Employing Actor Network Theory to Explore the Implementation of ICT in the Ghanaian Public Sector: The Case of DVLA

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Abstract **- Public sector organizations in Ghana have been grappled with reforms over the decades to make them efficient, reliable and effective and also to ensure efficient delivery of goods, works, and services to the general public. This research uses the case study methodology to explore the role of information technology in the public sector reforms at the Drivers Vehicle and Licensing Authority (DVLA) of Ghana. The study employed a qualitative research technique of the four moments of translation of the Actor-Network Theory in the context of New Public Management to analyse the data. The findings of the study recommended that managers of public organisations and other stakeholders in Ghana improve on ICT and IT infrastructure to ensure their operational excellence and efficiency for enterprise collaborations.**

Key words **-e-government; public sector reform, new public management, actor-network theory, information and communication technology (ICT), information technology**

I. INTRODUCTION

There are studies that have noted that public institutions that have deployed information technology in their reform efforts seem to have made some minimal progress in their service delivery performance. For instance, the financial management and accounting, and tax sectors, in Ghana, South Africa and Nigeria have been observed to have yielded some minimal results after reforms[1]. Also, the Malawi government increased grain production through the utilization of information technology by 300,000-400,000 metric tons thereby contributing to food security [2]. Ghana's food production also increased by an average annual rate of 5.14% from -3.01% since the structural adjustments programmes implemented in the 1980s by Mr. J.J. Rawlings [3], [4]. These programmes included the training of agricultural extension officers, provision of fertilizers and general utilisation of information technology.

ICT adoption in the public sector has the potential to reshape public sector activities and processes [5], build stronger relation between citizens, business and government [6]; [7] improve attitude, behaviour and job handling capacity of employees[8]; and enhance transparency, eradicate bribery and corruption[9]. In the concluding words of [10], "the introduction and sustenance of e-governance is not a pivotal option but a necessity for governance that would serve as a useful framework to achieving all the desired development projects in the region" (p. 75).

In situations such as those prevailing in sub-Saharan Africa, including Ghana, where public administration is characterised by inefficiency, bribery and corruption, limited capacity, and poorly-trained personnel [11] the adoption of ICT promises more success. However, there are a limited number of studies that can be found discussing the relationship between the implementation of NPM reforms and ICT[12]; [13].

A. Problem Statement

This research seeks to investigate the roles and functions played by information technology in the formulation and implementation of the New Public Management (NPM) reforms in Ghana. The research will also contribute to close that gap by presenting an analysis of contemporary ICT and its relationship to public-sector reforms that led up to Ghana's quest for efficient and effective systems of administration.

B. Objective of the Study

The purpose of this study was to discover the meaning that administrators give to the role of ICT systems in public sector management with regards to rendering of services to the general public. This research warrants a qualitative approach since its research questions intends to explore a phenomenon [14].

C. *Research Questions*

The research questions are intended to address the questions of whether the implementation of ICT has impacted on reforms in public sector in Ghana that had the aim of restructuring the public sector to provide efficient and effective public services to the Ghanaian citizen had the necessary impact, and specifically to explore the role of information technology in those reform agenda.

On this basis, the following research question was formulated:

What are the roles and functions of ICT in the initial preparation and implementation of a socio-technical project in the public sector structure in Ghana?

D. Significance of the Study

The findings of the study can be of benefit to Ghanaian policy makers and public authorities in general to plan long-term sustainable measures to adopt in the implementation of ICT in the public sector institutions to ensure realisation of the goals of such investments. This study will investigate the role, relationship and impact of ICT on public sector reforms that seek to reduce corruption, increase efficiency, reduce cost, and encourage economic growth [10].

E. Limitations

Since this research is undertaken within a social constructionist epistemology, it will therefore be subjective, relying heavily on both the judgement of subjects and the researchers, that is to say that the research will be "value-laden, not value-neutral" [15].

II. LITERATURE REVIEW

The study explores the various ICT policies adopted by the Ghana government through the various reform initiatives that the Ghanaian public sector has gone through over the years.

A. Public Service Overview

Public enterprises are agencies delivering public programs, goods, or services. However, these are fully independent of government – but with government being the majority shareholder - with their own funding sources in addition to direct public funding. They can compete on the open market and can make profits.

The Public Sector & Governance Board of the World Bank described public sector as comprising upstream core ministries and agencies, downstream bodies, and non-executive state institution. The upstream are the core ministries and agencies at the centre of government that service other sectors. Downstream bodies such as sector ministries and agencies as education and other autonomous bodies such as regulators and State-Owned Enterprises and corporate bodies. The non-executive state institutions include the judiciary, legislatures and others [16].

On his part, [17] defines public sector as organizations charged with providing services for the public, although increasingly their roles are being transformed from actual production to provision using a variety of public and privateentities, mostly financed with public resources or taxes and such services must be guided by some notion of the wider public interest. Four types of organizations:

1. the civil service,
2. regulatory agencies,
3. public enterprises or parastatals, and
4. regional and/or local governments (p. 10).

The public sector, as is defined here, designs and implement policies and programs to fulfil the broad economic and social objectives of the government including: economic and social policies; designs and implements public programs; raises revenue; and manages public accountability.

[18] and [19]consider organisational culture as a set of collective norms such as ethics that govern the behaviour of people in the organisation or "the social glue" that binds the organisation to its values, beliefs and ways in which it establishes and executes organisational practices and strategies. [20] is of the opinion that a suitable organisational culture together with strong visionary leadership can contribute to effective strategy implementation. [21] observe that when the organisational culture and values are shared by the employees, both quality standards and planning will be strengthened, thus having a possible positive impact on strategy implementation.

In a research, [22] compared the organisational culture between a public sector organisation and a private sector organisation concluded that private organisations' culture provides positive motivation and can be included in the rational-market oriented culture type where the main performance criterion is represented by efficiency. On the contrary, the organisational culture of the public sector institutions do not have the tendency towards the satisfaction of the citizens' needs.

Government reforms are usually meant for the whole nation and may cover several governmental agencies over large geographical locations implies that they are on the average large-scale and long term projects than other one, hence they would equally need large amount of funding with good auditing and financial systems in place [23]; [24]; [25].

It is in this sense that [26] argue that adequate and appropriate ICT infrastructure coupled with appropriate ICT alignment is essential to comprehending the complexity of public organisations. They found that Information technology is positively influences the development of a public sector. In t heir research [27], confirmed that ICT infrastructure has positive influence on the successful adoption of e-business in the public sector.

Therefore, to understand the implementation of ICT in the public sector in Ghana (a developing country) in terms of "what they do (their role), how they do it (their functioning), how to change what they do (public sector reform), and how to ensure that they do it successfully (institutional capacity)" [28], there is the need to do a detail study of reforms in Ghana.

Busi and Bititci (2006) have stated that Information and Communications Technology (ICT) and in particular the Internet, are crucial in making organisational collaboration possible in practice. They however, cautioned that due to the problem of poor power supply, especially in the developing world, internet access can be interrupted and thereby may negatively influence collaboration.

B. The New Public Management (NPM)

The New Public Management (NPM) gained prominence in the OECD corridors and grew widely from

there after a few countries achieved some success under its label in the 1980s[29]. According to [30], the New Public Management (NPM) ideology started in the late 1970s and early 1980s in the United Kingdom and the United States that had suffered the most from economic recessions and tax revolts. Other countries such as New Zealand and Australia then followed. Since then NPM has gained a lot of attention in the theoretical ideology about how to improve output and effectiveness in public sector management[31]; [32]. While scholars such as [31] considers NPM to represent a paradigmatic break from the traditional model of public administration, others such as [33] does not. In its early years, capitalist nations such as Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Norway, Portugal, Spain and Sweden joined the movement. Now it has been embraced by countries in the developing world including Asia, Africa, and Latin America and others. In Africa, countries such as Uganda, Zimbabwe, Tanzania, Malawi, Ghana and Zambia as the most noticeable ones.

The components of NPM are varied [34] summarises some to structural, organizational and managerial changes that are taking place in the public sector aimed at bringing public management closer private sector management practices. The summary of [33] of the components of NPM include the principles of market competition, business management, customer orientation, and value-for-money.

Table 2 summarises some of the common characteristics of these reforms under those that are undisputed and those that are under dispute.

Table 1. Characteristics of the New Public Management

Undisputed characteristics (identified by most observers)	**Debatable attributes (identified by some, but not all, observers)**
Budget cuts	Legal, budget, and spending constraints
Vouchers	Rationalization of jurisdictions
Accountability for performance	Policy analysis and evaluation
Performance auditing	Improved regulation
Privatization	Rationalization or streamlining of administrative Structures
Customers (one-stop shops, case management)	Democratization and citizen participation
Decentralization	
Strategic planning and management	
Separation of provision and production	
Competition	
Performance measurement	
Changed management style	
Contracting out	
Freedom to manage (flexibility)	
Improved accounting	
Personnel management (incentives)	
User charges	
Separation of politics and administration	
Improved financial management	
More use of information technology	

Source:(Gruening, 2001)

NPM is outstanding to reformers because it presents reform ideas that promises to solve the apparent problem of traditional public bureaucracies [35]NPM proposes and promises a variety of solutions that stakeholders such as politicians are looking for to sort out problems assailing their public administration. NPM went global when some successes that were achieved by some capitalist countries in its early years.

C. Theories

The study of ICT in governance is relatively a new area, therefore lacks the necessary theories to explain the phenomenon [36];[37]. This led to theories being borrowed from the fields of Psychology and Sociology to understand and explain ICT in organisations [38]. These fields however, took a simplistic approach to the interactions between ICT and organisations. In his work, [39] indicated that the relationship between ICT and organisations were indeed a lot more complex than simple. This led to the call for a more

comprehensive theory that will study the field as a fused area [40]. It is based on this that [41] introduced his three candidate theories the institutional theory, structuration theory, and the actor-network theory to study ICT in government. This study only looks at the actor-network theory which is summarized below.

1) *Actor-network theory (ANT):*Actor-network theory (ANT), otherwise known as the sociology of translation, is a sociological theory developed by[42]; [43];[44], both scholars of Science and Technology Studies, and by [45] Law (1992) a sociologist. It was developed in an attempt to understand the processes of innovation and knowledge creation in science and technology. In their view, [46] regards ANT as becoming increasingly influential but also deeply contested as an approach to understand humans (Actors) and their interactions with inanimate objects.

Also, [47]maintains that "the actor-network theory describes the dynamics of society in terms totally different from those usually used by sociologists." ANT does not make a distinction between humans and non-humans, social and technical elements. It does not reject the differences of human and non-human actors, it only object to treating them separately. In this sense ANT holds everything as an actor in a network where elements of different kinds hold together such as humans, technological artefacts, organisations, institutions, without making the usual differentiations or designating of any priority among any kind of elements. Therefore, all elements in the actor-network is preferably called and treated as an 'actant'. This concept of abandoning differentiation between humans and non-humans is called the principle of free association.

According to [43], ANT studies the motivations and actions of actors who form elements, linked by associations of heterogeneous networks of aligned interests. The technical part of ANT emphasizes the fact that the theory treats entities as inseparable networks, that does not differentiate between human or machine. The theory refers to these networks as heterogeneous networks, because they contain dissimilar elements [48] sees ANT as a theory that has the potential to account for all these different and dissimilar networks and to harmonise them to achieve a successful outcome of results.

Proponents of ANT such as [44] and [42], argue that society is made by "actor-worlds" that associates heterogeneous entities defining their identities, the roles they play, the nature of the bonds that unite them, their respective sizes, and the history they have participated in by a process of translation. Indeed, the relationships among these entities are heterogeneous as well to establish the notion of "actor-network to describe the possibilities of the elements and translation that occur between them. ANT is used for ICT in public sector institutions to illuminate the negotiations, behaviours, interest alignment, and associations of the actor-network. Below are summaries some concepts and principles of ANT.

Three main principles that underpin ANT include agnosticism, generalised symmetry and free association [49]. Agnosticism is the requirement that impartiality is applied to all actors (human and non-human) in analysis. Generalised symmetry requires that all actors be treated without distinction between what is human and non-human. Free association requires the abandonment of all presumed difference between technological or natural, and the social [49]; [50].

Another concept is heterogeneity of Networks which argues that all of social life – the family, the organisation, computing systems, the economy and technologies are all ordered networks of heterogeneous materials [45]. Hence, [45]concludes that in actor-network theory order is an effect generated by heterogeneous means (p. 382).

Since this study focuses on assessing the implementation of ICT to the transformation efforts of the Ghana public sector in line with the NPM reforms and how ICT investment can improve performance of the public sector, ANT has the potential to illuminate different parts of the issue.

Punctualisation is the concept that in the natural working of things, when processes are working well and correctly, the entity or actor that embodied these processes are seen and considered as a unit. For instance, a healthy person's body conceals the workings or processes of the person just as a unit. However, when this same person is ill, then he realises that the same body is a "complex network of processes, and a set of human, technical and pharmaceutical interventions." [45]. In the normal scheme of things people do not deal with these complexities. Rather, things are simplified in their complexities so they can be understood. Simplificatory effects is what actor network theorist have termed as Punctualisation. This concept of Punctualisation will help the research achieve it purposes since it will allow the unpacking of social complexity by zooming in or breaking down the complexity by zooming out, as suits the purposes of the research [51].

Another important concept of ANT is that of control, especially, Law's perspective on control. This concept of control including itself, comprises those of actors, actor-networks, inscriptions and envelopes. Control is the concept that anyone wishing to exercise control over others must create an actor-network. These concepts and others are summarised in table 3.

2) *Chosen constructs of ANT*: ANT with its related theoretical resources and concepts of sociology of translation increases our understanding of issues relevant to public sector reform implementation. Research that used ANT to assess IT-related reform implementation have shown it to be of critical value [52]; [53]; [54]. These studies have concluded that ANT has the potential to help reveal and understand how networks are formed, including the active roles of all actors in the processes of reform implementation. This has presented an opportunity to use ANT to explore and understand the use of

technologies to support public sector implementation id developing countries such as in the current studies.

This study will therefore use the four moments of translation. ANT. One of the important frameworks of ANT is the 'four moments of translation', namely Problematisation, Interessement, Enrolment and Mobilisation [49];[55].

Problematisation, answers the question of how an actor strives to become indispensable to the other actors by defining the problem and motivating them into the network. According to[49], Problematisation describes a product of alliances, or associations between actors by identifying what they want. It has been pointed out by [56] that using the term problematisation has some advantages that includes that the problem is the product of a performance and not a perspective; and that problematisation is a process that occurs over time and not a one-time event.

Interessement, which is the second moment of translation, answers the question of how the allies are locked into place. It relates to a series of processes where a focal actor attempts to lock other actors into a position that has been offered to them in the network. It involves obtaining the actors' interest and negotiating the terms of their involvement. Interessement also means the group of actions by which the focal actor aims to impose and stabilise the other actors' identity. For instance, [57] have given technology, physical devices, political force, or even textual content as potential devices of interessement in the practical world. Enrolment can only take place when interessement is successful.

Enrolment, which is the third moment of translation, answers the question of how to define and coordinate the various roles of the actors to achieve inscription. Inscription is the process of embedding the technical artefacts and behaviour with heterogeneous elements [58].

Translation becomes treason once an enrolled entity refuses to enter the actor-world in order to expand into others, this is called "betrayal". Table 3 summarises the definitions of the concepts.

Table 2. A summary of key concepts in ANT terminology

Concept	**Definition**
Actor (or actant)	Both human and non-human actors such as technological artefacts.
Actor-network	Heterogeneous network of aligned interests, including people, technology, organisations, etc.
Translation	Process of alignment of the interests in a diverse set of actors with the interests of the focal actor.
Problematisation	The first moment of translation, during which a focal actor defines identities and interests of other actors that are consistent with their own interests, and establishes translation as an obligatory passage point, thus rendering itself indispensable.
Obligatory passage point (OPP)	A situation that inevitably occurs in all actors to enable them to achieve their interests, as defined by the focal actor.
Interessement	The second moment of translation, which involves negotiating with actors to accept the definition of the focal actor.
Enrolment	The third moment of translation, wherein other actors in the network accept (or become aligned to) the interests and roles defined for them by the focal actor.
Inscription	A process of creation of artefacts that would ensure the protection of certain interests.
Mobilization	A focal actor's use of a set of methods to ensure that all actors have their representatives or spokespersons act according to the agreement and not betray the initiator's interest.
Speaker/delegate/representative	An actor that speaks on behalf of (or deputises for) other actors.
Betrayal	A situation where actors do not abide by the agreements arising from the enrolment of their representatives.
Irreversibility	The degree to which it is subsequently impossible to go back to a point where alternative possibilities exist.
Black box	A frozen network element, often with properties of irreversibility

Source [49];[45];[59] and [58]

Few studies have been done using ANT's moment of translation in assessing the role played by technology in development processes. However, a recent study by [52] in the Sri-Lankan public sector and concluded that ANT has the potential to understand how the networks are formed, the active roles of each actor in the processes, and how interests and identities are translated during the processes. Another example is that of [60] who used ANT's translation framework in a qualitative study to explore the formation and extension of a wireless project in Nepal from one village to more than 150 villages by acquiring the necessary contacts (actors) to pay attention to the project. The paper conclude that ICT actors have an important part to play in the formation and extension of ICT development projects through their extended networks, and in turn enhance effectiveness of project fostering socio-economic development.

This research therefore intends to do a holistic analysis of impact of ICT on a public sector, focusing on the relationship between technology and public sector in the setting of the NPM sweeping across the developing world. This work therefore uses the Actor-Network Theory in the setting of the New Public Management context. However, this research utilised only one of the frameworks of the 'Actor Network Theory 'Moment of translation' by [49].

3) *Challenges and limitations of ANT*: ANT an analytical framework has its strengths as well as its weaknesses. Its critics such as [61]; [62]; [63] and others cite among other criticisms these four which are relevant for this study: the generalised symmetry principle; adopting a reflexive stance in using ANT; the Machiavellian positioning of ANT; and the flat ontology of the approach.

Proponents of ANT [64]; [65] however have labelled these criticisms as being borne out of simple

misunderstanding. The principle of general symmetry is one of the most debated principles of ANT ascribes agency to both human and non-human actors. This has been attached by critics arguing that it is immoral to put humans and non-humans on the same level since it degrades the human actors [66]. However, proponents say that the principle is not on ethical grounds, but as a means to reduce the emphasise placed on the human agency used in sociological studies in data analysis. The reflexive stance criticism claims that proponents of ANT use language that tends not to reflect descriptions and explanations matching what respondents would have given, and that ANT has given a universal application of the moments of translation theory. This is countered by ANT proponents that it has several alternative interpretations and that reality is a construction and interpretation process with the researcher playing a major role.

On its Machiavellian orientation criticism which says that ANT places undue attention on how relationships are built and controlled [67]; [68]. The answer to this criticism is that researchers using ANT are sensitive to complexities with each context [63].The flat ontology criticism is that ANT tends places undue emphasis on the influence of networks on nature and society, neglecting that other social structures also play important roles in the consistency and continuity of relations among actors[69]. The answer to this criticism is that the macrostructure of society must necessarily be made up of the same material as its microstructure. Being aware of these criticism puts the ANT researcher on the alert to minimise or avoid these traps while carrying out research work using its framework.

III. METHODOLOGY

This research uses the case study approach to explore the role of ICT systems in public sector management in Ghana. In order to conduct a sound investigation requires rigour and veracity hence the research should be built on a sound research design. Furthermore, the validity and reliability of the data and the limitations of the methodology used which is significant for determining the final consequence of this research study, is explained. This chapter therefore seeks to demonstrate that the methodology and design of the research is of value to the investigation[70].

A. Research Design

The study is grounded in the Actor-Network Theory (ANT)[42]; [48]. ANT enables deeper understanding of the use of technology in the context of human and non-human actors and the social, political and economic contexts [71]. In this study, ANT is used for a powerful duality of theories to understand the issues involved in ICT and public sector management. ANT provided a solid basis for the use of technology in public sector for better implementation, communication/interaction and efficiencies among the various stakeholders.

B. Population and Sampling Strategy

The case population of the study was the total public sector workers. The case agency and its allied partners in ICT systems was investigated. The case selected, the Drivers and Vehicle Licensing Authority (DVLA) is headquartered in the Greater Accra region of Ghana where also all the public institutions are headquartered. Participants (about 16) were interviewed from the case study institution selected as well as from allied institutions. They included people working in ICT, managers in-charge of information systems and other persons or groups of persons involved in the implementation of the information systems. This number of participants is to enable the researchers achieve an in-depth understanding of the situation [72]. The study combined the purposive and convenient (non-probability) sampling techniques, allowing the researcher to narrow the selection of the cases and the participants to those who are more capable of giving the needed information to achieve the objectives of the study [73]; [74]. The convenient sampling included only participants available and willing to participate in the research. This is to maintain research ethic rules of not coercing or forcing participants to participate in the research. The researchers will then select the two public sector institutions that have implemented ICT as part of the NPM reforms as case studies.

All the respondents interviewed had significant years of experience in their respective areas of expertise. The selected respondents were directly or indirectly involved from the start of the project or in the implementation of previous public ICT reform programmes. The respondents were mostly selected and interviewed based on their positions, duration of service, experience and the relative importance or significance of their roles in the implementation of the DVLACOMP project and especially, their availability.

At the data gathering stage, interviews conducted, on average, lasted between one hour and two and a half hours per session. In some cases, the researchers had to make follow ups to some respondents to either clarify some issues or complete an interview. Hence, in certain instances, there were more than one interview sessions for some of the respondents. The follow up sessions allowed the researchers the opportunity to confirm some of the earlier assertions of the respondents and test for consistencies in the information provided by these respondents.

The table below summarises the respondents' backgrounds.

Table 3*: Interviewees involved in the DVLACOMP project*

CODE	Position	Years of Experience	Involvement in the DVLACOMP project
PA	Project Administrator (DVLA)	Over 15 years	Responsible for the implementation and maintenance of DVLACOMP business processes
TC	Technical Consultant (LOCAL)	Over 2 years	Working with public agencies and responsible for design and implementation of aspects DVLACOMP business processes
IOE	Internal Oracle Expert (DVLA)	Over 10 years	Responsible for the roll-out of the system to the various DVLA partner agencies and departments
DMIS	Director, MIS (DVLA)	Over 20 years	Responsible for the implementation of e-government projects in DVLA
MMIS	Manager, MIS (DVLA)	Over 15 years	Responsible for implementation of the DVLACOMP project in DVLA
DTL	Development Team Leader (DVLA)	Over 10 years	Liaise between project and stakeholders (internal and external) Coordinate periodic activities of the implementation teams
PTL	Project Team Leader (DVLA)	Over 10 years	Liaise between project and stakeholders (internal and external) Coordinate periodic activities of the implementation teams
NR	NITA Representative	Over 5 years	Responsible for e-government policy and implementation of e-government projects in Ghana.
DDRS	Deputy Director (Road Safety Commission)	Over 10 years	Coordinate activities of the implementation of DVLACOMP with Road Safety Commission

Source: Author's Construct

In all 16 respondents were willing and helpful to participate in the research, and all the interviews were conducted in a friendly, cooperative manner. Twelve of the respondents were males and four females; six respondents were between 30 and 39 years old, seven between 40 and 49 years and three were above 50 years of age. Of the sixteen respondents, one held a diploma, six had first degrees, and two had master's degrees. The work experience of the respondents was distributed as follows, two had 1 to 5 years; four had 6 to 10 years; six had 11 to 15 years; and four had 16 to 20 years.

IV. DISCUSSION OF THE RESULTS

This section discusses data that answers the two research questions. The first section answers research question one followed by the section answering the research question two.

A. Research Question One

What are the roles and functions of ICT in the initial preparations and implementation of a socio-technical structure and how do they impact on the achievements of NPM reform goals in Ghana's public sector?

In the last two to three decades most developing governments have embarked on reforms in various areas of the public sector mainly conceived under the New Public Management. Many of these reforms leveraged information technology to improve social services through decentralisation and integration. However, research suggests that the objectives of most of these reforms were not realised [75]. One of the research questions in this research wants to know the roles and functions of ICT in the initial preparation and during implementation of a socio-technical structure and how they impact on the achievements of NPM reform objectives in Ghana's public sector. The data analysed points out that ICT infrastructure was very relevant and played significant roles and functions in achieving reform goals if they are available in adequate quantities and utilised with skill and professionalism. This section discusses the role of ICT infrastructure in the implementation of a computerisation project in the DVLA, a public sector organisation in Ghana.

1) *ICT Infrastructure:* The role of IT in reform expectations concerning effectiveness of state governments has been pushed forward as a result of the raising pressures from the public, international donor agencies, the World Bank, budget crisis, and rapid changing technology. This led to state governments giving attention to ICT as a solution to address the many of the issues they are faced with.

One major point made in this direction was the call on policy makers at the macro level to encourage government ranks to legitimise ICT at that level. Without legitimisation of these policies to back the use of ICT at the organisational and user or agency levels, they will not be taken seriously and their impact will not be felt.

This factor has been a recurring one with all respondents during the interview process. The common perception among the respondent was that ICT infrastructure was an essential driving force, especially when the reform was also an ICT driven one. They believed that the adequate availability of ICT infrastructure can enhance and promote the success of reform implementation in developing countries. The reverse of the lack of ICT infrastructure will also impede the successful implementation of an ICT reforms. This is consistent with literature [26]. Respondents mentioned such infrastructure as electronic communications are essential in this regard. They however pointed out that there must be available skills to use such infrastructure to be beneficial and that an appropriate organisational and social culture is necessary and should be built in people in developing countries. The data revealed and concluded that there was not enough ICT infrastructure to ensure successful implementation of public sector ICT reform implementation.

Indeed, this knowledge of the importance of ICT infrastructure is now not lost on most governments across the world, including the developing world. As a global village, governments in the developing world now recognise the prospective of ICT infrastructure to effectively and efficiently transform public sector organisations in their delivery of public services to citizenry [76]. As indicated above, ICT infrastructure offers improvements in communication and collaboration that will help to coordinate activities of reform implementations to a success. This will increase probability of higher participation, involvement and motivation of all stakeholders in reform implementation projects.

Within the NPM reforms, ICT assumes a strategic role in the implementation of new reforms which mainly were focus on rationalisation and decentralisation of management structures and performance-based accountability [77]. Institutional reforms and technological changes have affected roles, working practices, and management structures within the information system to impact positively on the service delivery capacity of the agencies thereby fulfilling the objectives of the reforms. What could then have accounted for the high failure rate as recorded by research in the sector? It was noted from the data also that the best IT infrastructure are rather kept in the offices of the top management who do not know how to use them in the first place while those who are to use them to deliver services have nothing. This drives a top-down approach as confirmed by [78]. Then also most of these IT-led public sector reforms are pre-packed that do not take the constraints of the existing organisational environmental setting into account [79].

Data from the interviews showed that most public sector organisations deal with lots of data hence, need to depend on information technology as an essential part of their daily operations. Therefore, ICT is expected to facilitate good governance within government organisations that facilitates accurate decision-making; increasing transparency and accountability; and also supporting the efficient delivery of services [80] (cf. Omari and Barnes, 2014). Accordingly, respondents are of the view that the decision makers such political leaders should place high prominence on the role of IT to use it as a catalyst to drive reforms in the public sector. Interviewees however, bemoan the relative inappropriate use of ICT in the public sector in spite of its relevance as important channel of delivering efficiencies and in facilitating reforms. This, they pointed out that the capability offered by ICT for efficiency often conflicts with the bureaucratic culture of the public sector organisations in developing countries.

The adoption of IT and public sector reform are interdependent processes, making decision makers to often place prominence on IT to invoke changes in the public sector. However, it would seem the selection of effective ICT tools and the appropriate policies that will ensure success of the much technology-enabled service expectation from the public and others becomes a challenge. It is important that state governments in developing countries find means to influence the attitudes of people in the use of ICT that can bring about an ultimate change in how ICT can lead in reforms in the public sector. ICT has the potential to modernise the business of government by achieving linking up the work processes between different parts of government and providing innovative, efficient and convenient ways for citizens and businesses to communicate with government and to receive services.

It can therefore be concluded that adequate ICT infrastructure is essential not only for implementation of reform, but also of its adoption and employment of efficient public sector service delivery. Therefore, to successfully support public sector implementation, governments should ensure the provision of ICT infrastructure, with adequate skills to utilise them.

2) *Problematisation* in the DVLACOMP was a major hurdle in the project with many abortive starts of the project since 2008. The focal actor had the task of mobilizing all the other actors to function together, which will lead to a better effective and efficient DVLACOMP service to meet the OPP.

As a public sector project, approval from cabinet was necessary before the project can be implemented. Defining the whole project as one OPP was necessary since there were several multiple sub-projects within the main project would mean that the OPP of the different sub-projects would be forced into the main OPP instead of several OPPs. The different components of the computerisation project fashioned to tackle the various services provided by the DVLA were considered as separate sub-projects. This created some problems for the start of the whole project.

After the 2008 failed attempt to mobilize and traverse the OPP, the network was dissolved and the contract with the private software developer was abrogated for lack of capacity to carry out the roles assigned. The failure was due to reliance on the single OPP to be achieved by the different actors who were not well co-ordinated and developers who did not possess the required capability to handle the large-scale nature of the project. When this was realized after the 2008 at translation, a subsequent problematisation was detailed with different actors (consultants and project development teams) enrolled and mobilized with specific interests that handled sub-problematisation of the OPP. A second attempt of the implementation was made with partial results in 2014. The problematisation was not very different from that in 2008, however, a number of the actors have changed, the CEO, the Transport Minister, and the Consultants. The CEO remained the focal actor for the same reasons given for the 2008 network. Also, the Transport Minister still played a similar role as the previous one. The single consultant was however replaced with a number of them to be coordinated by the Director of IT. The consultants were supposed to have expertise in various areas of information technologies. Each

consultant was, therefore, to design, develop, and implement either one or just a couple of sub-projects.

A number of the in-house IT personnel were also trained in system design, development, implementation, maintenance and operation as part of the project team in the larger network. The in-house team was to counterpart the external private consultants, acting as a check on what was actually going on.

For instance, it allowed the Website sub-project, the Data Centre sub-project, and the Payment Sub-project to be rolled out in 2014. Even though the website immediately went down due to inefficient completion. The payment sub-project and the Data Centre sub-project are in production.

3) *Interessemment* – In the 2008 attempt at creating a solution network interessemment was hurdle getting the actors into a budding actor network to traverse an OPP. The focal actor had to use a multiplicity of strategies to get all to ascribe to Interessemment. These had to range from coercion, persuasion, and politics. Achieving Interessemment was met with power struggles where the interest of the focal actor was not aligned with one or more of other actors such as in the case of staff of DVLA who had self-serving interest that was not in line with that of the focal actor. The staff action, in this case, was actually an indirect influence of some members of management who were hiding behind the staff to push against the implementation of the projects. This revelation confirms what [81] refers to as lack of commitment of senior management and chief director of public institutions who are convinced or not well motivated about the gains of a particular project. Such disagreements showed up in the forms of cumbersome bureaucracies [82]. In this case, Interessemment was incomplete, hence an obstacle to the network traversing the OPP. The staff of DVLA particularly resented and opposed the attempted Interessemment by the CEO. They resisted changes to the way they worked. They preferred the status-quo within which they were used to since they had to learn new tricks all over. Also, it meant that their means of extra income through their fraudulent deals will end with a new streamlined system. They resented the attempts to take away their paper-based procedures. This was a major failure point of interessemment.

The next interessemment hurdle was the perceived posture of some actors to align their interest with that of the focal actor in order to traverse the OPP to achieve mobilization. This was the case of the project development team made up of Consultants/Business, Analyst/Manager, Developers, Designers, Architects, Testers, and the DVLACOMP whose actions of non-compliance rendered it impossible to achieve agreement of interests. Their actions led to the DVLACOMP not meeting its production schedules, failing its functionalities tests and exhibiting gaps in its reliability tests. This resulted in the failure of the DVLACOMP to function as expected, delivered on time, and eventual scrapping of the project.

The 2014 interessemment came on the heels of the 2008 failed attempt at creating a solution to the problem identified in the OPP. The failure was identified at interessemment due to a multiplicity of factors such as failure of the CEO to get all the actors particularly the staff and the consultants to buy into the interest that will get the DVLACOMP to meet its business performance as agreed. Other factors included a short-time frame, the incompetence of the software developer, lack of systems development capability, and politics from both local (within DVLA) and at the national level.

Therefore, at this second attempt, it was crucial to address these problems to attain successful OPP. Tackling these issues opened the way for the network to move into interessemment. Also, with the new approach of breaking the OPP into sizeable ones to ensure capabilities of the separate consultants to effectively and actively incorporate the internal IT staff team into the network, it became ready to get down to work. In the years between 2015 and 2016, another major factor that emerged to be a huge drawback on the network was the highly unstable electricity power supply from the national grid which though started in 2012, worsens between 20015 and 2016. This situation was so serious it earned the name "Dumsor" which quickly gained international recognition. The network had to halt work while a solution in the form of a power-plant was procured and installed before the network resumed work.

4) *Enrolmentand Mobilisation*: with the lack of agreement among the various actors to align their roles and relations thereby having a common interest with the focal actor not completed at Interessemment, enrolment became impossible. Enrolment requires actions to implement the roles and relations through the actions of the various actors. Some of the actors in the network did not play their roles as per the understanding in the OPP. The consultant, in this case, failed to deliver on what had been agreed as its role. They obviously had interests different from that of the CEO of DVLA, hence their actions deviated from what they had agreed to do. Their technical, functional and professional incompetence inhibited the network. The outcome was that the poor design and inadequate performance destabilized the operational implementation and mobilization of the system. This led to the DVLACOMP failing to occur in the December 2008 deadline.

An internal member of the development team lamented at one point that the team had to work on the following designs and developments at the same time at one point in time:

- Electronic Road Worthy Sticker (e-roadworthy) to replace existing manual and handwritten one, which was a government policy to automate all the revenue agencies;
- Smart (Biometric) Drivers' License Card and Smart Vehicle Registration Card, which are two separate

important legislation through the Transport Ministry to regulate the road sector;

- Electronically authenticated payment system introduced by management to check and reduced revenue leakage in the collection system last month;
- Computer-Based Theory Test (CBT) automation of operations, testing and Private Vehicle Testing Station (PVTS) (One of the innovations the Authority deemed necessary at that point was the introduction of private participation in vehicle testing, under a Public-Private Partnership (PPP)).
- A data centre set up at the head office as part of the overall ICT infrastructure and architecture development store vital information, provide opportunity for integration with the systems of stakeholder organisations such as the National Road Safety Commission (NRSC), Motor Transport and Traffic Department (MTTD), Banks, National Insurance Commission (NIC) and other organisations for purposes of selling data on pay-per-view basis. This has a high propensity to generate significant revenue for use by the Authority, without sacrificing safety and security.
- Online Service-DVLA automation, e-services portal of the Government of Ghana.

The above situation describes one of the main banes of African reforms where ministries and MDAs will usually adopt concurrent implementation of reform models along with their own strategic management models, trying to combine several projects to run concurrently with most of them lacking properly laid down effective coordination and communication between the MDAs [83]. These projects bundled together to be executed may look like they are all related since they are all in information technology, right? However, this may not necessarily be true. In technical terms they may all be different when it comes to implementation, needing different technology implementation tools, methodologies, and models. Hence, as observed by [28]; [83], Ghana's public sector reform programmes are usually fragmented and uncoordinated.

Following the failure of the first network to traverse its OPP to deliver an automated system to support the operations of the DVLA, on February 19th, 2014, six years after the failure of the first attempt at automation, the DVLA launched yet another automated system that will allow its users to access their services through their website from the comfort of their homes and offices. It was to run parallel with the manual system till September that same year when the old system was to be phased out [84]. The announcement intimated that the following services have been automated (a) under the driver license: learners' license, renewals of license, conversion of foreign license, international license permit, replacement and upgrading and proficiency tests; (b) under vehicle registration: vehicle registration, transfer of ownership, renewal of registration, vehicle lay-off and international vehicle permit.

V. CONCLUSIONS AND PRACTICAL RECOMMENDATIONS

This paper has traced the implementation of ICT reforms in Ghana within a context of Actor Network Theory. The implementation of administrative reforms in developing countries is often simplified to the assumption that legislation alone is sufficient to achieve success. Indeed, this stance tends to ignore the significant influence of other important actors such as politics, citizens, culture and others, necessary to successfully complete the implementation of reforms.

Conclusions. In general, this study contributes to the existing literature in the field of information systems and e-government research. It also has some unintended consequences of contributing to the body of knowledge on the migration of processes from the physical environment to the online environment.

Judging from the views of respondents it can be concluded that this study has generated useful and pertinent insight into the possibility of ICT as am NPM tool to help transform the Ghanaian public sector into an efficient one. Notwithstanding the challenges within the Ghanaian public sector, the analysis indicates generally positive hopes that the implementation of ICT facilitates public service delivery by helping to avoid the problems inherent in the manual public service delivery channels.

From the study it is clear that ICT reform projects can achieve their full potential of transforming the public sector when things are done properly, taking all actors into consideration. The findings point to a lack of resources within the Authority such as lack of the required technical staff to undertake its operations. This will also include training these staff to acquire or update on their skills that will enable them to be effective. Then also, the flow of financial resources to finance these reform projects is a source of challenge which must be addressed. It was found that the Authority retained fifteen (15) percent of its internal generated funds (IGF) to fund the project, this is not enough. The reliance on locally based ICT consultants was also a factor that was found to have negatively impacted on the delivery of the project over the years, especially when there was political interference in the selection of these consultants. The acclaimed benefits of ICT in the public sector can be realised only when political and institutional leadership resolve to abide by written down contracts to implement all items on them as stated and to appreciate and understand the benefits associated with ICT initiatives.

Operational wise, the study found that erratic power supply from the national grid delayed and disrupted implementation of the project. It was also observed that alternative power supply such as generators had its own problems in maintenance and fuel costs. Another problem is the poor internet connectivity in the country. There is low bandwidth, high cost of internet and erratic supply of internet

by suppliers, were challenges militating against the successful implementation of the project.

Another finding from the study was the weak collaboration within and among the various public institutions. Due to bureaucracy and rivalry among institutions which in some cases duplicate functions, delays and hurdles are created, thereby hampering smooth operations of the DVLA. For instance, for anything to be done, parliament has to give approval which may sometimes take weeks or even months. A case in point is the recent suspension of the issuance of the Smart Driver's License and Vehicle Registration Cards by the Minister of Transport, Kwaku Ofori Asiamah, by the Driver and Vehicle Licensing Authority (DVLA) until approval has been sought from approval from the ministry and cabinet before the implementation of such major project [85] The problem of inter and intra agency collaboration and coordination.

Hence, the study argues that constant and reliable supply of electricity and internet, with proportionate strong leadership support, strong communication and collaboration, and adequate resources, ICT projects implementation will be successful.

This study has also provided recommendations to the Ghanaian government, management of state corporations and other stakeholders, to enable them to make informed strategy implementation decisions, and to provide a platform for collaboration and networking with international organisations. The study could not exhaust all the issues concerning the implementation challenges of ICT. The emergence of comparative studies can be useful in ascertaining the role of ICT in the reform efforts of developing countries and other public sector institutions in different regions of the country and comparing their unique challenges in implementing ICT.

Other studies can also research into the demand side of ICT role in areas such as service provision in Ghana. Such studies should be explored from the perspective of the users of ICT services in the public sector in Ghana as they have encountered in public institutions.

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