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Article

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Cogent Business & Management

Provided in Cooperation with:

Taylor & Francis Group

Suggested Citation: Eze, Sunday Chinedu; Chinedu-Eze, Vera Chinwendu; Bello, Adenike Oluyemi (2018) : Actors and emerging information, communications and technology (EICT) adoption: A study of UK small and medium services enterprises', Cogent Business & Management, ISSN 2331-1975, Taylor & Francis, Abingdon, Vol. 5, <https://doi.org/10.1080/23311975.2018.1480188>

This Version is available at:

<https://hdl.handle.net/10419/206079>

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Received: 18 October 2017
Accepted: 09 May 2018
First Published: 28 May 2018

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INFORMATION & TECHNOLOGY MANAGEMENT | RESEARCH ARTICLE

Actors and emerging information, communications and technology (EICT) adoption: A study of UK small and medium services enterprises'

Sunday Chinedu Eze^{1*}, Vera Chinwendu Chinedu-Eze² and Adenike Oluyemi Bello¹

Abstract: This paper aims to understand the role of actors in the adoption of emerging Information and Communications Technologies (ICT) using the Actor-Network Theory (ANT). The use of ANT helps identify a diverse range of actors and their role and influence in the dynamic process of emerging ICT's adoption in UK small and medium enterprises (SMEs). This study adopts a qualitative approach to investigate how UK services SMEs are engaged in emerging ICT adoption by focusing on the role of actors in the process. Data were gathered through unstructured and semi-structured interviews with managers, IT experts, government agencies, and customers. Using ANT, the roles of various human and nonhuman actors in a four-stage dynamic adoption process are examined. The findings reveal the critical and dynamic roles of various actors in the socio-technical network. Although SME managers play the decisional role in emerging ICT adoption, their views and decisions are constantly influenced by various other human and nonhuman factors. The roles and interactions of all actors are dynamic, depending on the adoption stages.

Subjects: Management of IT; CAD CAE CAM-Computing and Information Technology; Information and Communication Technology (ICT)

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PUBLIC INTEREST STATEMENT

Information Communication Technology (ICT) adoption and implementation in small and medium enterprises (SMEs) is complex and unpredictable. It is associated with the identification of users' needs to developing and adopting emerging ICT. Therefore, the key to adopting ICT successfully in SMEs is beyond training and educating people that develop it; instead, it involves the co-creation of values with active and resourceful entities who are an integral part of the diffusion process. ICT adoption is a social process that constitutes diverse actors. These actors challenge and are being challenged by others to ensure that technology adoption is successful in the small business context. This research has the potential to explain the complex and dynamic interactions that are associated with technology adoption and implementation in a bid to ensure that SMEs are proactive, tactical, adopt, and adapt to new and evolving technology applications continually.

| **Keywords:** SMEs; ICT; adoption; Actor-Network Theory; technology adoption

1. Introduction

The success of small and medium enterprises (SMEs) has always been vital for national economic growth and social stability. According to the UK's Federation of Small Business, SMEs account for 99% of all enterprises in the UK, 59% of private sector employment, and 49% of private sector turnover. With the rapid development of Information and Communication Technologies (ICTs), SMEs are increasingly dependent on the use of ICTs to transform their business practice and improve their performance in the very competitive business environment. The implementation of new technology has been recognized as an important process for transforming a business (Yu & Tao, 2009). ICTs have become an essential enabler for business operations and management. However, ICTs are constantly evolving and improving; therefore, the sustained success of any SME is not only enabled by the use of ICT, but also dependent on the company's ability to constantly adopt and make the best use of emerging ICT for innovation and business competitiveness (Eze et al. 2014).

Emerging ICT, in this context, is used as a broad term to cover any new ICT development or improved ICT application. Although emerging ICT applications offer great opportunities, their successful adoption faces challenges by SME managers and their long-term viability is often uncertain (Cavusoglu, Hu, Li, & Ma, 2010) due to the fact that small businesses operate in a much more volatile environment with little support on new technology adoption (Simpson & Docherty, 2004). Very often, various stakeholders inhibit the adoption outcomes (Fang, Benamati, & Lederer, 2011). Therefore, the complexity of the contemporary business environment forces managers to understand the various roles played by diverse actors in the adoption process in order to develop new ideas and insights that will help their decisions. Specifically, the complexities associated with ICT itself imply that these applications are becoming even more problematic and require managers' specific attention. Although ICT adoption has received extensive attention from various researchers, most of the research focuses on the factors affecting ICT adoption by treating ICT adoption as a one-off decision-making event (Eze, Awa, Okoye, Emecheta, & Anazodo, 2013; Eze and Chinedu Eze 2018) and there have been very limited inquiries on how the various actors exert influences that may encourage or inhibit adoption (Barrett, Grant, & Wailes, 2006; Cavusoglu et al., 2010; Kallinikos, 2004).

ICT adoption involves diverse human actors. Studying the complex nature of internal and external actors assists managers in understanding the most significant actor(s) and its(their) strategic impact on organizations (Benamati & Lederer, 2001). It is essential that small business managers involve different internal and external actors in investigating emerging ICT since the tasks required in developing and adopting successful emerging ICT are vast and cannot be handled by a single actor (Benamati & Lederer, 2001). However, the literature pays much attention to large organizations, almost to the point of neglecting small businesses. More so, no substantive studies have explored how various actors influenced the adoption of emerging ICT in the small business context despite the fact that involving diverse actors may improve their ICT adoption strategically (Cavusoglu et al., 2010).

Therefore, this research aims to better understand the role of diverse actors and their influences in emerging ICT adoption in UK service SMEs using the Actor-Network Theory (ANT). Being aware of the current criticism and limitations on the dominant use of the quantitative approach in adoption research, this study adopts a qualitative approach aiming to gather rich data. The empirical data collected through interviews have been used to first establish and validate a dynamic adoption process that has been published in Eze et al. (2014). Based on the dynamic process of emerging adoption published, this study provides further analysis on the dynamic roles of actors and their key influences at each stage of the dynamic adoption process. It is hoped that the findings of this study will not only advance our knowledge and understanding on the dynamic nature of emerging ICT adoption and the

roles of diverse actors in this dynamic process, but also help small business managers to be more strategic and proactive since the adoption of emerging ICT is becoming more challenging.

2. Actor network theory

ICT adoption and implementation is a socioeconomic process involving diverse human and nonhuman actors who influence adoption behavior in a social-technical network (Venkatesh, Morris, Davis, & Davis, 2003). Most times, actors lean on the beliefs, values, and knowledge of appropriate elements to understand and allocate meanings to actions, which aid in significant interactions (Jacobsson & Linderoth, 2010). Orlikowski (1992) maintains that technology may have objective functions accepted at one point but may be challenged over time due to diverse meanings actors assign to it. An understanding of how technology innovation works involves a thorough review of the members of the society that make the technology happen and knowledge about the technology itself and the specific users in specific settings (Eze, Duan, & Chen, 2012; Jacobsson & Linderoth, 2010; Orlikowski & Gash, 1994). Scholars (Barrett et al., 2006; Jacobsson & Linderoth, 2010; Orlikowski and Lacono, 2001) are of the view that studying adoption and implementation of ICT is not to be taken for granted, and rather the interaction of the technology and social contexts must be carefully analyzed, including programs of actions inscribed in the technology by diverse actors.

Orlikowski (1992, p. 406) explains that “technology is physically constructed by actors working in a given social context and technology is socially constructed through the meaning they attached to it and the various features they emphasize and use.” ANT recognizes the fact that nontechnical artifacts play the same role as human actors and facilitate social order through heterogeneous networks of human and nonhuman actors (Barrett et al., 2006).

This study is theoretically underpinned by ANT because it offers a suitable lead for our investigation and understanding. Although ANT has been vigorously challenged (Benbasat & Barki, 2007; Silver, 2007), it has been used to investigate ICT adoption. The theory recognizes the volatile nature of ICT (e.g. Andrade & Urquhart, 2010; Benbasat & Barki, 2007; Chen and Hirschheim 2004; Silva, 2007; Williams, Dwivedi, Lal, & Schwarz, 2009). Traditional adoption theories emphasize the technical aspect and neglect the responsibilities of the human agency (Jacobsson & Linderoth, 2010; Lee & Oh, 2006; Tatnall and Jerzy, 2003; Vannoy & Palvia, 2010). They rarely challenge the technological implementation (Akrich, Callon, & Latour, 2002; Andrade & Urquhart, 2010) as they contribute little or no insight on the constant technology advancements and the dynamic and evolutionary nature of technology adoption (Eze et al., 2014). Scholars argue that such theoretical frameworks are static and predictable in definite terms (Al-Natour & Benbasat, 2009; Ray & Ray, 2006), less adaptable (Ray & Ray, 2006), and lacking the strong basis for integrating various actors into the adoption process (Eze et al., 2014).

ANT emphasizes the dynamic and mutual influence of technical and social systems (Mahring, Holmstrom, Keil, & Montealegre, 2004). ANT regards ICT, people, and any other elements as actors and names them “actants” (Hanseth, Aanestad, & Berg, 2004) and defines an actor “as any element which bends and shapes around itself, makes others elements depend upon itself and translates their wills into the language of its own” (Callon and Latour, 1981, p. 286). ANT admits that actors are not restricted to only human beings; rather, it is based on how strong the association between human and nonhuman actors is and tracing such association to a source. Vannoy and Palvia (2010) propose that social influence leads to technology adoption, and technology adoption, in turn, comprises actors’ embracement of the technology and its embedment in the society. Orlikowski (1992) argues that the ongoing actions of human with the nonhuman help in assessing the advantages of new technology and its deployment.

ANT allows researchers to observe a complex network of players during the ICT adoption process and the disparate goals of actors by tracing their interaction (Andrade & Urquhart, 2010). ANT traces the socio-technical interactions, reveals the negotiation processes (Andrade & Urquhart,

2010; Sarkker et al., 2006), and attempts to provide explicit accounts of the socio-technical inhibiting and enabling factors that influence adoption (Sarkker et al., 2006).

Overall, the strength of ANT in understanding ICT adoption lies in its emphasis on studying both the human and nonhuman entities. The key ANT concepts of inscription, translation, framing, and stabilization are adopted for this study. These key concepts have been explained by Eze et al. (2014) as described next.

2.1. Inscription

Inscription is a process in which actors articulate what the technology or its functions should be (Faraj, Kwon, & Watts, 2004).

2.2. Translation

It is the process of aligning numerous interests and beliefs of different actors with that of the key actors within the network (Callon, 1986). “Key Actors” are the competing actors that ensure that other actors support their claims in technology development and deployment (Sarker et al., 2006). It involves understanding how actors seek the interest of other human actors or convince others, directly or indirectly, to adopt new technologies (Callon, 1986).

2.3. Framing

Framing allows new technologies to undergo alteration or change because they require either advanced features or an improvement upon their existing features, especially when adopted by lead users (Faraj et al., 2004).

2.4. Stabilization

Stabilization is a stage where diverse actors consider the problem solved (Bijker, Hughes, & Pinch, 1989). It is important to note that at the stabilization stage, the technology cannot be modified. Technology can be amended over time, leading to a redefinition of a problem (Bijker et al., 1989).

3. Research methodology

This study adopts a qualitative approach in an attempt to understand the dynamic and emergent nature of actors in ICT adoption, their roles in the adoption process, and how these roles affect adoption success. To achieve this, this study employed a two-round data-collection process using unstructured (first round) and semi-structured (second round) interviews. Since qualitative research emphasizes the discovery and explanation of people’s experiences, purposive random sampling was adopted to identify service SMEs that engaged in e-business practice in the first round of data collection. The logic behind purposeful sampling is to select units of analysis (individual based) that enable the researcher to make a reasonable comparison in relation to research objectives and not for statistical generalization.

Unstructured and semi-structured interviews were conducted in two different rounds. The purpose of the first round of the unstructured interviews was threefold: first, to understand the current state of emerging ICT adoption in small service SMEs in order to have a broad and unconstrained view; second, to test the applicability of the key ANT concepts—inscription, translation, framing, and stabilization—to the initial raw data; and third, to identify key actors involved and their roles in the adoption. Findings from the first round of interviews helped develop the semi-structured interview questions for the second round of data collection.

The semi-structured interview approach allowed researchers to take hold of the full richness of the respondents’ view expressed in their own words and the data generated were participants’ narratives (Schulter and Avital, 2011). On account that Oates (2006) recommends that the questions be sent in advance so the respondents can have leeway to think through and help establish the researchers’ credibility, semi-structured interview questions were sent two days before the

Table 1. Interviewee profile

Interview Participants	Position	Company size	Type of Service
A1	Managing director	30	Security
A2	Manager	25	Internet marketing and advertising
A3	IT support staff		
A4	IT support staff		
A5	Manager	9	Social media/consultancy
A6	Manager	-	Social network provider
A7	Managing director	25	IT vendor/consultancy
A8	Directors		
A9	Operational Manager	45	Sales and distribution
A10	Managing director	80	Construction
A11	Manager	5	IT vendor/consultancy
A12	Manager	52	Business and management/consultancy
A13	Manager/IT Support staff	99	IT
A14	Manager	8	Accounting
A15	Developer	1	IT and networking
A16	Designer	1	IT
A17	Test analyst	245	IT quality control
A18	IT Designer/developer	2	IT
A19	IT developer	1	IT and networking
A20	IT consultant	11	Consultancy
A21	Government agencies	-	Education and training
A22	Government agency	-	Education and training
A23	Government agencies		Education and training
A24	Government agency	22	Support services
A25	Government agencies	-	Support and advisory services
A26	Manager	102	IT consultant/business supports/advice

interview to allow the participants make their judgments and feel more relaxed before the interview.

A formal letter was sent ahead of time detailing the purpose of the research and confidentiality issues. Oates (2006) regards this as an essential part of the interview procedure since relying on memory is not recommended and may be prone to bias and error. All the interviews lasted for about 45 min to 1 h. In the first round, the interviewee sample was generated from an online database and 65 participants were contacted randomly, of which 11 participants agreed to be interviewed. In the second round, 15 semi-structured interviews were conducted with a range of key human actors identified from the first round of interviews. They included small business managers, SME service sector customers, government agencies, SME consultants, and Information Technology (IT) vendors. Table 1 provides a summary of participants' profile.

4. Data analysis

The data were analyzed and interpreted in line with the theoretical concepts of ANT using the thematic analysis on a latent level (Braun & Clarke, 2006). During theoretical and inductive coding at the latent level, efforts were made to identify and examine the underlying ideas, assumptions, and

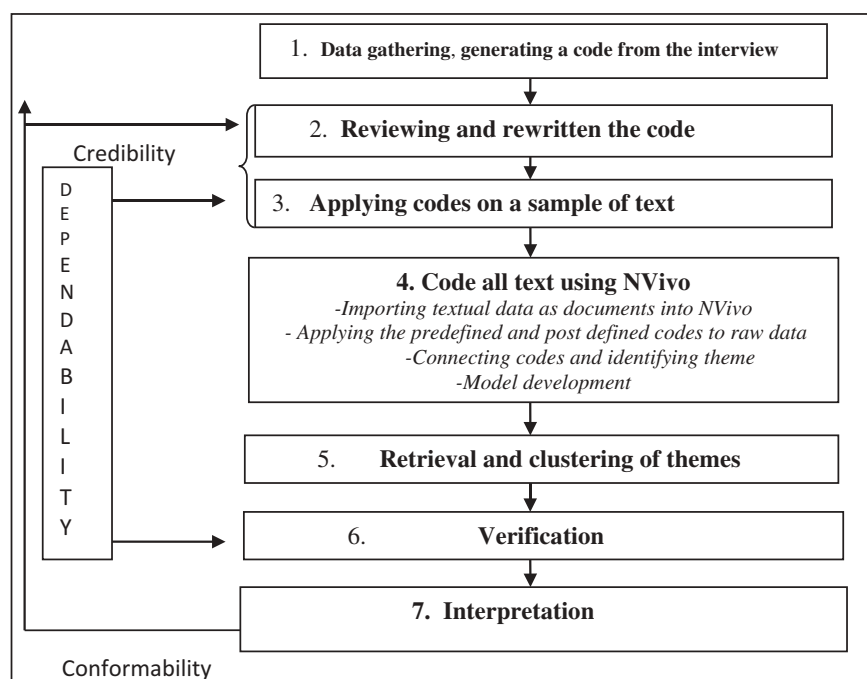
conceptualization (Braun & Clarke, 2006) instead of focusing at the semantic level, which only emphasizes on the surface meaning of the data. This approach was useful in the research because it allows the application of codes to the raw data and allows themes to also emerge inductively and, second, it aids in the credibility and dependability checks (see Miles & Huberman, 1994). Moreover, guide on coding of the raw data on the roles of actors was provided (see Table 2). Figure 1 shows the data analysis process. In stages one to three of the data analysis process, codes generated in the initial interviews were applied on the raw data to check how credible they are. In stage four of the data analysis model, all of the transcribed data were imported into NVivo (software for qualitative data analysis).

NVivo software facilitated the coding of data into appropriate categories. Consistencies were addressed between the categories identified and the extracted quotes from the interview

Table 2. Guide on the post-defined code on the roles of actors

Roles	Definitions
Manager	
<i>Innovativeness</i>	This means initiating and managing ideas or change.
<i>Empowering</i>	This means encouraging and guiding others.
<i>Controlling</i>	The process of ensuring that the right direction is adhered.
<i>Monitoring</i>	This means verifying ensuring adherence to a particular situation.
Government	
<i>Collaborative supports</i>	This means connecting businesses to other entities that can help them change; an act of working with other entities to improve performance.
<i>Funding</i>	Financial aid given to support a project.
<i>Research</i>	This means search for knowledge to help improve business activities; this can come in form of a conversation that results in novel ideas.
<i>Legislative advice</i>	Advice associated with regulation.
<i>Training</i>	Acquiring knowledge and skills; this can be practical as well as vocational.
Customers	
<i>Idea generation</i>	This means the development and communication of ideas; this spans from creation.
<i>Product testing</i>	The evaluation and verification.
<i>Product modification</i>	This involves trial and amendment of the new product.
Consultants	
<i>Requirement gathering and evaluation</i>	This is a process involving specifying the purpose, understanding the objectives and background information of the relevant projects, and the limitations.
<i>Requirement transformation</i>	This means tailoring requirements to needs; this may be in the form of developing a design or reference documents.
IT experts	
<i>Education</i>	Knowledge acquired through skills and experience that is transferred to others.
<i>Design and development</i>	The process of transforming ideas or reference documents into a physical object, which may depend on a particular approach.
<i>Verification</i>	This means confirming that the technology is in line with the requirements.
<i>Training</i>	Acquiring knowledge and skills; this can be practical as well as vocational.
Vendors	
<i>ICT adaptation</i>	The act of implementation; ensuring that the phenomenon meets the organization's arrangement.
Employees	
<i>Feedback</i>	An appraisal that forms the basis for subsequent development or modification.

Figure 1. Data analysis process.



transcript using inter-coder reliability analysis (Bryman, 2008) involving four judges. These judges related the extracted quotes against the themes, and the final outcome was further validated through cross-case analysis of supporting evidence (Macredie & Mijinyawa, 2011), which has been proved to be effective. The inter-coder analysis reveals that the percentage agreement for the scope of the study is 78%, which exceeds the 70% benchmark recommended by Miles & Huberman (1994). The data analysis process was part of the design method, which revealed how data was analyzed and reported (dependability check), followed by conformability checks to ascertain how tightly the raw data is linked to the interpretation (see Boyatzis, 2008). During the analysis, a guide was developed to help code the data based on the meaning attached to each role (see Table 2).

5. Findings and discussion

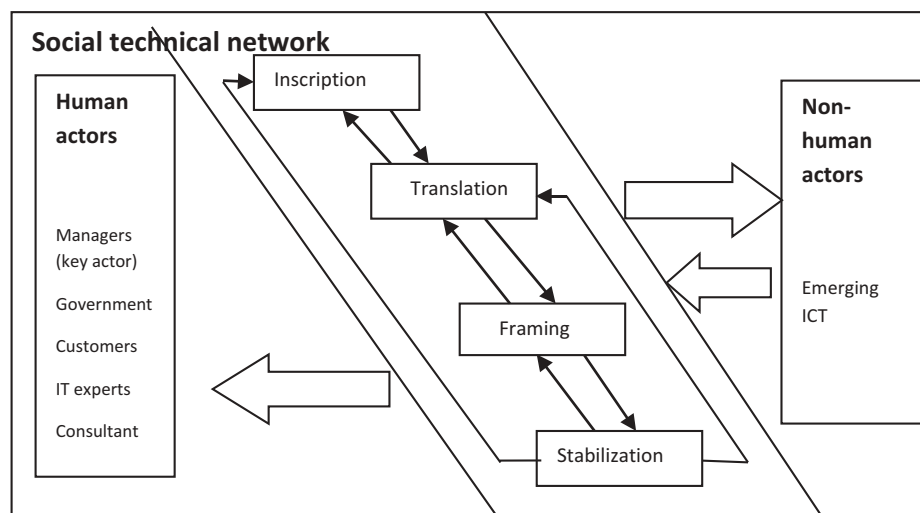
5.1. Emerging ICT adoption process

The findings presented here are based on narratives of participants, ANT concepts, and the relevant literature. Based on the qualitative evidence and ANT theory, this study first establishes an emerging ICT adoption process model, as shown in Figure 1. The model provides a mechanism for showing the reiterative and nonlinear nature of the ICT adoption process in SMEs. It shows a process that can reiterate along with technology development. Details on the development and validation of the model can be found in Eze et al. (2014).

5.1. Analysis of the roles of actors

As shown in Figure 2, a number of actors are involved in the adoption of emerging ICT because of the complex and dynamic nature of emerging ICT applications. Small business managers, as the emerging ICT's adopter and decision maker, are the competing actor that ensures that other actors support their claim in technology development and deployment. Therefore, they are regarded as the key actor in this context who takes up the role of the most visible actor. The key actor makes possible the enrollment of other actors in the research. Interviews conducted with SME managers made it possible to identify other internal actors, such as employees, and external actors, such as IT experts, IT vendors and consultants, government agencies, emerging ICT, and

Figure 2. The dynamic process of ICT adoption.



standards. These human actors, during the interview, identified at what stage these roles are performed.

The roles of actors are summarized in Table 3 and table 4 below and discussed briefly in the following sections.

Table 3. Roles of actors

Actors	Roles	Adoption Process			
		Inscription	Translation	Framing	Stabilization
SME managers (key actor)	Innovativeness	✓			
	Empowerment	✓	✓		
	Monitoring	✓	✓	✓	✓
	Controlling	✓	✓	✓	✓
Government	Collaborative support	✓	✓	✓	✓
	Funding	✓	✓	✓	✓
	Research	✓	✓	✓	✓
	Legislation	✓	✓	✓	✓
	Training	✓	✓	✓	✓
Customers	Idea generation	✓		✓	
	Product testing and modification			✓	✓
Consultants	Requirement gathering and evaluation		✓		
	Requirement transformation		✓		
IT Expert	Education		✓		
	Development			✓	
	Verification			✓	
	Training				✓
Vendors	Product adaptation				✓
Employees	Feedback on performance				✓
ICT	Driver/Enabler	✓			✓

Table 4. Roles of actors with supporting cases

Actors	Roles of actors	Supporting cases
SME Managers	Innovativeness	A5, A11, A12, A13
	Empowerment	A11, A12, A19
	Monitoring	A11, A14, A19, A24
	Controlling	A13, A15, A19
Government	Collaborative support	A21, A22, A23
	Fund	A21, A22, A23, A24, A25
	Research	A21, A23, A24
	Legislation	A12, A22, A23, A25
	Training	A21, A23, A26
Customers	Idea generation	A11, A12, A13
	Product testing and modification	A5, A11 A12, A13, A17
Consultants	Requirement gathering and evaluation	A12, A13 A14, A20
	Requirement transformation	A12, A13, A14,A5, A18
IT Experts	Education	A15, A18, A23, A25
	Development	A15, A17, A19
	Verification	A15, A17, A18, A20
	Training	A15, A16, A19
Vendor	Product adaptation	A7, A13, A 6
Employees	Feedback on performance	A11, A12, A14,
Emerging ICT	Driver/Enabler	A1,A5,A7,A9,A24

Codes and sample supporting evidence on the roles of actors

Codes	Supporting evidence
	Managers
Innovativeness	“As a CEO I may have a couple of young graduates and you say to them guys, I have got this business problem go and find me solution. So you would be the innovator deriving ideas through the organisation” (A12). “... the main stakeholder was the MD who was driving the project” (A13).
Empowerment	“I also have a role through the process which is ... encouraging people with new ideas and new ways of doing things...” (A11) “It is your responsibility to tell and help them build their business case so that the actual business moves” (A12).
Monitoring	“We [managers] went through you know and if there is any problem or reason, it will be brought to [IT experts] attention” (A14). “...directors should be more responsible on what is going on in the company...as regards to legislation because they will be paying for an auditor, they pay for the services and knowledge of the auditor to make sure the auditor keeps the financial director aware of not only the current legislation but what is coming down the pipeline” (A11).
Controlling	“From MD point of view he was controlling from the management point of view, looking at the cost, looking at the value each of the solution will add to the business” (A13). “Basically as middle party [we]...make sure they install the product which will meet our needs” (A15).

(Continued)

(Continued)	
Codes	Supporting evidence
	Government
Collaborative support	<p>“one of the reasons for our contact with your own university is that we wanted to try to deliver something in partnership with higher education institution that could help some of our small businesses in guiding them through the things they simply don't have” (A23).</p> <p>“We are currently working with UK Trading Investment to see if [small businesses] might exploit linkage externally” (A22).</p>
Funds	<p>“...because of the super fast funding that is coming, we have started to look most specifically, at the IT agenda and the needs of these small businesses-” (A23).</p> <p>“...occasionally we will take forward a project, and seek funding for it” (A25).</p>
Research	<p>“...what [SMEs] don't have is time to invest in the research to find out what is out there that could help them to do their business better” (A23).</p> <p>“...in my case I will look online, do some research before I see the client and understand what market sector they are in” (A21).</p>
Legislation	<p>“...it can be anything simple as the government changing their tax from 17.5% to 20%. The organisation deals with the fact that is got to change all its invoicing, the fact that is got to change all his consumer pricing, and the fact that he got change and notify his entire organisation that this is already happening. So simple change such as that has a serious knock on impact throughout the whole of the business” (A12).</p>
Training	<p>“I guess one of our role has been and will continue to be with seminal programmes is to make sure that businesses out there knows about this programme and can take them on” (A26).</p> <p>“What we are delivering them was training on the internet on computer network, on marketing [and] move on to running a programme called take IT on” (A26).</p>
	Customers
Idea generation	<p>“A lot of organisations would have a chain of customers, so what they have to do is that... they may use these customers to seek for some ideas” (A12).</p> <p>“The user contribution was invaluable because they were looking at it from the perspective of what they wanted to see from the system. They contributed immensely in terms of what we want... from the system” (A13).</p>
Product testing and modification	<p>“We use the customer to trial tests the solution... In fact, it would be your testing ground and obviously you may find that client [is] sort of championing your new technology so he becomes a reference ground” (A12).</p> <p>“...we are getting the customers involved in the modification of the product” (A13).</p>
	Consultants
Requirement gathering and evaluation	<p>“As an IT consultant I consider the organisation past and present arrangements. What they have been doing? The kind of systems that is in place, and where they want to go next? This will help understand what system they will actually need” (A20).</p> <p>“As I said is the consultant that will become the champion to such process who will now say it makes sense... evaluation three or four alternative solution of an emerging technology” (A12).</p>
Requirement transformation	<p>“...SMEs do not have the skill set, they may call a consultant to write a business case” (A12).</p> <p>“We have product analysts and consultants; they transform requirements into design documents...” (A17).</p>
	IT experts
Education	<p>“I will let them know that there are off the shelf application or will they want me to develop the application from start... So what you have to do is to make them realize that there are various applications to do a particular job. There are different forms of applications... If they are not sure about any application, I have to make them realise the implication of each application the runs in their operating systems.” (A15).</p>
Development	<p>“In small business ... the applications that are actually used are codes... by the developers” (A17).</p> <p>“It depends on the methodology we use... If we decide to go for Ajax methodology; it simply means we have to divide the soft ware into sections” (A15).</p>

(Continued)

Codes	Supporting evidence
Verification	<p>"If I develop software, something's they are not perfect. There are thing that are overlooked because these are just minor things mean while the person that I am writing the software for will not overlook. So as a software developer I have to test my software ... I have to follow the entire requirement" (A15).</p> <p>"It is possible that we have introduced issues and misunderstood the users and the requirement that we tested against is not exactly what the users want. As a test analyst, you are testing to see that the applications that will be release are according to what is in the design document to the requirement that, that is what the users want... So we test to validate and to verify the requirement" (A17).</p>
Training	<p>"...we have to because those people who play role in the IT sections have to train our staff on different applications to make sure there are not any problems. There was training given by the people" (A15).</p> <p>"in most cases we normally have to train the users, get them fully acquainted" (A19).</p>
	IT vendors
Product adaptation	<p>"IT vendors came in to evaluate the systems and map out into their solution... also trying to look at if their product will fit into the solution. So what they did was to come down, get the information, went back to their company, use a copy of the application to replicate how they hope to set the system up in the company after doing that they came back to the site and try to confirm what the set could work and could actually fit into our organisation based on that a couple of changes were made until the company is happy with the system. From there we implemented the solution" (A13).</p>
	Employees
Feedback on performance	<p>"Well, obviously my employees play a role because they give me feedback where our systems have weaknesses so I can finance it and what more application we need..." (A14).</p> <p>"Employees are also important because they are the ones running the system" (A11).</p>
	Emerging ICT
Enhancing business process	<p>"... We have embraced most of these technologies because we are much bigger, we [are] 25 people working for us and we were turning over a million. With that size, comes a lot of complications, headaches and now one person... can manage all the task with these technologies" (A7).</p> <p>"...there are also a lot of advantages basically, going into this IT development infrastructure, you can be able to communicate effectively" (A24).</p>

6. Roles of SME Managers (the key actor)

6.1. Innovativeness

Innovativeness, in this context, is an act of initiating and valuing other people's opinion and ideas by the managers. New ICT adoption would not succeed if there is no support from the managers (Ramsey, Ibbotson, & Mccole, 2008). This is similar to some of the views of the respondents: "As a CEO I may have a couple of young graduates and you say to them guys, I have got this business problem go and find me a solution. So you will be the innovator deriving ideas through the organization" (A12); "... The main stakeholder was the MD who was driving the project" (A 13); and "All of the new innovations are actually starting at SMEs level"(A5). The study reveals that in the **inscription stage**, SMEs managers can be the driving force of ICT adoption because they are regarded as unique individuals who use their instinct to discover and bring an innovation into the implementation stage (Akrich et al., 2002). They may also be involved in understanding the mutual interest of those involved in the process in order to archive the organizational goal.

6.2. Empowerment

Empowerment simply means encouraging actors to become more involved in day-to-day decision making and activities that affect the organization. As noted: "It is [my] responsibility to tell and help them build their business case so that the actual business moves" (A12) and "...your client [the

manager] is the master, so he will be telling you what he wants" (A19). SME managers can empower, teach, and motivate others to develop appropriate business strategies that aid in effective ICT adoption. Observation shows that empowerment is a management strategy used only by innovative small business managers to support work, set goals, as well as encourage open learning. This role is linked to the **inscription stage and the translation stage**.

6.3. Monitoring

Appropriate monitoring control has an influence to the organization's success. Similarly, the respondents also echoed: "We [managers] went through ... and if there is any problem or reason, it will be brought to [IT experts] attention" (A 14) and "The Manager is the master, so he will be telling you what he wants" (A19). The finding suggests that close monitoring is important in all the stages to ensure various actors adhere to the emerging ICT adoption directives. Monitoring is a significant role performed in **all stages of the adoption process**.

6.3. Controlling

Emerging ICT adoption can be influenced by people within and outside the organization (Benamati and Lederer, 2001). Controlling means ensuring that the right standard of emerging ICT is achieved for the smooth running of the organization as well as ensuring that corrective measures are undertaken as and when needed. As pointed by some respondents: "From MD point of view, he was controlling from the management point of view, looking at the cost, looking at the value each of the solution will add to the business" (A 13) and "Basically as middle party [we] ...make sure they install the product which will meet our needs" (A 15).

Controlling plays a significant role in the **translation, framing, and stabilization stages**.

7. Roles of the government

7.1. Collaborative support

Collaborative support is linked to assistance given to small businesses by government agencies on how best to take up new ICT. As noted by respondents: "We are currently working with UK Trading Investment to see if [small businesses] might exploit linkage externally" (A22); "We have a specialized staff team who works with partners such as Job Centre Plus, and some of the Enterprise Agencies in terms of organisation of people that want to start their own business" (A21); and "One of the reasons for our contact with your own university is that we wanted to try to deliver something in partnership with higher education institution that could help some of our small businesses and guide them through the things they simply don't have or know" (A23). The role is to ensure that the key actor is aware of those external entities that can help meet and improve their overall business process. This role was linked to the **translation stage**. This finding is in line with the works of Lacovou et al. (1995), who note that the UK government has been designing policy guidelines that provide information about internet opportunities and launched several expansion initiatives to support the adoption and use of IT.

7.2. Funding

Funding is vital for starting, maintaining, and growing SMEs. Funding is a role that not only is important in the **inscription stage**, but also extends to the **translation stage and the stabilization stage**. According to Martin and Helstead (2004), through the European Development Fund, the European Regional Development Fund, as well as the different support programs, the government funds projects to help SMEs with online learning opportunities through a European Union (EU) fund project. Evidence suggests that the government has funded a number of projects to support SMEs. For example, through the recent superfast funding available recently, the government is presently looking at more specific IT agendas to help put small businesses at the forefront of taking a bold step to adopting new broadband. This was similarly echoed: "Over the last 2 or 3 years, central government has been doing some activities.

They have been funding all these activities, and they will do a different type of things, doing web work, internet, and stuff like that developing lots of things” (A22) and “–Because of the super-fast funding that is coming in, we have started to look most specifically, at the IT agenda and the need of these small businesses–” (A23).

Research. Most small businesses lack the basic research skills, time, and funding to independently carry out research to ascertain the best ICT applications to adopt that will improve their operations. The findings suggest that research was a role that government and most of its agencies play to support these businesses. Respondents across cases note: “[SMEs] don’t have the time to invest in research” (A23) and “Where they want to have information or benchmark survey or they want to do some desk top research about their market or customers, we can provide that” (A24). The finding suggests that government agencies often conduct research to help key actors keep up to date with the available information regarding competition, customers, as well as the products available to meet their needs. The role is evident in the **inscription stage and the translation stage**.

7.2.1. Legislation

According to Low and Johnston (2009), regulatory changes often affect businesses and, at the same time, come with a huge amount of information that businesses are expected to be aware of. Legislation, in this context, constitutes laws framed by the government, which may impact business either negatively or positively. The finding reveals that there might be changes in the central government and the local government that businesses need to be aware of. The finding also reveals that it is the responsibility of the government to ensure that businesses are aware of such changes, as noted by some respondents: “There is lots of information that comes with regulations- that businesses should take advantage off.—so we might start some of those projects off” (A22) and “We have a particular function as a local authority in maintaining environmental health standard and trading standard” (A25). However, the finding reveals that most of the services are still not free and the bureaucratic process may often slow down the level of legislative support needed by SMEs. Legislation is a role performed during the **translation, framing, and stabilization stages**.

7.2.2. Training and support

Findings reveal that the government has made efforts by organizing seminars for SMEs, as indicated: “What we are delivering them was training on the internet, on computer network...” (A21) and “...our role has been...seminal programmes which is to make sure that businesses out there knows about this programme and can take them on” (A26).

The purpose is to create awareness of the opportunities associated with adopting ICT. Similarly, Martin and Helstead (2004), in their studies, identified some of these government agencies to include Learndirect, a local UK portal that offers advice and training through European funding. Provision of training can encourage SMEs to expand and develop their knowledge base and increase awareness of the opportunities associated with adopting emerging ICT. Training is important in **the inscription and the stabilization stage**.

8. Roles of customers

8.1. Idea generation

Learning and understanding customers and integrating their views in the emerging ICT adoption process often result in a successful outcome (Akrich et al., 2002). The importance of having customers’ views during innovation development has been recognized in the literature (Gottfrisson, 2011). This has been pointed out across cases: “A lot of organisations would have a chain of customers... they may use these customers to seek for some ideas” (A12) and

*“The users’ contributions were invaluable... They contributed immensely in terms of what we want... from the system” (A13). Emerging ICT adoption is always guided by customers’ voices and ideas and the role is associated with the **inscription stage and the framing stage**.*

8.2. Product trial/testing and modification

Product testing plays an important role in the development and adoption of an emerging ICT. The finding suggests that customers can provide sound and knowledgeable insight and help reduce the risk of emerging ICT failure, as indicated by some respondents: *“We use the customer to trial the solution” (A12) and “Before [customers] accept the application, they will test it to see that is what they want” (A17)*. According to Kaulio (1998), there are three ways customers take part in the design process. They include designs for, which is an approach through which information is gathered from users and used to create the product. Design with indicates gathering data on customers’ preferences and using such data to design the product and display the proposed solution, so customers can react on them. Design by indicates an approach where customers are actively involved in the design process. Customers provide knowledgeable insight and help reduce the risk of emerging ICT failure. Product testing and modification is visible in the **framing stage**.

9. Roles of consultants

9.1. Requirement gathering and evaluation

The key actors may not have the required knowledge to align their emerging ICT need to their business processes. Consultants are often the first point of contact who further collate information and evaluate the situation. The finding suggests that requirement gathering and evaluation are necessary for trustworthy consultants to ensure that the right product is introduced. This was echoed: *“—it also has to be trust [on] the quality of the advice you are getting” (A23) and “I can see businesses wary of the advice they are been given...They [Consultants] are not independent” (A25)*. This role is visible in the **translation stage**.

9.2. Requirement transformation

It was not surprising that consultants engage in developing ICT plan/business case and ensure that the ICT is implemented successfully, but the finding also reveals that they transform key actors’ requirements into a language that is understandable by other actors such as the IT expert who helps plan, develop, and implement new ICT (Fang et al., 2011). This role is carried out in the **translation stage**.

10. Roles of IT experts

10.1. Education and training

This role helps SMEs understand the various options (developing in-house or outsourcing) available because most times they have little knowledge about ICT: *“...sometimes organizations [SMEs] come up with funny ideas that they think software...can do” (A15) and “... most times the issues we usually...[SMEs]...have a fixed ideal of what they want” (A18)*. This role is vital because it helps reveal to SMEs the implications of choosing any option. Education is linked to the **framing stage**.

Development and Verification. IT experts are responsible for transforming the design documents into a physical object taking into account the requirement of the key actor. Development is a role undertaken by IT experts to transform the ideas into new ICT. As noted: *“Having the concepts and trying to actualise the concepts... is one problem... So our role is to make sure that the template designed is acceptable by the client” (A17) and “IT experts] play a very important role you know... obviously we can’t tackle it from the technology point of view” (A14)*. Verification is also a role performed by IT experts to ensure that the emerging ICT is

adaptable and working as expected to meet the organizational requirements. This role is predominantly carried out in the **framing stage**.

11. Roles of vendors

11.1. Product adaptation

ICT adaptation involves evaluating the application and ensuring it fits into the existing and new organization's values. The findings suggest that vendors make commitments to providing small business managers with the right ICT by customizing and creating interfaces with the new ICT and the necessary functional enhancements. This was supported: *"IT vendors came in to evaluate the systems...based on a couple of changes were made until the company is happy with the system"* (A13). The finding was similar to that of Fang et al. (2011). This role is evident in the **stabilization stage**.

12. Roles of employees

12.1. Feedback on performance

Teo, Srivastava, Ranganathan, and Loo (2011) note that what most stakeholders consider beneficial when implementing new technology are the internal organizational employees. The finding reveals that a number of employees who work with SMEs are curious when the need for new ICT arises and are eager to partake in the process. Observation shows that employees at a later stage often resist the systems and challenge their usability. The finding also reveals that such reactions or signals go back to the key actors and in the reduction of risk since employees have a direct contact with the systems. Therefore, organizations should be mindful of the employees' ideas and requirements when adopting emerging ICT. Feedback on performance was evident in the **stabilization stage**.

13. The role of emerging ICT

13.1. Driver/enabler

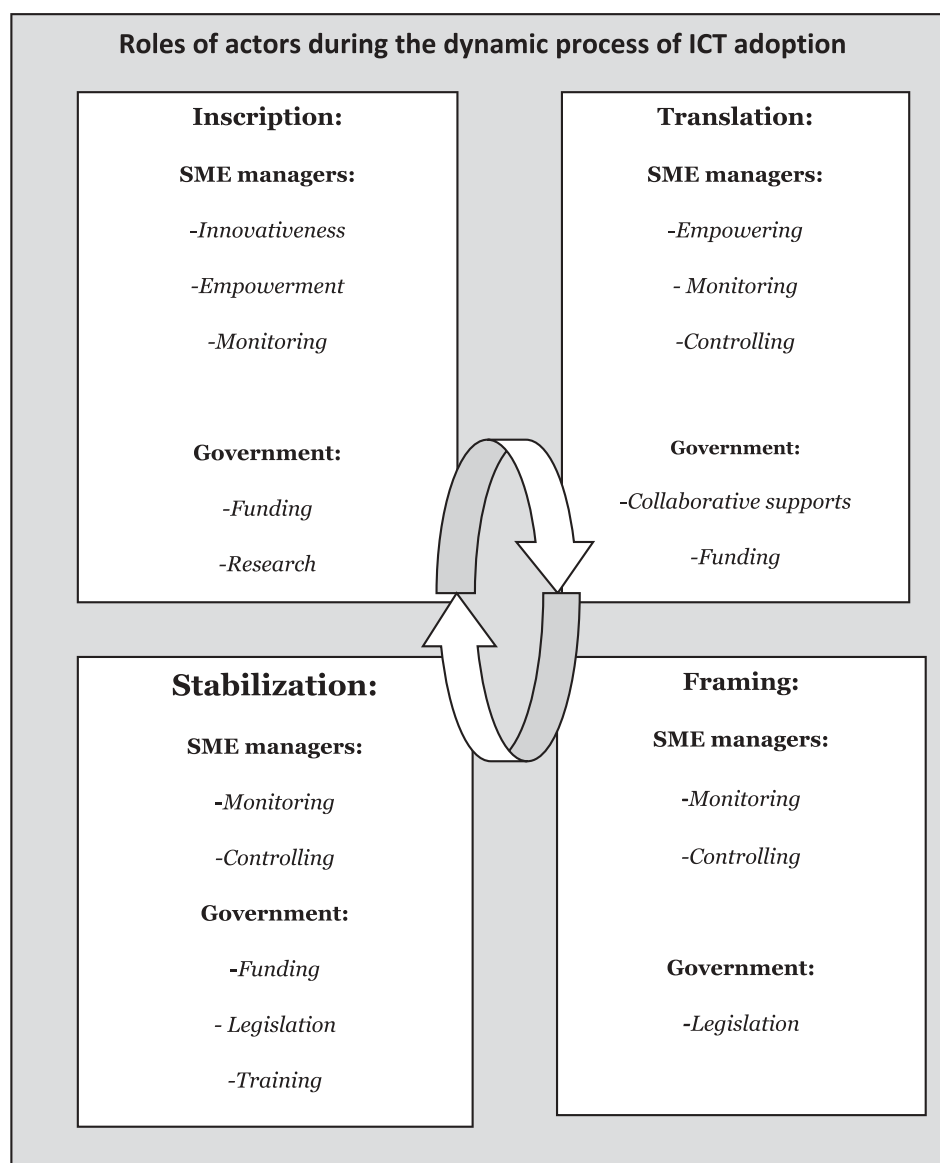
ICT can be a driver as well as an enabler for business enhancement and innovation. According to Herold (2010), ICT has become an integral part of the society and plays a role of enhancing, supporting, changing, and improving human lives. As noted: *"We have embraced most of these technologies because we are much bigger, we [are] 25 people working for us and we were turning over a million. With that size, comes a lot of complications, headaches and now one person... can manage all the task with these technologies"* (A7) and *"...we also use such platforms to market innovations as well"* (A5). This is evident in most of the cases investigated. The development of emerging ICT provides opportunities for business. They are also an essential enabler for business transformation and success. Emerging ICT acts as a driver in the inscription stage and as an essential enabler in the stabilization stage.

In summary, a number of important findings emerged from our analysis using ANT as a theoretical lens. 1. Actors' roles are not static, but dynamic. They play different roles in the different adoption stages. 2. Both human and nonhuman actors influence and are influenced by each other. 3. SME managers are the key actor and play a dominant role in influencing and being influenced by a nonhuman actor, i.e. emerging ICT in this context. In addition, the findings reveal that key actors and the government are visible in all stages of adoption, whereas IT experts are linked to translation, framing, and stabilization. This suggests that key actors, government, and IT experts play significant roles in the different stages of the adoption process. Moreover, it was observed that monitoring and legislation are the most consistent roles in multiple stages.

14. Conclusion and implication

Using ANT to examine the process of emerging ICT adoption has helped unveil the dynamic nature of the ICT process and the roles of diverse actors involved in the social-technical network of technology adoption (see figure 3 below). The key actors are more likely to adopt emerging ICT

Figure 3. Roles of actors in the dynamic process of emerging ICT adoption.



if they perceive such application to offer instant and effortless values since the conflict that often arises between actors takes time to resolve due to actors' different perceptions and the fact that small business managers come with preconceived ideas based on their previous experiences, business norms and values, or imposed by IT consultants and try to impose them on the potential ICT, which may or may not align based on what might have been enacted at the inscription.

To ensure such challenges are minimized, the key actor should de-emphasize the preconceived ideas on how emerging ICT should be adopted and implemented. Whereas the findings also confirm that small business managers play central roles in the sense-making of the emerging ICT and ensure that it aligns with appropriate actors, the key actors engage with emerging ICT adoption continually to ensure they are technology ready, constantly engage with other actors to understand and adopt the right technology, to ensure the expected performance is achieved, and finally to ensure that the values anticipated by the ICT can be realized.

It is believed that most key actors have the feeling that they are isolated especially where they cannot secure some of the free support offered by the government. Most small businesses also do not understand how IT can be used to improve business performance; rather, what most do is to get recommendation from friends and family. More so, a number of infrastructure companies have been seen to be going into developing web application without a thorough understanding of their business processes. Key actors should establish a relationship with some specific actors and mentors and trust them in such a way that they can support their online trading platforms. This can serve a useful step in helping gain an external support that is proficient and avoid common business mistakes through this way. Key actors should rely solely on their informal networks and focus on actors who are knowledgeable about a particular ICT in that sector. They should develop a strategic partnership and not rely on actors who have an interest in a particular product. Moreover, small business managers should identify their capabilities and their drawbacks using the framework to be able to identify where these actors can effectively help (Simpson & Docherty, 2004). It is also important for key actors to encourage employees to contribute their quota in ICT adoption decision making since it is evident that employees can play a substantial role in the adoption process.

The adoption of emerging ICT is no longer a decision that rests solely on developers. This has moved from a decision made by a single organization or industry simply to involving various actors who must be involved in one role or the other to influence the process. The study unveils how the nature of the roles played by these actors may inform the successful adoption of these applications by small businesses.

Finally, most often in qualitative research, the size and sample used are limited. This study examined the roles of authors in emerging ICT adoption with 26 interviewees. The size and sample use are limited. These limitations require caution when generating findings. This study requires further validation across a wider population using a mixed method: a combination of qualitative and quantitative methods. Therefore, further studies could collect and collate a larger amount of data to allow a more in-depth generalization.

Funding

This paper is self-sponsored (no funding).

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Citation information

Cite this article as: Actors and emerging information, communications and technology (EICT) adoption: A study of UK small and medium services enterprises', Sunday Chinedu Eze, Vera Chinwendu Chinedu-Eze & Adenike Oluyemi Bello, *Cogent Business & Management* (2018), 5: 1480188.

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