International Journal of Latest Engineering and Management Research (IJLEMR)
ISSN: 2455-4847
www.ijlemr.com || Volume 04 - Issue 05 || May 2019 || PP. 30-43

Prospects and Challenges in Embracing Internet of Things with open Innovation strategies in SME's: An exploratory study in Ghana

Eleanor Afful[1], James Ami-Narh[2], Isaac Asampana[3]
[1](Department of Information Technology,
University of Professional Studies Accra,Ghana)
[2](Information services and technology Directorate Department,
University of Professional Studies Accra, Ghana)
[3](Department of Information Technology,
University of Professional Studies Accra, Ghana)

Abstract: The need for improved frameworks to enhance SMEs service delivery is to integrate an open standard where the unconnected organizations are connected through devices. Internet of things as the technology enabled expands the connectivity of sensor-embedded objects to improve productivity and overall performance in Small and Medium Enterprises (SMEs) economies through open innovation strategies. This study proposes a framework for Internet of things open innovation strategies for SMEs in developing countries based on the value Co-creation using ecosystem platform. An interaction among SMEs' in the formation of an ecosystem for value Co-creation on a sharing economy platform. When incorporated with Internet of things innovation and management strategies contributes for better strategic orientations of SMEs business model in developing countries.

The paper aims to study the Internet of Things open innovation strategies as an enabler for Small and Medium-sized Enterprises (SMEs) to identify the prospects and challenges in the Ghanaian community based on existing literature review. The paper seeks to identify basic characteristics of SMEs in Ghana and the best practices on open innovation with Internet of things strategies in developing economy. The paper shows how Internet of things open innovation strategies can be leveraged for rapid economic advancements with Small Medium Enterprises(SMEs) in Ghana. The paper additionally examines the investment prospects of adopting Internet of things open innovation strategiesfor the economic environment of Ghana. In addition, the issues that Small Medium Enterprises must resolve to successfully implement the Internet of things open innovation strategies in Ghana.

Keywords: Internet of Things, open innovation strategies, SMEs, Value co-creation, ecosystem, sharing economy.

Introduction

Internet of Things is a connectivity platform for objects with embedded sensors to interact behave as a source of data generation and information for productivity in most business. By connecting the unconnected objects around us and may reach a higher level of synergy and efficiency. Through the connectivity of several service systems, e.g. Uber service platform interactions among stakeholders maximise productivity.

Hence, data generated will not be intermediate by the platform owners. Other organisations can use the detached data from the service. Therefore, the entire service systemmade up of an integrated platform of technology platform, sensors and data will no longer be the only best strategy.

Hence the need for improved guidelines to make sense of strategies in open Internet of Things ecosystems[1]. Building a practical business ecosystem for market creation and growth (Moore, 2006) which most SMEs would be attracted to a complex interconnectivity of standardised systems processes and services [2].

Background

The dynamic role of Small and Medium Enterprises in developing countries such as Ghana towards employment generation and income creation is over emphasised by several authors. [3].In recent times fast-changing technologies and globalizing economies are putting increased pressures on firms to enhance adaptability and flexibility. It confronts many SMEs with greater external competition hence the need to reorganise their structures and expand market share.

To adapt to evolving markets and changing circumstances with limited resources, SMEs must be able to upgrade the skills of many employees, a central necessity to firm productivity. Because of open innovation

practices incorporated in all businesses to prove the steady refinement in product or process, a transformation towards improved operational efficiency and sustainability in adoption to Internet of things ecosystem[4]**.**

In simulating the business environment for innovative activities for SMEs most institutions play a significant role such as providing financial support services for doing business including incubators, technology transfer, training, research and consulting services, technology parks.[5]

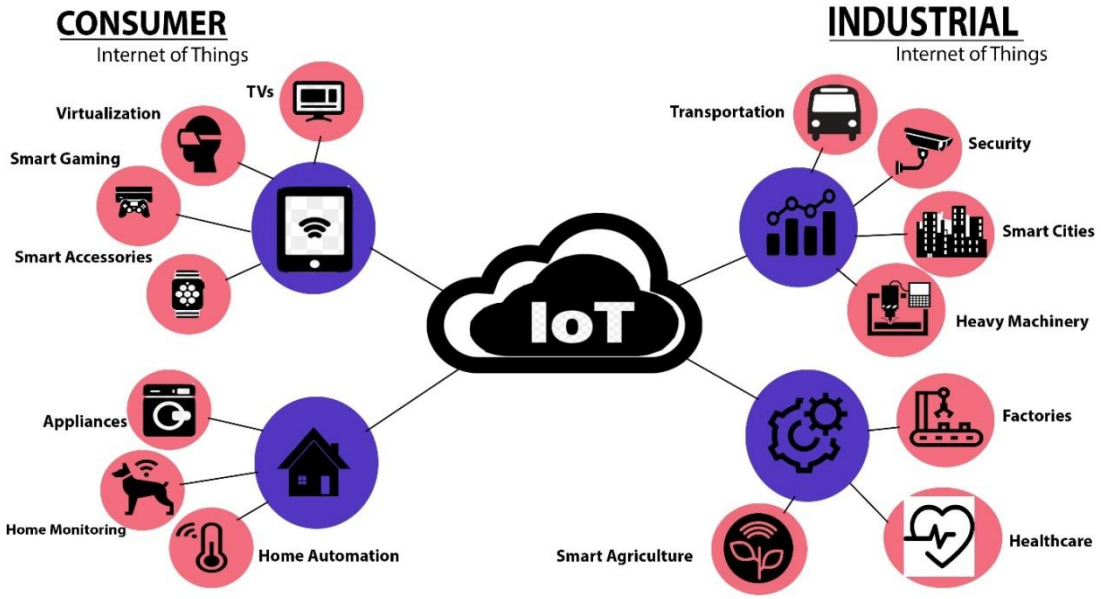


Fig.1An illustration of business environment with IoT open Innovation strategies

Problem Statement

Besides funding that offers an opportunity to universities, research centres by large enterprises, enough partnerships with SMEs might be a need for universities and public research centres to serve as attractive collaborative partners[6,12]but SMEs with inadequate resources to do the same. In addition, SMEs have inadequate technological assets and ability to be of interest for most universities and public research centres.

Though, recent development has shown that open innovation practices are because of technological partnership,[7], generating new opportunities [8] through various Internet of Things open innovation strategies [9].

Open innovation enhance value creation much more than closed innovation principles could improve SMEs business strategies performance. The paper seeks to identify basic characteristics of small medium enterprises in Ghana and the best practices on open innovation with Internet of things strategies in developing economy. The paper shows how Internet of things open innovation strategies can be leveraged for rapid economic advancements with Small Medium Enterprises in Ghana to build an ecosystem for value co-creation.

Classification of Literature on open Innovation Strategies, Internet of Things and SMEs

Sub Question	Literature	Sources
What is open innovation?	Because of fundamental and dynamic changes in technology with faster knowledge growth, firms combine internal and external ideas and internal and external paths to market towards the development of new technologies. These strategies integrated into processes, products and services have changed towards a more open approach, hence the concept of open innovation to build stronger global market competition.	Ahlstrom(2010), Chesbrough (2003), Chesbrough et al. (2006),Dahlander & Gann (2010), Enkel et al. (2009), Gassmann (2006), Huizingh (2011), Lee et al. (2010), Lichtenthaler (2011), March (1991), March (1995), Porter & Stern (2001), Schilling (2013), Solow (1957), Van de Vrande et al. (2009)
What are different methods of open innovation?	Different methods are available depending on the chosen approach and innovation process firms will adopt. The open innovation collaborative	Bogers et al. (2012), Dahan & Hauser (2002), Engardio et al. (2005), Gassmann et al. (2010), Inkpen & Currall (2004), Koza and Lewin (1998),

	methods include but not limited to the following licensing, outsourcing, Co-creation, strategic alliances. Joint ventures and research organisations. If a company possesses technologies, knowledge or capabilities and wants to further exploit them, outsourcing-in would be the method. Outsourcing-in offers firms a way to leverage existing knowledge and capabilities while earning money. It is an interesting possibility for SMEs that do not exploit or use their capabilities and want to increase their revenue and their reach. It adopts various collaborative methods with customers to develop the product or services to provide the platform to select different partners. A mix of open and proprietary way of getting and maximising the benefit by leveraging ideas to improve open innovation principles. Firms leverage core competences, penetrate new markets, protect old ones and/or gain new strategic capabilities with Strategic alliances. A firm may enter an alliance to exploit an existing ability ('jointly commercialising'). For immediate returns, a firm aiming at short-term results and establishing a significant positive relationship between taking part in innovation performance and research organisation might not be the best fit. However, a more long-term commitment compared to most of the other methods stated above allow firms to leverage and build upon existing competences while learning from the other partners. Also, through collective research organisations. This mode of open innovation could be useful for SMEs, since it allows them to share costs and risks and, therefore, can limit SMEs' barriers to innovation.	Laursen et al. (2010), Parkhe (1993), Piller et al. (2010), Prahalad & Ramaswamy (2004), Quinn (2000), Sanders & Stappers (2008), Schilling (2013), Sikimic et al. (2016), Koza and Lewin (1998) Spithoven et al. (2013), Zwass (2010) Chesbrough, H.W., Vanhaverbeke, W. and West, J. (eds.) (2006) Open Innovation: Researching a New Paradigm. Oxford University Press, Oxford. Van de Vrande, V., Lemmens, C. and Vanhaverbeke, W. (2006) Choosing Governance Modes for External Technology
What are different partner possibilities for open innovation	Different partner possibilities from the pool of competitors, customers, suppliers, universities & research centres are available depending on the method chosen. The next step in the open innovation process is to select a partner from a pool of potential partners for the specific company and situation that takes place to collaborate with after method identification. After identifying the stakeholders, an	Chung & Kim (2003), Elmuti et al. (2005), Famuyiwa et al. (2008), Gnyawali & Park (2011), Greer & Lei (2012), Hamel et al. (1989), Johnson& Houston (2000), Lee et al. (2010), Link & Scott (2005), Miotti & Sachwald (2003), Padilla-Melendez & Garrido-Moreno (2012), Prandelli et al. (2008), Pun & Heese (2014), Quinn (2000), Sahay (2003), Schilling (2013), Shepard (1987), Tether (2002), Tsai (2002), Von Hippel (2005)

	analysis of their power, interests, attitudes and legitimacy carried out to find out which ones of the stakeholders could be potential partners through expert opinions, human relationships, e-mail requests and online communities, expert opinions, human relationships, e-mail requests and online communities. Because of inadequate resources such as financial, skills and information sources, SMEs often seek for potential partners. A limitation that do not concern larger firms. To ensure the success of open innovation, they integrate an inclusion of intermediaries (facilitators) to help with the searching process into a strategy that creates value. In selecting the right partner for the collaboration, it is therefore, important that SMEs review these factors of Strategic and resource fit to define the degree to which potential partners have compatible objectives, style and resources respectively.	
Under which Conditions should SME's Invest in Open Innovation?	Knowledge availability is through collaborations of partners involved in projects and may find value in a new market or may add value if together with other markets which may launch into new products and services. A broader range of sector explore the validity of the concept in a range of open innovation adoption. As a result, open innovation identifies knowledge distributed and living in external sources including individuals, start-ups, small and large companies, universities.	Bigliardi&Galati (2016), Brunswicker & Ehrenmann(2013), Chesbrough (2003), Durst & Ståhle (2013), (et al., 2010), Van de Vrande et al. (2009), Verbano et al. (2011)
What are the advantages and disadvantages of Open innovation methods for SMEs?	It is essential for SMEs to identify and implement open innovation with the right conditions in place. Therefore, the need to test which type of open innovation model fits the firm. By leveraging their internal ideas outside their own business through external channels to market and improve organizational performance, managers of SMEs tests which type of open innovation method to identify the specific situation and which method and partner are most appropriate.	Barajas et al. (2012), Chesbrough & Crowther (2006), Dyer & Singh (1998), Enkel et al. (2009), Ferradas (2014), Fershtman & Kamien (1992), Judge & Dooley (2006), Kamien et al. (1992), Kline (2003), Kogut (1988) , Köhler (2011), Kowalski & Director (2009), Koza & Lewin (1998), Laursen & Salter (2006), Lee et al. (2010), Liao et al. (2003), Nerkar (2007), Nonaka & Konno (1998), Oke et al. (2007), Parida et al. (2012), Pukkala (2015), Quinn (1992), Reid (2004), Rosenbusch et al. (2011), Rothwell (1994), Schilling (2013), Van de Vrande et al. (2009), Van Gils & Zwart (2004), Vanhaverbeke et al. (2012),

		Yoon et al. (2016), Zeng et al. (2010)
What are advantagesand disadvantages of each open innovation partner for SMEs	Most research articles discussed the advantages of open innovation practices showing that a collaborative effort from SMEs depends on the partner chosen. Potential partners such as research centres, competitors, suppliers and Universities are advantages gain in most open innovation. Open innovative method selection criteria is essential, considering internal, external and integrated analysis of the partners. A complementary of a right balance between positive effects and negative consequences in relation to recommendations in each decision phase in creating value for customers.	Authors of this paper
How the characteristics of a company, such as size and resource base affect its ability to implement new technologies (IoT)?	Such an emergence in Information Technology, access to venture capital and a growing start-up infrastructure facilitates in the pervasive invasion with new challenges rising from the service economy. New firms speeds up and disrupts with established industry players to innovate more without necessary considering the size of the firm. Understanding the different stages within the business and uniqueness of the open innovation processes through Internet of Things interventions results in partners for sharing economy in value Co-creation through a collaborative effort. However, service businesses entail new challenges with the ability to give human resources, time, equipment and budget per process and service requirement to meet customer satisfaction	Authors of this paper (Arnold et al., 2016; Ehret & Wirtz, 2017), (Kans & Ingwald, 2016; Kowalkowski et al., 2013); (Rennung et al., 2016; Radziwon et al., 2014); (Airaksinen et al., 2015; Bundesministerium für Wirtschaft und Energie, 2014); (Ihlau et al., 2013); (Buonanno et al., 2005); s (Knight, 2000), Amit and Zott 2001; Parker et al. 2016, 2017; Stabell and Fjeldstad 1998)
Definition of Small and Medium Enterprise (SME)	SMEs' make most country's economy contribution across the globe in the past decade with various types of businesses. We derived most definitions for SMEs from different countries of the world from the number of employees, annual sales, the size of the enterprise assets or any of these combinations.	(Authors of this paper)
Definition of Internet of Things (IoT)	Various concepts embrace Internet of Things described as an enlargement of the internet, connecting the unconnected objects including billions of physical devices with unique identifiers to build system interaction, collecting and exchanging data over a network without human intervention. Internet of things aim at the embedded system devices with sensors connected objects to report in real-time, informing	Business models for the Internet of Things, Marketing Technology Center (MTC), (ongoing research project initiated 2012) (http://www.prlog.org/10467852-research-report-on-chinese-internet-of-things-industry-20102012.html Research Report on Chinese Internet of Things Industry, 2010-2012 , (Eposs 2008), Kortuem, G.,Kawsar, F., Fitton D., Sundramoorthy, V.: "Smart Objects as Building Blocks for the Internet," Internet Computing,

	decisions more to improve efficiency in the way we work, play and relate to things in all aspects of our lives.	Vol.14, NO.1, pp.44-51(2010), 5 Open.sen.se.,http://open.sen.se

Source: Anna C. Pellegrino (University of Twente) ; Authors of this paper

Table 1 Findings of literature review and sources

Basic Characteristics of SMEs in Ghana

Services	Food Vendors, Restaurants	Construction, Metal Fabrication	Wood Processing & Handicrafts	Transport and Garages
Mobile Phone repairs, Watch repairs, Television Repairs, Radio Repairs, Shoe Repairs Regeneration repairs	Fast food joints Drinking spots Baking and Pastries Fruit processing	Brick, block making and laying Stone Quarrying	Plumbing Carpentry Timber works	Mechanic and Fitting Shops
Newspaper vending	Traditional Catering	Digging wells	Furniture works	Bicycle and motor repairs
Car Washing	Roasting of yam, plantain, meat and fish	Fencing	Pottery	Taxi and Trotro operators
Barbering Shops		Electrical wiring	Batik tie & dye	Coach services
Photographing		Masonry	Traditional carvings	
Traditional Medicine		Blacksmithing	Kente weaving	
Laundry services		Sales of Iron rods Welding and soldering		
Hawking Hairdressing Dressmaking/Seamstress		Iron gates and doors Building houses		

Source: Baah-Nuakoh, A. (2003). Environment, Informal Sector and labour markets. Accra: Woeli Publishing Services.

Table 2 Classification of Informal Sector Activities in Ghana

Every type of industry including agriculture, forestry, fishing, manufacturing, transportation, mining, construction, communication, utilities, wholesale trade, services, finance, insurance, retail trade and real estate, small business exist

The key inputs and activities determined the business drivers that vary significantly for SMEs in Ghana operational and financial results are but not limited to the examples listed below

- Number of stores or locations andaverage size (i.e. square feet) per location
- Number of products sold (volume), prices of products/services sold, number of salespeople and effectiveness of salespeople
- Traffic volume to a website and conversion rate of traffic to a website
- Production rate for manufacturing, efficiency rates and downtime
- Energy and electricity costs
- Rent and office space
- Salaries and wages per employee, commissions, fees and other selling expenses
- Foreign exchange rates and commodity prices (i.e., oil, gold, etc.)

Internet of Things Characteristics

With varied definition of Internet of things (IoT), the top strategic technology trend integrated into our daily life and expected to shape business opportunities through 30 million IoT objects by 2020 as the result of the ever-increasingly advancements in Information technology[10]

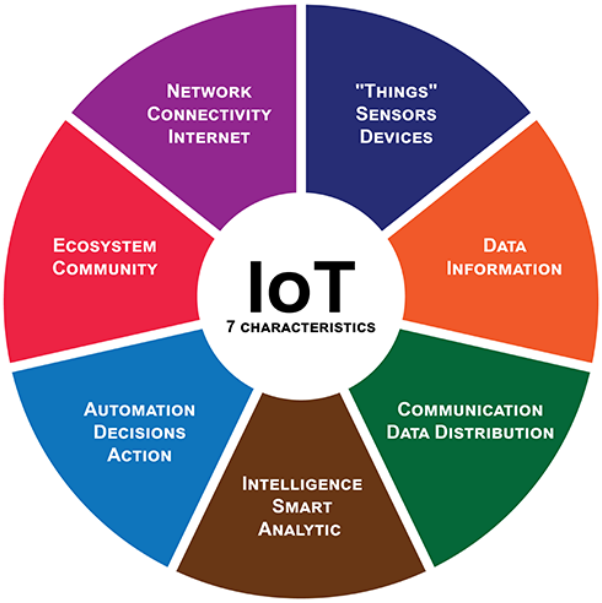


Figure 1- https://nordigi.no/index.php/en/blog/55-what-is-the-iot

An illustration of Internet of Things Characteristics

The figure 2 depicts the Internet of Things characteristics describing multiple domains due to the collection of various technologies, hence the seven crucial internet of things characteristics.

- Connectivity. - This does not need much further explanation. Devices, sensors, they need to be connected: to an item, to each other, actuators, a process and to 'the Internet' or another network.
- Things. -Anything from sensors to household appliances that is tagged or connected. Devices can contain sensors or sensing materials attached to devices and items.
- Data. - Data is the glue of the Internet of Things, the first step towards action and intelligence.
- Communication. - Devices connected so they can exchange data and the analysis of the data
- Intelligence -The aspect of intelligence as in the sensing capabilities in Internet of Things devices and the intelligence gathered from data analytics (also artificial intelligence).
- Action. -The consequence of intelligence, being it manual or automated based upon debates regarding phenomena for instance, in climate change decisions and automation, often the most important piece.
- Ecosystem- The platform dimension and the need for solid partnerships from a perspective of other technologies, communities, goals and the picture in which the Internet of Things fits.

New opportunities spring up with business perspectives receiving wide attention from various stakeholders such as researchers, other private and public industries [11].

The figure below depicts Internet of Things enabled objects (things) embedded with sensors which enables better inteaction of the connected physical world is prominent in Small and Medium Enterprises using Internet of Things innovation strategies application. This would improve the efficiency, accuracy anytime, any device, anyone, any service/any business, any network (non -homogenous) without restrictions to any location.

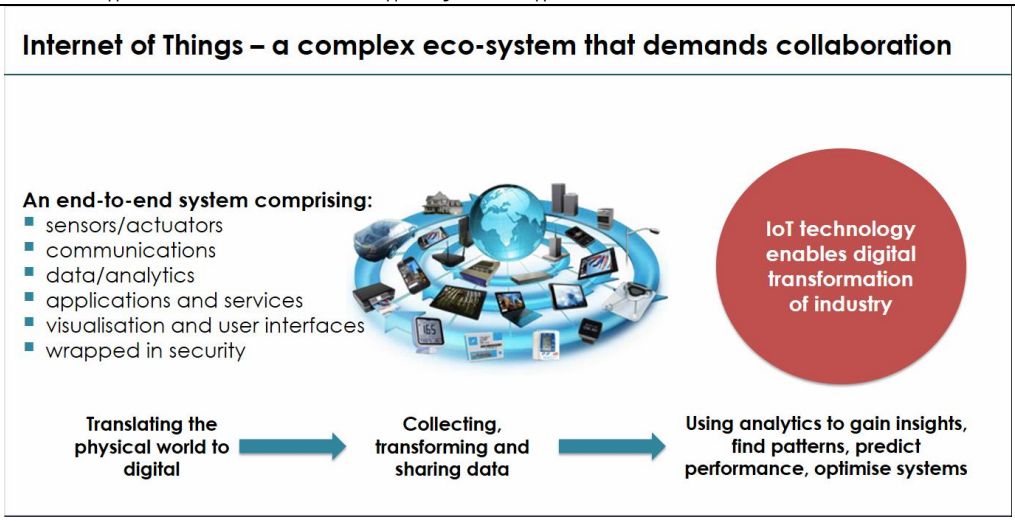


Figure 2 :www.iot.org.au/wp/wp-content/uploads/2016/12/IOTAA_PPT_23May2017.pptxMay 23, 2017 opportunity for AustraliA. @IoTAA1 @FrankZeichner. Internet of Things is accelerating digital transformation of the economy.

SMEs and Internet of Things Ecosystem in Ghana Economy

The number of employees in an enterprise less than 10 with a fixed asset including plants and machinery not exceeding 10 thousand Cedis is an adopted definition for Small-Scale Industries in Ghana, in this study [13].

SMEs adoption to new technologies and its sustainability with open innovation practices challenged by inadequate resource. In the same vein, the adoption for large businesses with more resources is different with much emphasises on corporate organisation culture no matter which type of innovation pursued on the network of services platform.[14]

Towards Internet of Things ecosystem, firms may orientate based on the guiding principles on firms interactions with the marketplace (both customers and competitors). The network service platform built as the result of strategic innovation and orientations may affect the business model adaptation.

As a result, the dynamic nature of the services facilitates rapid provisioned that makes it scalable and interactive to the service provider and customer.

Key applications of IoT for retailers include supply chain, connected consumer and smart-store applications. Retailers will bring customer experience of online shopping into the store wherever and generate data for prediction on how customers will shop.

In a smart mall, store traffic generated data, analysed across several retailers to comprehend the entire shopping journey by monitoring customer demand and supply of store traffic in real time. A rich digital marketing experience when implemented will grant the opportunity to announce events to customers via their mobile devices. Connected-consumers with their mobile devices can check from smart store's local inventory levels and in-store pricing. Also, a proactive response is possible with IoT connectivity to customers' needs and incentive to purchase goods and services with ease of identification to customers' location and time in context.

RFID integrated into warehouse management will provide accurate service-level optimisation in monitoring sales in a typical distribution center or warehouse in real time to achieve an automated open space.

Among smart transportation is moving merchandize more to keep up with transport, tracking a route optimisation. Much higher accuracy got with Internet of Things than using GPS to track and route trucks in the recent past.

In logistics, the embedded sensors enabled to know the status of shipment besides improving final delivery times with better trajectories calculations and the overall customer experience at less cost of delivery using optimal routes

Predict maintenance issues that might affect power consumption for savings or monitor temperature fluctuations to ensure safety goods and services achieved by predicting equipment failure and detecting issues related to complex equipment with integrated sensors used by manufacturers and retailers.

Collection of the intelligent data created from the preferences of customers integrating from various departments including manufacturing, distribution and marketing as the result of the real application and an advance of Internet of Things yields value Co-creation to launch new products and services.

Internet of Things applications have in common the connectivity of systems to streamline energy consumption management, supply chains an enhance customer insight on an automated comprehensive dashboard of all-important information generated by Internet of Things ecosystem.

Value Co-Creation Process adoption for SMEs with Internet of Things Innovation Strategies

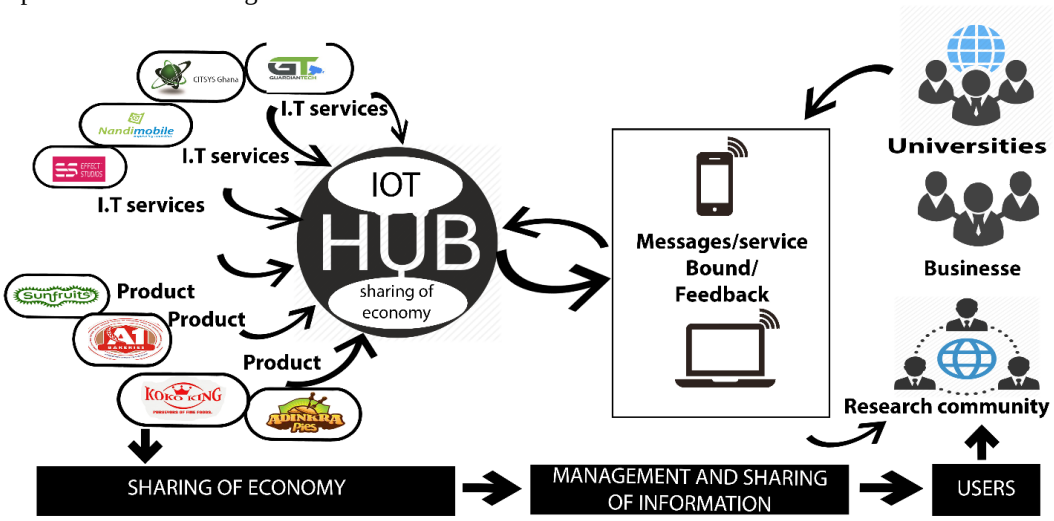
In relation to the level of integration, the firm orientation based on the ecosystem differentiation knowledge processing, small medium enterprises play a significant role.

Depending on the internalisation of external knowledge and externalisation of internal knowledge, the network actors of stakeholders should enjoy value Co-creation with Internet of things innovation strategies.

When implementing the innovation strategies of Internet of things, systems with embedded sensors built an inter-related network of Co-creation platform to control and sustain the value chain in a sharing economy.

With the constraints that SMEs face, Internet of Things open innovation strategies provides them with many opportunities such as flexibility, scalability, business agility and overall cost-reduction in business operations.

The figure below describes the various SMEs sharing economy through IoT ecosystem develop through open innovation strategies.



Most researchers recommend that open innovation gives way to new opportunities for all flavours of SME, from start-ups to players in both traditional markets and high-tech markets without having the required technologies in-house. An articulated understanding (dialogue with transparency) of participant and stakeholders involving various flavours of SMEs both public and private sectors, customers, wider business opportunities and local community interests connected with an Internet of Things ecosystem and a strong legal framework and management foundation in place.

With much openness in the ongoing collaboration and access to knowledge, risk benefits among others, stakeholders will benefit from a successful implementation of Internet of Things ecosystems in the national and internationalmarket, which is the expected outcome.

IoT Engagements

The focus on a mix of major types of offerings in delivery of products and services progresses as the devices become more complex and their connectivity increases from Endpoints to Enhanced Services. More innovative ways of diverse opportunities translated in the process such as building Simple hubs, Integrating hubs, Network and Cloud services providing more technological offerings.

To assess the business environment for enterprises to develop the capabilities of integrating diverse portfolios of services in establishing business relations as a result analysing volume, veracity velocity of data generated by Internet of Things ecosystem. The value in Internet of Things would create more opportunities in existing innovation processes through the change of customer experience for people in businesses to experiment and learn to build capabilities in relationships of people in businesses with different cultures. A collaborative effort by these three (3) Es' (Enhancers, Engagers and Enablers)to gain insights from the wealth of new data that the Internet of things provides against the proposed revenue model and income stream.Thus, enterprises

overwhelmed by competitors with unique Internet of Things-related capabilities risk moving in to the various engagements at once.

Below are the importance of services available through the Internet of Things strategy models of Enablers, Engagers, and Enhancers. The process of innovation and the co-creation[12]. The terminologies raise interdependencies among the diverse stakeholders in managing innovative strategies

Exhibit 1: **Services Available through the Internet of Things**

This list of IoT services is arranged on two critical dimensions. The horizontal rows (from *monitor* at the bottom to *optimize* at the top) represent the value delivered to customers, in order of complexity. The columns (from endpoints to enhanced services) represent the technologies of the IoT as described in this article, in increasing complexity from left to right. (Network and cloud services are not shown because they are not typically oriented to end-users.)

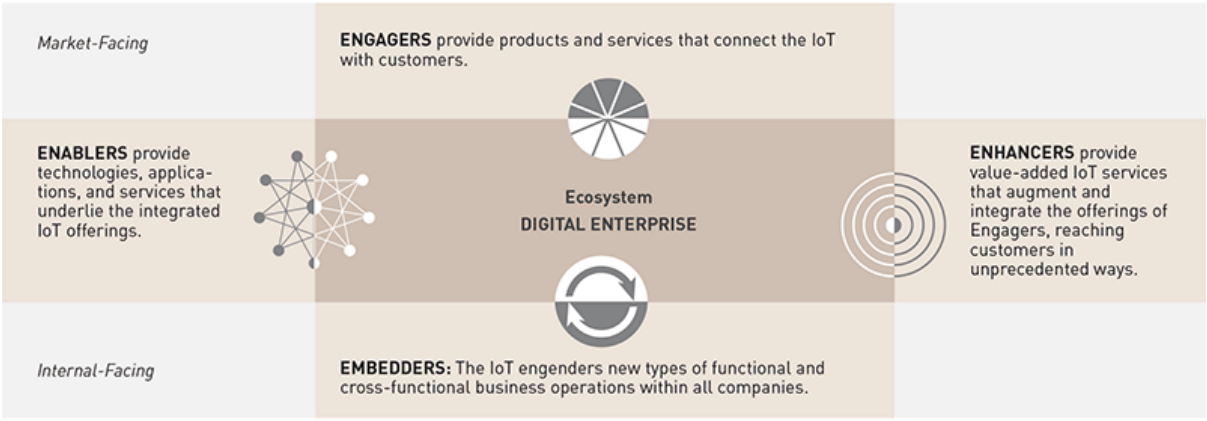
NO/CLOSED NETWORKS	INTERNET OF THINGS			
	Endpoints	Simple Hubs	Integrating Hubs	Enhanced Services
Optimize			GE Software Predix and other industrial platforms for interconnecting analytics engines and business operations Large-scale digital city systems like those under development at MIT and in Barcelona	
Adapt	Stand-alone GPS navigation devices	Progressive Snapshot and other auto insurance telematics systems Smartphone apps that use location tracking	Apple HomeKit and other protocol-based platforms allowing diverse devices in a building to interconnect to one another and the Internet	Emerging systems for setting insurance rates based on health and driving behavior
Control	Motion- or light-responsive alarms and controls	Google Nest and other Internet-connected systems for heating, cooling, and ventilation Estimote Beacon, iBeacon, and other Bluetooth-enabled object identification sensor systems	WeMo and other systems for controlling lights and appliances through remote or mobile devices	Potential connected-car traffic management systems
Monitor	Simple thermo-stats and motion sensors	Jawbone UP, Fitbit, and other fitness activity sensors and hub systems	BodyGuardian and other medical wearables that feed data to online diagnostic platforms	

Source: Strategy&

Figure 5

Exhibit 2: **The IoT Ecosystem**

The overall IoT market will be divided among Enablers, Engagers, and Enhancers. These three kinds of companies will interact, working together to provide the technology and services needed by all—both to market the IoT and to deploy it for their own operations.



Source: Strategy&

Figure 6:https://www.strategy-business.com/article/00294#embedding

IoT Data processes

The sprawling set of Internet of Things technologies described as a network-connected devices, embedded in the physical environment, to improve some existing process or to enable a new scenario. A variety of new services created because of data gathering from many objects collected analysing and utilising in data centres.

With connected SMEs, for example, by collecting, analysing and utilising data from various SMEs (start-ups to medium enterprises) in real time, it will be possible to improve businesses to the International market through sharing economy with value Co-creation.

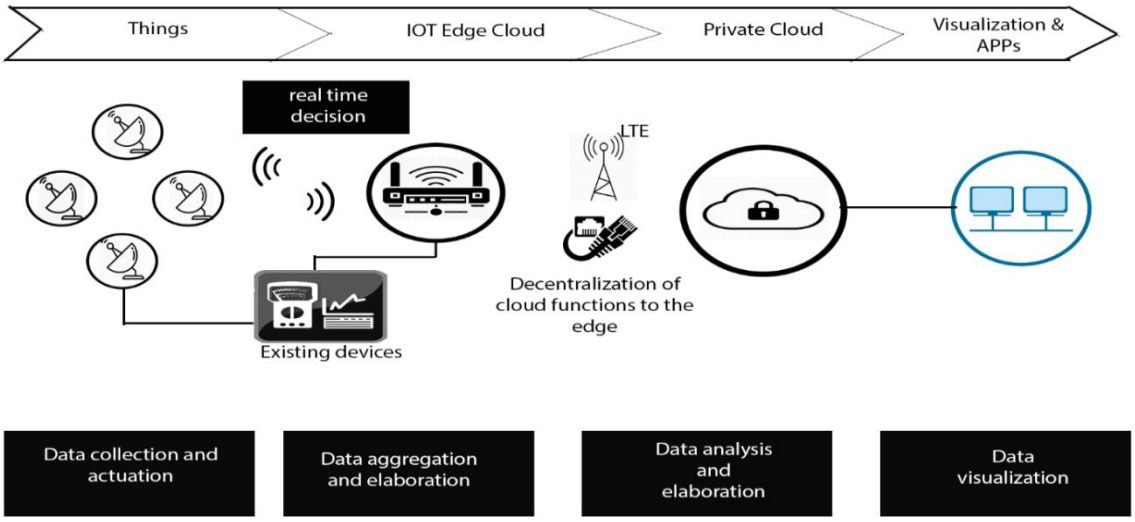


Figure 7

IoT open Innovation Strategies to build business Ecosystem

Open innovation strategy for IoT ecosystem adoption requires all stakeholders to interact on a value Co-creation platformInvolvement Strategy: an invitation on the IoT ecosystem platform to the customers and providers to maximise profit- It involves Co-experience & Co-definition process to achieve economies of Scale. The concern here is the number of customers and providers (stakeholders) are "getting on board" to maximise profit.

Curation Strategy-In relation to economies of scope. Is to collect, select, analyse, edit and re-examine content and meaning of existing products and services. An information on customers and providers to put a new interpretation and also give a new meaning to them (continuous innovation) which facilitates value Co- creation process involving all stakeholders (i.e. customers, service providers, information and IoT technologies.)

Empowerment Strategies of stakeholders: Customers take part by lifting their aspirations level while so are providers by referring to their capabilities of providing service. Thus promoting Co-elevation and Co-development process through cross business analysis involving economies of skill.

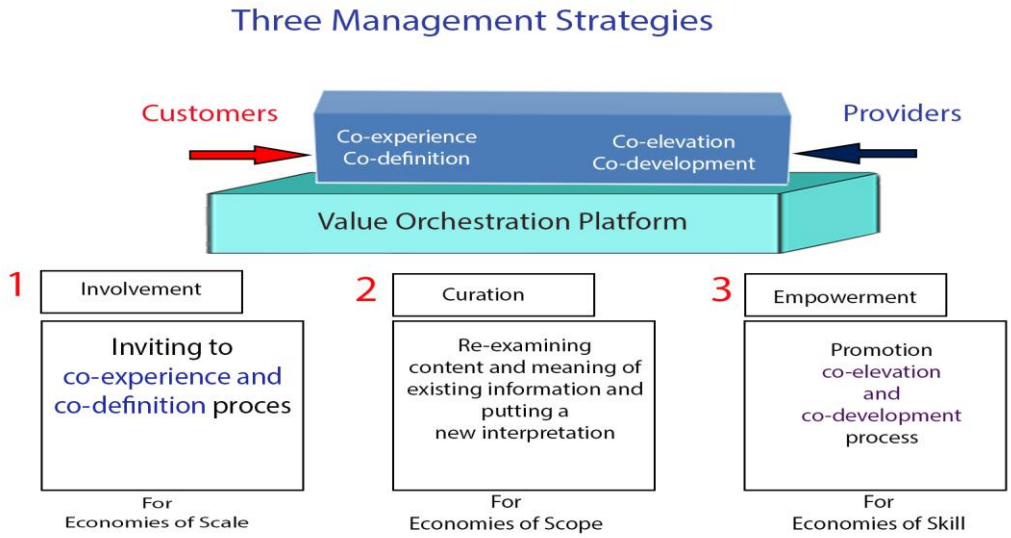


Fig 8: Describes the three management strategies.

The Internet of Things open Innovation adoption challenges in Ghana

The challenge is that an attempt to create an environment that encourages user innovation in the Internet of Things platform implementation is difficult in building ecosystems. An outlineof the characteristics of business and engineering seeks to compel Internet of Things platform, which requires big players to work with small players, start-ups support services. Internet of things technologies streamlined across boundaries to unlock new business models built through government, business and citizens of Ghana exchange data. Focus on sectors on the economy of Ghana to enhance food and agribusiness, water, energy, transport and smart cities to build on Ghana's natural resources through collaborative sharing economy platform and breakdown of unnecessary regulatory boundaries that inhibit innovation among SMEs

When SMEs areexposedto the ecosystem platform will maximise adoption and innovation supported by collaborating and sharing of user-generated artifacts, identify new business models related to smart objects or things to facilitate and support SMEs within the ecosystem via data generation and exchange of user data between systems. Then Interoperability of Internet of Things becomes an issue when handling an integration of sensors and actuators and smart objects components and products from different vendors

Various players from different platforms may cause many devices not to integrate with each other regarding the use of Internet of Things ecosystem. To reduce the difficulty in that interoperability it requires an open infrastructure of any hardware or software to connect and exchange data promote real-time decision making in SMEs.The IoT open innovation coupled with management strategies guide to deploy a proposed solution in the Agriculture sector of the Ghanaian economy.

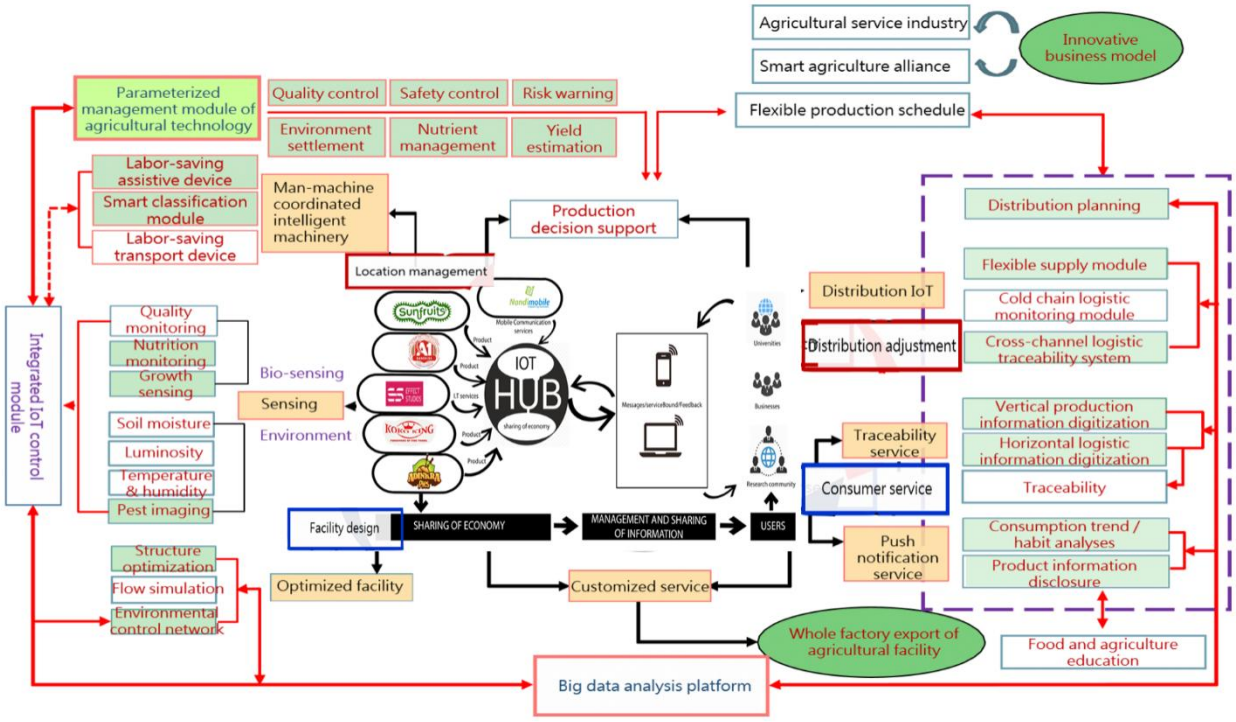


Fig 9: IoT open innovation coupled with management strategies guide to deploy a proposed solution in the Agriculture sector of the Ghanaian economy**.**

Expected Results-Value of Internet of Things in Business Strategy

The expectation is a sharing economy or demand economy, a special case of platform economy with most advanced algorithm of Internet of Things open Innovation strategies. Considering, the criteria of selecting partners with smart or intelligent devices, SMEs play a significant role in the business ecosystem (both internal and wider ecosystem). Much focus on system integrators for start-ups to enhance market growth in a sustainable development in a more viable and evolving business environment to empower citizens through learning and sharing of skills, innovate services and improving time to market.

Conclusion

The emerging trend driven by market forces to implement and utilise open innovation practices of which most SMEs must adopt for local and global competitiveness is the seamless and adaptive technologies of Internet of Things. SMEs in Ghana are required to advance in technology-enabled services in addition to e-mail,

social network platform/ social media and websites and broadband communications.

An integration platform to house hardware, software and embedded sensors capabilities to provide one or more SME's back-end systems including their supply chain management, warehouse management, customer support, payment or other applications which trigger notifications or full business processes automation to enhance products and service delivery. In view of the proposed solution in the Agricultural business industry, a collaboration to produce a value Co-creation outcome via Internet of Things open innovation strategies brings the sharing economy strategy platform for all stakeholders.

Therefore, to meet the ever-increasing demand of SMEs services at the local and global market with innovative business models and strategy in the Ghanaian perspective is to adopt Internet of Things strategies with Open Innovation practices such as business incubators, accelerators and technology parks.

Acknowledgement

This research paper would not have been possible without the support of the members of Faculty of Information Technology and Communication Studies, especially, Dr. John Bosco Damnyang, the Dean of the faculty and Dr. Godfred Akrofi, Head of Information Technology Department of which we are very grateful.

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