
INFORMATION AND COMMUNICATION TECHNOLOGIES AND PROJECT PLANNING IN THE NIGERIAN FOOD AND BEVERAGE INDUSTRY

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between all authors. Author SOA designed the study, anchored the field study, gathered the initial data, performed preliminary data analysis wrote the protocol and interpreted the data. Authors IAI and JBA managed the literature searches and produced the initial draft. All authors read and approved the final manuscript.

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ABSTRACT

Information and Communication Technologies (ICTs) have been known as vital technologies that are associated with production mechanisms for technological progress. The study examined the impact of ICT on project planning activities in Nigerian food and beverage industry. Data from primary sources were obtained through the use of questionnaire and interview scheduled on one hundred and seventy five (175) purposively selected users of ICT across three Departments of food and beverage firms in Nigeria. This was with a view to elicit information on the level of outputs and significance of the application of ICT to the performance of the industry. Data collected were analyzed using both descriptive and inferential statistics. The results of the analysis of variance shows that there were significant difference in the mean rank of respondents' opinion on ICT to improve quality (F=110.07, P = 0.05), reduce cost (F=110.07, p<0.05), improves process (F=140.93, p<0.05), and reduce processing time (F=184.36, p<0.05). Evidence shows that Internet usage, Virtual Private Network (VPN), Enterprise Resource Planning (ERP) and Product Lifecycle Management (PLM) had strong impact on product quality, process improvement, cost and time reduction. It was concluded that the absence of ICT in the firm will slow down the effective coordination of raw materials.

Keywords: ICTs; project planning; food and beverage industry.

1. INTRODUCTION

Manufacturing industry is one of the most critical factors for adequate socio-economic development. The industry is crucial to many developing countries [1,2]. The food and beverage industry is the largest of

all the sectors of Manufacturers Association of Nigeria which consists about 49% of the manufacturing companies [3]. The industry involves application of technologies to raw materials either in it crude form or semi-processed leading to the creation of products. [4] presents project management

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as an application of knowledge, skills, tools, and techniques to project activities in order to meet project requirements, although successful projects generally allow some time for planning before they are implemented.

Many organizations employed ICT in a wide range and for different operations. Operations like quality control, production, and management functions in the Nigerian food and beverage industry where studied by [5]. ICT has provided new ways to store, process, distribute and exchange information both within companies, customers and suppliers in the supply chain [6]. Software is generally seen as components of ICT. Consistently, project management software has made project planning activities simpler in the recent time [4]. Program Evaluation Review Techniques (PERT) is a technique for providing definite estimates of how long it will take to complete a task or several tasks.

Many studies have shown positive significant impact of these ICTs on operations of industries [7-9]. [10] focused on the manufacturing companies and concluded that ICT has significant impact on labour productivity and on multifactor productivity (MFP) growth in durable goods sectors. [11] linked MFP growth to 'real cost reduction and suggested that this could be as a result of the mindset of production managers who strive to improve profitability by finding ways to economize on inputs. [12] registered that organizations tend to rely heavily on ICT solutions in order to develop and grow their businesses. According to [13] opined that ICT has enabled firms to remove distance and time constraint in accessing required information flow. It also reduces the cost of production, transmitted, accessed and shared knowledge at the minimum cost. [14] ascertains that the use of ICT in many organizations have assisted in reducing transactional cost, overcome the constraints of distance and cut across geographic boundaries thereby assisting to improve coordination of activities within organizational boundaries.

As a result of the importance of ICT in the industrial sector, there is need to empirically establish ICT impact in project planning activities of the food and beverage sector because there is little or no information on the application of ICT on project planning in the industry.

2. THEORETICAL BACKGROUND

Planning in a project management context, is the process involved in establishing courses of action within the prevailing environment to accomplish predetermined objectives [15]. A successful project is

one that delivers expected results. Effective project definition and initiation play an important role in controlling project processes in contrast to drifting into a project with little foresight or planning [16,17]. [18] in Project Management Demystified wrote that Planning is primarily 'thinking ahead'. If it is the project manager's job to manage what is going on, it is the planner's role to worry about the future. You may wear two hats, one saying project management on the front and one saying project planner on the peak. Someone, somewhere, sometime, has the function of being the planner and trying to predict how the project will go and what needs to be organized for the future [18].

In the total world trade, project planning is very crucial to food and beverage industry because the food and beverage industry is involved in the production of basic food items that serve as an intake for human consumption. Once planning is faulty, it will affect the overall deliverables. Of the Project Management functions, planning, organizing, staffing, leading, and controlling, planning is the most fundamental. Before any project can be tackled in the management function, a plan must be design first, a blueprint for good achievement that specifies the necessary resource allocation, schedules, tasks, and other actions. Planning incorporates both ideas and defining the means for achieving them. Planning also reason about how an organization will get to where it wants to go. It involves commitment of resources in the most economical means and allowing this commitment to be made less distinctive.

Project planning provides the project's framework and an opportunity to begin the important project documentation process [19]. A project plan is like a time budget, which is a process of allocating time to various tasks and using it as a model to compare the expected time with the actual time of project completion. If something takes longer than expected, then there will be a need to take corrective measures. Project planning is a modeling process. Project managers create a model of the project and experiment with the model to find neat, efficient and cheap ways of proceeding through the activities or tasks which make up the project.

2.1 ICTs and the Industry

ICTs have always played a very important part in human life. In the mid-20th century, the role of information increased immeasurably as a result of social progress and the vigorous development in science and technology. The use of ICTs as project planning components in the food and beverage industry fosters operational efficiency [20]. Also, ICT supports and promotes the exchange of information

Main ICT categories	Technologies – Systems
Enterprise Systems	Enterprise Resource Planning – ERP & ERP II or XRP Customer Relationship Management - CRM
Information Systems	Supply Chain Management – SCM Transaction Processing Systems – TPS Management Information Systems - MIS Decision-Support Systems - DSS Executive Support Systems – ESS
Digital Technologies	E-Commerce – B2B, B2C, B2G E-Business
Telecommunication Systems	Internet, e-mail, voice over IP Local Area Networks Wide Area Networks Virtual Private Networks
Identification and Data Capture Technologies & Telematics Technologies	Portable Data Collection, Hand Held Readers, Magnetic & Smart Card Readers, RFID and so forth.

Source: [34] Papastathopoulos, Anastassopoulos and Beneki (2009)

between the different parts of the supply chain [21]. This promotes efficiency by reducing administrative workloads. ICT is also an important tool for monitoring the production and manufacturing process, thus improving quality management and ensuring compliance with environmental standards [22]. Lack of adoption of ICT on project planning in the project activities processes may leave organizations ill-equipped to break even.

It is commonly accepted that Information and Communication Technologies and Systems provide many benefits to companies, including small and medium scale enterprises (SME's) to make them more efficient, effective and competitive. [23-25]. ICTs, represented by the Internet, delivers at once a worldwide broadcasting capacity, a mechanism for information dissemination, a medium for interaction between individuals and a marketplace for goods and services [26]. As pointed out by [27], mails, telephone, TV and radio, books, newspapers and periodicals are the traditional ways users send and receive information.

However, just as ICT resources are useful in teaching and research, the same success story can be recorded even among food and beverage firms. [28-31] classified ICT into five main categories.

2.2 ICT Classification

Information and communication technologies (ICTs) are technologies that support parts of organizations,

entire organizations and groups of organizations. Most organizations consider ICT as their backbone, and a vital organizational tool. This comprises of Hardware and software infrastructure that integrates varied organizational systems and enables flawless transactions and productions. However, Enterprise systems are complex software packages that offer the potential of integrating data and processes across functions in an enterprise. Enterprise system can run on a variety of computer hardware and network configurations, typically employing a database as a repository for information [32]. Study has also established that the major ICT adopted by food and beverage firms are categorized under Enterprise System and Telecommunication System. These include Enterprise resource planning, Product lifecycle management, Customer Relationship Management, Supply Chain Management, Management Information Systems, Portable Data Collection Hand Held, Virtual Private Networks, Internet, e-mail and voice over IP [5].

The adoption of ICTs among small and medium size enterprises (SMEs) is a phenomenon that has been the object of increasing interest by the academic literature and the policy makers. A number of empirical studies show that a peculiar feature of the US economy during the 1990s was the presence of high growth rates both in productivity and employment [33]. In fact, the productivity growth recorded by European countries in the same years was not matched by a comparable creation of jobs, both in manufacturing and services. [33] further buttressed that there can be

numerous benefits using enterprises systems. These include:

- Cycle time reduction
- Faster information transactions
- Better financial management
- Laying the groundwork for electronic commerce
- Making tactic process knowledge explicit.

The specific advantages for business units of recent ICT developments are hardly confined to the productivity gains given by the ITs applied in production (such as CAD-CAM, FMS) or the reduction of co-ordination and transaction costs allowed, for instance, by LANs and EDI. With the Internet boom of the 1990's, it has been possible for the firms not only to attain similar efficiency gains at lower costs but also to enlarge the size of their potential markets and find new opportunities for growing. The impact of ICT in industrial sectors can be categorized in the following ways.

2.3 Operation Efficiency

ICTs generally contribute in both private and public sector of organizations to an improvement in three critical domains, which are efficiency, quality, and transparency [35]. Efficiency consists of two elements known as time and cost efficiency.

Time efficiency occurs as a result of work process acceleration through standardization, digitization, and automation, but also as a result of faster information procurement, ICTs tend to increase time efficiency. The introduction of ICTs in an organization generates both costs and benefits [36]. The diffusion of an innovation is determined by the relative speed at which it is adopted by the members of a social system and is measured by the number of adopters in a given period of time. If we consider in particular intra-firm adoption, the decision to adopt ICT is motivated by a series of factors such as the need of increasing operational efficiency, the willingness to improve market reach and profitability, and the need to manage risks [37]

2.4 New Investment

It is expected that adoption of ICT by both the industrial and services sectors will result in new investments, which no doubt will have a remarkable multiplier effect on the economy. Adoption of ICT stimulated substantial and unavoidable investments in these sectors in the area of acquisition of new and modern equipment's, upgrading of existing facilities

and development of adequate infrastructure. [38] affirmed that, at the industry level, investment in ICT capital has a positive impact on MFP growth. This seems to have been quite important in the nation's food and beverage firms.

2.5 Capacity Building and Utilization

Low capacity utilization of ICT had sometime become a perennial problem to organizations in Nigeria; especially those in the industrial sector been attributed to raw materials availability, ICT adoption had contributed significantly to closing of communication gaps, as users and suppliers can now communicate more easily and faster, through electronic mail (E-mail) and web site, when placing orders or sourcing for raw materials. A firm can only achieve higher productivity by employing the right individuals with the capacity and desire to contribute to its goals. The ICT sector is vital for growth because its associated production mechanisms have been characterized by rapid technological progress, solid and strong demand volumes [39]. The effective acquisition of appropriate technologies and training of staff on the use of technologies is linked to a better ability to meet the needs of a target market. More so, organizations that are committed in the effective use of new technologies enhance work outcomes [40].

2.6 Quality of Product

The features and characteristics of a product and its ability to meet given requirement is a pertinent issue in the food industry. ICT is an important tool for monitoring the production and manufacturing process, thus improving quality management and ensuring compliance with environmental standards [21].

3. METHODS

The study covered five sub-sectors of food and beverage firms. These include biscuits and bakery products, confectioneries, dairy products, processed food products and tea, coffee and other beverages. These firms were selected from three states in the Southwest zone of Nigeria namely; Lagos, Oyo and Ogun states. The criterion for the selection was because the zone has the highest concentration of food and beverage firms in Nigeria [3,41]. A set of questionnaires were designed and simple random sampling technique was used to administer the questionnaires on one hundred and seventy five (175) users of ICT. The ultimate goal is to establish the effect of the relationship between ICT and project planning activities leading to the performance of the firms.

The parameters considered to investigate these effects includes improved quality, reduced cost, improved process, reduced time and product diversification.

The data collected was treated and subjected to analyses using descriptive and inferential statistics. Descriptive Statistics such as frequency and percentages were adopted to assess the ICT used in the firms and Analysis of Variance (ANOVA) with Duncan multiple range test were used to investigate the effect of these ICTs on the performance of the firms. This is with a view to distinguish from random effects, the ICT with the most significant effect of all the ICTs.

4. RESULTS

Table 1 showed the percentage distribution of ICT adoption by the food and beverage firms in Nigeria. The result shows that ICT is a major source of production in the present firms. This is shown in the analyses where majority of the respondents (81.6%) reported that ICT is frequently used by the firms. The table also shows the factors that motivates the adoption of ICT on project planning activities in the firms. The result revealed that the motivating factors for the use of these technologies are majorly (52.1%) to maximize cost and reduce time. Cost maximization aids reduction of production costs (efficient utilization of value of each expenditure or inputs requires by the organization). These results validate the findings of [36] and recap by [35] that adoption of ICT is motivated by the need to increase operational efficiency, willingness to improve market reach and profitability.

Table 2 presents the Analysis of Variance (ANOVA) on the significant of the variables used for the analysis. The relationship is a bivariate relationship since a one to one relationship in terms of the level of significance between each of the independent variable is carried out on the dependent variable. The result

shows that there is a significant difference ($F=110.7$, $P = 0.0001$) in the mean rank of the opinion of ICT improve product quality. The mean rank of internet usage (0.79^a) has the highest value and is seen to be significantly higher than other ICTs. The results further show that Virtual private network (VPN) (0.62^b) and Enterprise resource planning (ERP) (0.62^b) are relatively lower to internet usage but nevertheless has strong influence on improve quality. However TPS (0.01^g), Executive support system (ESS) (0.01^g), Decision support system (DSS) (0.01^g), and Customer relationship management (CRM) (0.01^g) has the lowest value. This is an indication that internet usage, Virtual private network, Enterprise resource planning and product lifecycle management had great impact on the product quality of the firms.

Table 3 presents a bivariate relationship in terms of the level of significance between each of the independent variables dependent variable (cost reduction). The result shows that there is a significant difference ($F=41.83$, $p<0.05$) on ICT reduce cost. Enterprise Resource Planning (0.59^a) has the highest value and is significantly higher than other ICTs. The table further shows that TPS (0.2^c), DSS (0.2^c), CRM (0.2^c), MERLIN (0.2^c), MIS (0.8^c), and OMNIPLAN (0.03^c) are significantly the same and have the lowest value. This is an indication that Enterprise resource planning is critical to cost reduction and if the firm's objective is base on cost, enterprise resource planning will be the most suitable ICT to achieve the objective.

Table 4 shows the ANOVA result on the evaluation of ICT improves process of production in ascending order. There are significant differences ($F=140.93$, $P<0.05$) between ICTs and process improvement. ERP (0.69^a) and internet (0.82^a) has the highest significance on improve process. VPR (0.73^b), PLM (0.69^b) and MERLIN (0.68^b) are significantly the same but relatively lower than ERP and internet while OMNIPLAN (0.04^f), DSS (0.03^f) and CPM (0.02^f) has the lowest value.

Table 1. ICT adoption in the firms

Parameters	Classification	Percentage (%)
How often is ICT being used in project planning activities by your firm	Always	81.6
	Occasionally	4.6
	Rarely	12.1
	Usually	1.7
Total		100
Greatest motivating factors for using ICT	Product attributes	10.1
	Quality	20.7
	Sales turnover	9.2
	Cost and time effectiveness	52.1
	Profit generation	7.9
Total		100

Table 2. Relationships between ICT and product quality

ICT	Mean rank
TPS	0.01 ^g
ESS	0.01 ^g
CRM	0.02 ^g
DSS	0.02 ^g
OMNIPLAN	0.03 ^{fg}
SCM	0.07 ^{efg}
PREMAVERA	0.10 ^{def}
MIS	0.13 ^{de}
PDC	0.16 ^d
MERLIN	0.39 ^c
PLM	0.46 ^c
ERP	**0.62 ^b
VPN	**0.62 ^b
INTERNET	**0.79 ^a

(F=110.07, P = 0.05)

“*, **, *** (Indicate 10%, 5%, 1% level of significance respectively) mean within each row with different superscript are significantly different (p<0.05)”

TPS = Transaction processing system, ESS = Executive support system, DSS = Decision support system, SCM = Supply chain management, CRM = Customer relationship management, MIS = Management information system, PDC = Portable data collection, PLM = Product lifecycle management, ERP = Enterprise resource planning, VPN = Virtual private network.

Table 3. Relationships between ICT and cost reduction

Factors	Mean rank
MERLIN	.02 ^e
DSS	.02 ^e
CRM	.02 ^e
TPS	.02 ^e
OMNIPLAN	.03 ^e
MIS	.08 ^e
SCM	.09 ^{de}
VPN	.15 ^{ed}
ESS	.17 ^{ed}
PDC	.17 ^{ed}
INTERNET	.17 ^e
PREMAVERA	** .32 ^b
PLM	** 0.33 ^b
ERP	** 0.59 ^a

(F= 41.83, P<0.05)

“*, **, *** (Indicate 10%, 5%, 1% level of significance respectively) mean within each row with different superscript are significantly different (p<0.05)”

Table 5 showed the ANOVA result of the mean rank of the opinion of respondents on ICT reduced time in ascending order. There are significant differences (F=184.36, P<0.0001) in the mean rank of the opinion of the respondents. The mean rank of internet (0.86a) has the highest significance on time reduction and is

significantly higher than other ICTs while PREMAVERA had the lowest value of (0.00^f).

Table 6 shows ANOVA results of the mean rank of the opinion of the respondents in ascending order. The result shows that there is no significant difference (F=1.59, P>0.005) between ICT and product diversification. The mean rank of PLM, INTERNET, and VPN are higher but have no significant differences.

Table 4. Relationships between ICT and process improvement

Factor	Mean rank
TPS	.03 ^f
DSS	.03 ^f
CRM	.03 ^f
OMNIPLAN	.04 ^f
SCM	.10 ^{ef}
MIS	.15 ^{de}
ESS	.21 ^d
PDC	.21 ^d
PREMAVFRA	.42 ^e
MERLIN	** .68 ^b
PLM	** .69 ^b
VPN	** .73 ^b
INTERNET	** .82 ^a
ERP	** .85 ^a

(F=140.93, P<0.05)

“*, **, *** (Indicate 10%, 5%, 1% level of significance respectively) mean within each row with different superscript are significantly different (p<0.05)”

Table 5. Relationships between ICT and time reduction

Factor	Mean rank
PREMAVERA	0.00 ^f
DSS	0.02 ^{ef}
OMNIPLAN	0.02 ^{ef}
TPS	0.03 ^{ef}
CRM	0.05 ^{ef}
SCM	0.08 ^e
MIS	0.09 ^{ed}
ESS	0.15 ^{ed}
PDS	0.15 ^e
VPN	** 0.65 ^b
ERP	** 0.69 ^b
PLM	** 0.70 ^b
MERLIN	** 0.70 ^b
INTERNET	** 0.86 ^a

(F=184.36, P<0.05)

“*, **, *** (Indicate 10%, 5%, 1% level of significance respectively) mean within each row with different superscript are significantly different (p<0.05)”

Table 6. Relationships between ICT and product diversification

Factors	Mean rank
MERLIN	.00 ^b
TPS	.00 ^b
DSS	.00 ^b
OMNIPLAN	.00 ^b
PREMAVERA	.00 ^b
ERP	.01 ^{ab}
CRM	.01 ^{ab}
SCM	.01 ^{ab}
MIS	.01 ^{ab}
ESS	.01 ^{ab}
PDS	.01 ^{ab}
VPN	.02 ^{ab}
INTERNET	.02 ^{ab}
PLM	.02 ^{ab}

($F=1.59, P>0.05$)

, **, * (Indicate 10%, 5%, 1% level of significance respectively) mean within each row with different superscript are significantly different ($p<0.05$)"

5. CONCLUSION

It was discovered from the results that the adoption and usage of ICTs in the project planning activities of the firms has considerable contributions to the improvement of quality, reduction of time and cost, and improvement of process. The study further concluded that there is a strong relationship among four of the variables identified and ICTs adopted in the firms these variables are improve quality, improve process, reduce time and reduce cost. Thus, the deployment of ICTs in project planning activities seems to have improved the production process and quality standard of the products significantly, as mentioned in the literature for the enhancement and promotion of the efficient and effective coordination of overall activities that are involved in the production process.

Similarly, it was shown in the results that majority of the Nigerian food and beverage firms always use ICTs in project planning activities. And the motivating factors for the use of ICTs were because ICTs are cost and time effective in comparison with the manual method. These results are in accordance with [37] findings. The study therefore recommends that food and beverage industry should encourage and intensify the usage of these ICTs to avoid production delay and ineffective coordination of raw materials.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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