1.17	26

Table 2 shows the clients, developers and lenders perceptions on the top and least important factors that positively improve technology transfer processes in BOT projects. These study findings indicate that respondents' opinions are entirely different in terms of the most important factors enhancing technology transfer process. Furthermore, the computed AR values revealed the top fifteen most

important factors and include: Policies relating to technology transfer (AR1), Clearly articulated goals and strategies (AR2), Effective communication between the relevant parties (AR3), Organization willingness to embrace new technology (AR4), Experience government authority (AR5), Willingness to learn from others (AR6), Stakeholders capability and competencies (AR7), supportive leadership (AR8), Commitment from the relevant parties (AR9), and Compliance with contractual agreement (AR10), Performance measurement (AR11). Lack of networking (AR12), Good process management (AR13), Environmental influences (political, economic, social) (AR14), and Training and development (AR15),

On the other hand, the findings ranked the least important factors that positively affect technology transfer processes and include: Individual capacity and competencies (AR26), Feedback mechanism (AR25), Capacity to learn (AR24), Reliable concessionaire consortium (AR23), Ensure reliability of the source (AR22), Commitment to continuous improvement (AR21), Acting consistent with objective (AR20), User friendly technology (AR19), Use of information technology (AR18), Reward mechanism (AR17), and Support from other partners (AR16). This clearly indicates that all respondents agree on the importance attached to these factors in improving the technology transfer processes in the BOT projects development in Nigeria.

Discussion

Barriers that most negatively influence technology transfer

Time constraint is perceived as the most significant barrier that negatively affects the technology transfer process (Table 1, AR1). This is due to the time consumed while exchanging and internalizing information. There is a possibility that individuals with numerous other demands on their time will focus solely on work demands for which they have primary accountability (Szulanski, 1996). Also the lengthy negotiation periods associated with BOT procurement and its subsequent influence on bidding and transaction costs may limit the time required to implement the technology transfer process. This finding suggests that public sectors in collaboration with BOT concessionaires need to provide enough time for employees and relevant parties to learn and share information.

The second most significant barrier that affects the technology transfer process is the lack of trust (Table 1, AR2). This suggests that some participants in BOT projects are still experiencing a lack of trust between the project stakeholders. The fact is

that the trust between parties has to be developed over a shorter period rather than over the concession period considering the time allocated for the design and construction of the facility. This suggests that project stakeholders in BOT projects should pay attention to encouraging and developing trust between them for a successful technology transfer.

Lack of effective value management system (Table 1, AR3) was found to be the third most significant barrier that affects the technology transfer processes in BOT projects. The reason may be as a result of the inexperience of the government in handling BOT transaction especially at the procurement stage where the project needs to be carefully planned and adequately controlled. Also selection of the reliable and appropriate concessionaire is highly essential in adopting effective value management system in BOT projects. The finding therefore suggests that government should pay more attention to encourage effective value management system while selecting concessionaire for successful technology transfer in BOT projects.

The lack of motivation of staff to share knowledge (Table 1, AR18) is perceived as the least important barrier to technology transfer processes in BOT projects. Even though motivational factors were determined as barriers to technology transfer process, it seems the lack of motivation to share knowledge is not a growing concern. Li et al. (2005) found out that workers are willing to share knowledge in BOT projects. Another reason may be that project stakeholders seek external skills and experience from competent advisers to complement their knowledge and skills in the bidding stage of the project. However, the cost of such advice makes BOT bidding cost and transaction costs very expensive. This suggests that workers in most of the organisations are motivated to share knowledge but other issues are significantly influencing the technology transfer process. Thus stakeholders should pay more attention to the significant barriers identified.

Factors that positively influence technology transfer

Policies relating to technology transfer (AR1) as shown in Table 2 were perceived to be the most significant factor that can positively influences technology transfer processes. This generally indicates that all of the respondents have collectively agreed on the importance of the factor in successful technology transfer processes in BOT projects. The finding summarily shown that for a successful technology transfer in BOT projects, supportive policies are necessary. Therefore provision of technology transfer policies

should be included in the national policy on PPP for consideration by the relevant stakeholders especially while delivering BOT projects.

Clearly articulated goals and strategies (Table 2, AR2) was discovered as the second most significant factor to technology transfer process success in BOT projects. This translates that respondents have collectively emphasized on the significance of setting a clearly articulated goals and strategies that can enhance the success of technology transfer process in BOT projects. This finding is in line with Szulanski (1996) assertion on the importance attached to the factor in improving technology transfer processes. Therefore, technology transfer strategies should be captured within the context of project agreement for consideration by all relevant stakeholders. This will ensure that the project agreement and other contracts require the project company to fully transfer the technology and all its improvements to the local economy during the concession period. The strategy will offer great opportunity by employing and training nationals in the development, construction, and operation of the infrastructure facilities.

The least important factor that positively influences technology transfer processes as perceived by the BOT practitioners is individual capacity and competencies (Table 2, AR3). The fact is that most BOT concessionaires do not have adequate skills in technology transfer processes as few competitors are usually involved in bidding BOT projects due to scarcity of competent and reliable concessionaires locally. Also the government officials do not have the relevant skills in transmitting technology transfer processes from private to public sectors in BOT projects. This is also observed by UNIDO (1996) on the required need to have adequate knowledge and relevant skills by both the practitioners and government officials in the development of BOT contract transaction.

Conclusions

PPP concept has been gradually used to deliver critical infrastructure facilities such as roads, bridges, airports, seaport, schools, and housing in Nigeria. Although BOT is the most frequent PPP approach used to procure such public facilities due to many benefits derived from its application. Such benefits include technology transfer that can generate overall economic growth in infrastructure development in the country. However, there are growing demands on the level of technology transfer processes from private to the public sectors. Technology transfer procedure and guidelines have been inadequately provided in

the national policy on PPP and this has led to many factors influencing the technology transfer process in the real practice. Perhaps, these factors can be identified and ranked in accordance with their relative significance in achieving successful technology transfer processes in BOT projects.

The study has investigated and identified the most significant factors influencing successful technology transfer process in BOT projects considering the Nigerian environment. Data from questionnaire survey has been used to identify and rank the most significant factors influencing a successful technology transfer process in BOT project development. The ten influential factors that emerged as negatively affecting the technology transfer process, in order of descending significance are: time constraints, lack of trust between parties, lack of effective value management system, fear of losing the competitive edge, inadequate procedure and guidelines, lack of transparency and accountability, lack of willingness to share knowledge, lack of knowledge capture management/ dissemination, reluctance to change the industry routines, and external influence such as political, economic and social factors. Similarly the fifteen most significant factors that positively influenced technology transfer processes are identified, in order of descending significance as: policies relating to technology transfer, clearly articulated goals and strategies, effective communication between the relevant parties, organization willingness to embrace new technology, experience government authority, willingness to learn from others, stakeholders capability and competencies, supportive leadership, commitment from the relevant parties, and compliance with contractual agreement, Performance measurement, lack of networking, good process management, environmental influences (political, economic, social), and Training and development.

Most importantly, the findings of policies relating to technology transfer and clearly articulated goals and strategies as the most significant factors, suggests that government need to provide supportive policies and strategies in to the BOT project agreement for technology transfer consideration to the relevant parties. Government and BOT concessionaires can overcome the barriers encountered while enhancing the factors to improve the level of technology transfer processes in BOT projects development.

The study proposes that both the government and BOT concessionaires engaged in technology transfer process should pay more attention to the identified

factors in order to achieve successful transfer process. Similarly, to improve technology transfer processes, the government should include policies and strategies in BOT project agreement for consideration by all the relevant parties in order to efficiently achieve their technology transfer goals in BOT projects development in Nigeria.

References

Abjanbekov, A. and Padilla, A. E. A. (2004). From knowledge transfer to knowledge translation: Case study of a telecom consultancy. Linköping, Sweden: Linköping University.

Akintoye, A., McIntosh, G. and Fitzgerald, E. (2000). A survey of supply chain collaboration and management in the UK construction industry. European Journal of Purchasing andSupply Management, 3-4(6), 159-68.

Akintoye, A., Hardcastle, C., Beck, B., Chinyio, E. and Asenova, D. (2003). Achieving best value in private finance initiative project procurement. Construction Management and Economics, 21(5), 46170.

Awodele, O. A., Ogunlana, S. O. and Akinradewo, O. F. (2012). Evaluation of Public-Private-Partnership (PPP) as alternative procurement route for infrastructure development: Case study of Nigeria mega city. WABER Conference proceedings held between 24 26 July at Merit Award House, Abuja, Nigeria.

Bresnen, M., Edelman, L., Newell, S., Scarbrough, H. and Swan, J. (2003). Social practices and the management of knowledge in project environments. International Journal of Project Management, 21(1), 157 66.

Bresnen, M., Edelman, L., Newell, S., Scarbrough, H. and Swan, J. (2005). Exploring social capital in the construction firm. Building Research and Information, 33(3), 235 - 44.

Carlile, P. R. and Rebentisch, E. S. (2003). In to the black box: The knowledge transformation cycle. Management Science, 49(9), 1180-95.

Carrillo, P., Robinson, H., Al-Ghassani, A. and Anumba, C. (2004). Knowledge management in construction: Drivers, resources and barriers. Project Management Journal, 35(1), 46-56.

Dahiru A. and Bustani S. (2010). Appraisal of factors that influence the implementation of BOT infrastructure projects in Nigeria. Proceedings of the West Africa Built Environment Research (WABER) Conference held between 27 28 July, 2010

Accra, Ghana, 189 199.

Dahiru A. and Bustani S. A. (2011). Evaluating the benefits of BOT infrastructure projects in Nigeria. Proceedings of the West Africa Built Environment Research (WABER) Conference held between 19 21 July, 2011 Accra, Ghana. pp 435 443.

Dahiru, A. (2011). Appraisal of BOT Procurement Processes in Infrastructure Projects Development. Unpublished PhD Thesis, Building Department, Ahmadu Bello University Zaria.

Davis, R., Watson, P., Man C., and Sar, C. (2007). Knowledge management for the Quantity Surveying Profession. Working paper on strategic integration of surveying services, Hong Kong.

Gann, D. M., Wang, Y. and Hawkins, R. (1998). Do regulations encourage innovation? The case of energy efficiency in housing. Building Research and Information, 26(5), 280-96.

Goh, S C (2002). Managing effective knowledge transfer: An integrative framework and some practical implications. Journal of Knowledge Management, 6(1), 2330.

Gidado, K. (2010). A model for PFI implementation in the Sub-Saharan Africa - Nigeria as a case study. A paper presented at the third international world of construction project management conference held between 20 22nd October, 2010 in Coventry University, UK

Ibem, E. O. and Aduwo, E. B. (2012). Public Private Partnerships (PPPs) in housing provision in Ogun State, Nigeria: Opportunities and challenges. WABER Conference proceedings held between 24 26 July, at Merit Award Housing Abuja, Nigeria.

Ibrahim, A.D. (2005). Analysis of financing and risk management for BOT projects. Journal of the Nigerian Institute of Quantity Surveying, 53(4), 26 - 40.

Ibrahim, A.D., Price, A.D.F., and Dainty, A.R.J. (2006). The analysis and allocation of risks in Public-Private-Partnerships in infrastructure projects in Nigeria. Journal of Financial Management of Property and Construction, 11(3), 149 - 163.

Kwawu, W., Eihaq, T. Ballal, T. (2010). Knowledge transfer processes in PFI: Identification of barriers and enablers. COBRA 2010 Conference proceedings. The construction, Building and Real Estate Research Conference of the Royal Institution of Chartered Surveyors, held at Dauphine Universite, Paris, France.

Lavelle, D, and Bardon, A. (2009). E-tendering in construction: Time for a change? Built Environment Research Paper. School of the Built Environment, Northumbria University, Newcastle upon Tyne, UK

Li, B, Akintoye, A., Edwards, P. J. and Hardcastle, C. (2005). Critical success factors for PPP/PFI projects in the Uk construction industry. Construction Management and Economics, 23(5), 459 - 71.

National Policy on PPP (2009). The Need for Investment in Nigeria's Infrastructure. Approved document by the federal executive council.

Nkado, R. (2010). Public-Private-Partnership approach to infrastructure development in Nigeria: Nature and features of railway construction. A paper presented at the international workshop organized by the NIQS FCT chapter on PPP approach to infrastructure development held between 14 15 April, 2010 at Merit Award House, Maitama, Abuja.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. Organization Science., 5(1), 14-24.

Renzl, B. (2008). Trust in management and knowledge sharing: The mediating effects of fear and knowledge documentation. Omega, 36(2), 206 - 20.

Szulanski, G. (1996). Exploring internal stickiness: Impediments to the transfer of best practice within the firm. Strategic Management Journal, 17(10), 27 43.

Tiong, R. L. K. (1990). Comparative study of BOT projects. Journal of management in Engineering, 6(1), 107-122.

UNIDO (1996). UNIDO BOT Guidelines: Guidelines for infrastructure development through Build-Operate-Transfer (BOT) projects. UNIDO publication, Vienna, Austria, ID/SER.O/22.

World Bank (2005). Infrastructure Development: The roles of public and private sectors. World Bank group's approach to supporting investment in infrastructure.