A Typology of Big Data Capabilities from Resources to Dynamic Capabilities. Evidence from a Ghanaian Health Insurance Firm.

Full Paper

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Abstract

Big data is generating a lot of interest across different industries, with firms seeking to leverage big data to obtain enormous benefits. In the health insurance industry, especially in developing countries, there are efforts to use big data to increase healthcare access and at the same time reduce cost. Despite these efforts, there is a lack of literature on how to develop big data capabilities. Conceptually, the typology of capabilities has been suggested to follow a hierarchical order from resources and finally lead to dynamic capabilities in firms. This research examines the typology of big data capabilities in a health insurance developing country firm, to achieve dynamic capabilities from resources.

Keywords

Big data, big data capabilities, health insurance, dynamic capabilities, resources

Introduction

Big Data has become the oil of today’s world with about 2.5 exabytes (billion gigabytes) of data created every day (IBM 2011). The enormous potential that big data presents has led to a surge in big data academic and practitioner literature (Boyd and Crawford 2012). Despite the surge in big data literature, big data is still relatively an under-researched area (Kwon et al. 2014). Much of the research on big data have focused on the technical perspectives of big data, the benefits and challenges of big data and the attendant hype associated with big data (Boyd and Crawford 2012). These research are often silent on how firms develop big data capabilities. The lack of this knowledge often makes it difficult for non-adopters to chart their way through the darkly waters of big data (Kwon et al. 2014).

In industry, big data is generating a lot of interest across varied domains such as banking, telecommunications, commerce and health insurance (Shim et al. 2015). In health insurance, firms are trying to leverage big data to increase healthcare access and reduce cost (Srinivasan and Arunasalam 2013). The use of big data in health insurance makes it necessary for health insurance firms to develop big data capabilities to manage and analyse medical insurance claims data for insights, timely data-driven decision making and the development of new customized insurance products as well as new market opportunities. In developing countries, access to data on medical insurance claims by health insurance firms is crucial to ensure the sustainability of health insurance firms (Wyber et al. 2015). This makes it important for developing country (DC) health insurance firms to understand how to develop big data capabilities.

In addition, the research is opportune, as there have been growing interest in capability development research from a DC perspective. The work of Boateng (2016), as well as Budu and Boateng (2015) attests to the application of the dynamic capabilities framework to explore capability development in emerging technology research areas like e-commerce and mobile business in DCs. The authors echo
that, future research should explore the use of the dynamic capability framework to examine the
development of capabilities in other IS emerging technologies such as big data. Furthermore, several
authors have suggested that the typology of capabilities in firms can be conceptualized as a
hierarchical order of capabilities, beginning with resources and combining the resources along the
hierarchy to achieve dynamic capabilities in firms. This research, therefore, intends to look at the
typology of big data capabilities using the hierarchical order to developing dynamic capabilities from
resources.

The purpose of this research, therefore, is to examine the typology of big data capabilities in a health
insurance DC firm using the hierarchical order to developing dynamic capabilities from resources.

Conceptualizing Dynamic Capabilities From Resources

Dynamic capabilities are responses to the need for change or new opportunities, and the changes can
take many forms (Ambrosini, Bowman and Collier 2009). The change may involve the transformation
of organizational processes, allocation of resources, and operations. The changing allocation and
utilization of resources is a critical part of dynamic capabilities. These resources—which are assets and
capabilities—can include human capital, including managers and employees, technological capital,
knowledge-based capital, and tangible-asset-based capital, among others. Several authors in trying to
identify dynamic capabilities have suggested that dynamic capabilities result out of a hierarchical
order of capabilities (Collis 1994; Winter 2003; Zahra et al. 2006; Wang and Ahmed 2007; Ambrosini
et al. 2009). Combining the hierarchical levels of the various authors suggest a four-level hierarchy by
which the typology of capabilities can conceptualized from resources to obtain dynamic capabilities.
Table 1 shows the four-level hierarchy level to the typology of capabilities from a resource level to a
dynamic capability level.

<table>
<thead>
<tr>
<th>Hierarchical Level</th>
<th>Action (What happens)</th>
<th>Resulting State</th>
<th>Applicable Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>First-order Capabilities</td>
<td>Firm shows ability to combine resources to achieve a desired goal.</td>
<td>Capabilities with a goal</td>
<td>Wang and Ahmed (2007); Collis (1994); Zahra et al. (2006)</td>
</tr>
<tr>
<td>Second-order capabilities</td>
<td>First-order capabilities are bundled together and given a strategic direction by the firm</td>
<td>Core Capabilities</td>
<td>Wang and Ahmed (2007); Collis (1994); Zahra et al. (2006)</td>
</tr>
<tr>
<td>Third-order capabilities</td>
<td>Firm pursues the reconfiguration, renewal, and re-creation of resources, capabilities and core capabilities to handle firm environmental changes</td>
<td>Dynamic Capabilities</td>
<td>Collis (1994); Winter (2003); Zahra et al. (2006); Wang and Ahmed (2007); Ambrosini et al. (2009)</td>
</tr>
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Table 1. The four level hierarchy to the typology of capabilities from resource level to dynamic capability level (Source: Author's Construct)

The Need for a Typology of Big Data Capabilities

The nature or dimensions of big data capabilities have been variously discussed through the literature
(Kwon et al. 2014; Wamba et al. 2017; Akter et al. 2016; Gupta and George 2016; Wang and Hajli
2017). The literature depicts big data as having a multidimensional perspective to big data
capabilities. The different dimensions give rise to big data capabilities having a typology of several
capabilities. Three key studies in the literature see big data capabilities as having a hierarchical order
of sub-capabilities which culminate into other capabilities as they combine or are configured into
other higher order capabilities (Wamba et al. 2017; Akter et al. 2016; Gupta and George 2016). Table
2 shows the three key studies and the research gaps identified in their hierarchical order of big data
capabilities.
A Typology of Big Data Capabilities

Using RBV and sociomaterialism, Wamba et al. (2017) perceive big data capabilities as a third-order capability construct consisting of the second-order capabilities - Infrastructure Flexibility, Management Capability and Personnel Expertise Capability. Connectivity, modularity and compatibility are considered as the first-order constructs that make up the Infrastructure Flexibility. Planning, investment, coordination, and control are seen as first-order constructs that make up the Management Capability. Personnel Expertise Capability is also seen as consisting of the first-order constructs technical knowledge, technology management knowledge, business knowledge and relational knowledge. The authors further acknowledge that dynamic capabilities in firms can be achieved if big data capabilities is formed at the third-order capability construct. However, the authors fail to look at the zero-order constructs (i.e. the resources) (Winter 2003; Wang and Ahmed 2007) that come together to form the first-order constructs which subsequently leads to the second-order constructs and finally big data capabilities as a third-order construct. This neglect of the zero-order constructs (i.e. the resources) may be due to the positivist approach used in the study by Wamba et al. (2017). Since, the positivist approach is quite objective in its approach compared to a critical realism philosophical stance which looks underneath the layers of the reality to ascertain causal mechanisms and the nature of the reality that is observed (Mingers et al. 2013).

Akter et al. (2016) also using RBV and sociomaterialism suggest that big data capabilities are a higher-order capability and a multi-dimensional construct. The authors indicate that big data capabilities have management capability, talent capability, and technology capability as second-order capabilities. The technology capability is suggested to have the same first-order capabilities as the infrastructural capability suggested by Wamba et al. (2017). The management capability has the same first-order constructs as the management capability suggested by Wamba et al. (2017). The talent capability also is suggested to have the same first-order constructs as the personnel expertise capability suggested by Wamba et al. (2017). The authors also admit that dynamic capabilities in firms can be achieved if big data capabilities are formed at the third-order capability construct. Akter et al. (2016) also fail to consider the zero-order constructs (i.e. the resources) (Winter, 2003; Wang and Ahmed 2007) that come together to form the first-order constructs which subsequently leads to the second-order constructs and finally big data capabilities as a third-order construct.

On the other hand, Gupta and George (2016) using the resource-based theory suggest that big data capabilities are of a hierarchical order typology consisting of tangible resources, human skills and intangible resources as first-order capabilities. The tangible resources are perceived at the resource level (zero-order construct) as consisting of internal data, external data, big data technologies such as Hadoop and NoSQL as well as other basic resources such as time and investments. Human skills at the resource level are made up of managerial skills in the form of analytic acumen and technical skills such as big data specific training and education. The intangible resources at the resource level (zero-order construct) consist of the data-driven culture as well as the intensity of organizational learning that a firm possesses in relation to big data. Gupta and George (2016) view of big data capabilities fails to acknowledge that resources are not static but dynamic and do change into other capabilities as they are combined or reconfigure. The authors also fail to realize the dynamic nature of resources that combine and reconfigure over time to lead to dynamic capabilities in firms. These gaps identified

Table 2. Key studies using a hierarchical model of big data capabilities and their research gaps (Source: Author’s Construct)

<table>
<thead>
<tr>
<th>Study</th>
<th>Theory Used</th>
<th>Analysis Type</th>
<th>Research Gaps</th>
</tr>
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<tbody>
<tr>
<td>Wamba et al. (2017)</td>
<td>Resource Based View (RBV), Sociomaterialism</td>
<td>Hierarchical Model</td>
<td>The study fails to start the big data capability hierarchical order from the resource level. However, the study sees capabilities combining and leading to dynamic capabilities in firms.</td>
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<td>Hierarchical Model</td>
<td>The study fails to start the big data capability hierarchical order from the resource level. However, the study sees capabilities combining and leading to dynamic capabilities in firms.</td>
</tr>
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<td>Gupta and George (2016)</td>
<td>Resource Based Theory (RBT)</td>
<td>Hierarchical Model</td>
<td>The study starts the big data capability hierarchical order from the resource level. However, the study sees the resources as being static and not dynamically changing.</td>
</tr>
</tbody>
</table>
might be due to the fact that the resource-based theory (RBT) considers a static view of resources instead of the dynamic view of resources. The dynamic view of resources is what leads to firms achieving dynamic capabilities.

The research gaps identified in the hierarchical order view of the three key studies indicate the need to have a new typology of big data capabilities. The new typology needs to combine the strengths of the three studies in looking at the typology of big data capabilities. This new typology of big data capabilities must start from the resource level (zero-order construct) move through the first-order capabilities, to the second-order capabilities and finally lead to third-order capabilities at which dynamic capabilities can be achieved in firms. The next section looks at the new typology of big data capabilities.

**The Typology of Big Data Capabilities**

Big data can be seen as a socio-technical reality based on its definition by some authors. Boyd and Crawford (2012) defines big data as a cultural, technological and scholarly phenomenon which interplays on: technology (e.g. the optimization of computation power and the precision of algorithms to gather, analyse, link, and match large data sets), analysis (e.g. data pattern identification for economic, social, technical, and legal claims), and mythology (e.g. the widespread belief that ‘big data’ offers a higher level of generating valuable insights).

The various big data capability dimensions from the literature also suggest the socio-technical nature of big data. The infrastructural capabilities, technology capabilities, and tangible capabilities seem to depict some technical dimensions of big data (Wamba et al. 2017; Akter et al. 2016; Gupta et al. 2016). The management, human skill, personnel and intangible capabilities or resources seems to suggest some social dimensions of big data (Wamba et al. 2017; Akter et al. 2016; Gupta et al. 2016). The social dimensions of big data capabilities can be also be looked at from the firm perspective or human skills perspective. This gives rise to seeing some dimensions of big data capabilities in the form of organizational capabilities and human skill capabilities with respect to a firm.

Based on the socio-technical nature of big data and the big data capability literature, this research proposes that three sub-dimensions of big data capabilities exist as second-order capabilities or core capabilities in the typology of big data capabilities.

The technological capabilities are a bundle of the firm’s big data infrastructure as well as the big data technologies and their related technological activities or tasks that are strategically key to the benefit of the firm at a particular time. Big data is centered around large datasets, data management technologies, database technologies, network technologies, and their related activities or processes that help in sourcing, acquiring and processing the datasets (Yaqoob et al. 2016; Chen, Mau and Liu 2014). These technologies and technical processes are key to the big data technological capabilities of a firm. Furthermore, the data analytics of the large datasets gives rise to analytical technologies and processes that are central to the big data technological capabilities that a firm must possess if value or insights are to be derived from big data. The technological capabilities of big data thus comprise of the big data infrastructural capabilities of the firm, the data management capabilities of the firm and the analytical capabilities of the firm as first-order capabilities. The resources of the various first-order capabilities of the technological capabilities and how they combine to move up the hierarchical order are shown in Figure 1.

The human skills capabilities are a bundle of the related big data personnel skills which when strategically focused will yield to the benefit of the firm at a particular time. Three main groups of skill sets are required to handle the big data systems. These skill sets are, IT skills needed to manage databases, systems, networks and offer IT support to staff and stakeholders (Gupta and George 2016) within the firm in relation to big data; data science skills (Dhar 2013) for generating descriptive, diagnostic, predictive and prescriptive analytics and; business analytic skills (Phillips-Wren et al. 2015) to help communicate generally the business implications of results derived from the analytics of the data. These skill sets show that the human skills capabilities comprise of the three first-order capabilities namely IT skills capabilities, data science capabilities and business analytic capabilities. The different resources and capabilities of the various first-order capabilities of the human skills capabilities and how they move up the hierarchical order are shown in Figure 1.

Organizational capabilities refer to the capacity of a firm to perform a set of coordinated task by making use of its resources to achieve particular results at the end (Helfat and Peteraf 2003).
implies, the need to manage the big data related assets and capabilities or resources as well as create a condition within the firm that fosters the success of the big data system.

The management aspects of the big data assets and capabilities just like in IT capability research (Kim et al. 2011) can be referred to as management capabilities. Beyond the management capabilities lies the need to build organizational cultural capabilities which will ensure conditions that foster the success of the big data system. Data-driven culture and organizational learning (Marfo and Boateng 2016; Gupta and George 2016) capabilities are sets of capabilities which can create conditions that foster the success of the big data system in the firm. Another important set of capabilities which is essential to boost confidence, trust and eventual success of the big data system of the firm is data privacy and data ethical capabilities. Data privacy and data ethics in keeping data confidential and transparent are at the heart of big data and must carefully be handled given the sensitivity of the data.
that big data brings. For these reasons, organizational capabilities in this research are seen as a bundle of the management capabilities as well as capabilities that sustain a big data organizational culture as well as ensure data privacy and ethics which is key in ensuring that the big data system is continually successful. The organizational capabilities thus consist of three first-order level capabilities namely management capabilities, organizational cultural capabilities, and data ethical capabilities. The various resources that make up the resource level of the various first-order capabilities of the organizational capabilities are shown in Figure 1.

Methodology

A critical realism (CR) philosophical stance and qualitative methods were used to unearth structures and mechanisms of big data capabilities (Mingers et al. 2013). CR in IS research argues that big data capability constituents are not apparent in the observable pattern of events, and can only be identified through practical and theoretical work. Case study and qualitative methods are one of the best approaches to unearth structures and mechanisms in a reality (Easton 2010). Thus, the study employed a case study research design with a qualitative research methodology.

A Ghanaian private health insurance firm - Nationwide Medical Insurance- which is currently implementing a big data system was used for the case study. The sample units for the study were determined after a pilot study at another private health insurance firm which was considering to adopt big data. The units of analysis were made up of the staff in the Information Technology (IT), Claims, Business Development Unit (BDU), Actuarial, Membership, Health Service Providers (HSP) Unit in the health insurance firm. Other units of analysis were the management, technology suppliers and healthcare service providers (i.e. hospital, pharmacy, dental and laboratory staff) of the health insurance firm.

The study employed the use of interviews, focus group discussions and observations for data collection. The interviews and focus group discussions consisted of open-ended questions focusing on the various dimensions in the typology of big data capabilities in the health insurance firm. The questions sought to examine what is causing the various dimensions to be seen. This helped to examine the sub-dimensions being observed. Two (2) IT staff, two (2) BDU staff, two (2) Actuarial unit staff and three (3) top management staff including the CEO of the firm were interviewed. In addition, two (3) technology suppliers and four (4) healthcare service providers were also interviewed. The focus group discussions were conducted in the Membership and HSP units of the firm. It consisted of three (3) sets of focus group discussions with each group consisting of three (3) staff members of the firm. In total, twenty-five (25) people were engaged in the interviews and focussed group discussions. The interviews, focus group discussions and observations were supplemented with documentary evidence.

To analyze the qualitative data obtained, Miles and Huberman’s data analysis approach which uses an iterative process of data collection, data display, data condensation and conclusion drawing was used (Miles, Huberman and Saldana 2013).

Evidence from Nationwide Medical Insurance

Nationwide has over the years managed the data of its health insurance claims from its service providers through its intranet based software called NatMed. The claims inputted into the intranet software took almost 90 days to convert from manual papers into digitized form for a given batch of claims. After the claims’ digitization, adjudication was done to detect fraud and subsequently payment was carried out. This voluminous task was as a result of the large volumes of the varied type of claims data that, Nationwide received from its 521 health service provider (HSP) network. This made analytics performed on the digitized data mostly outdated and not reflective of the real case on the ground. Besides, the varied nature of data from the different service providers, the large volumes of the data compounded the difficulty in fully handling the analytics associated with the digitized data. This made it difficult for the firm to expand its services from corporate institutions to the general public for fear of not being able to control the services they offer to such customers. Monitoring of claims utilization, plans, benefits and exclusions of the general public was impossible to handle due to the lack of control and monitoring systems on the ground. In addition, the sheer volumes of data to be collected in varied forms from varied service providers, with different conditions to enforce further aggravated the problem if the general public was brought onboard. The IT head commented on this by saying that;
“Our processes were causing us to change with our members increasing and we couldn’t go on entering claims manually, that means we had to increase our overhead costs at the claims unit. Healthcare cost kept increasing with the need to monitor attendance, cost and adjudicate claims. Industry wise the market was choked and we needed to change our portfolio by going after the ordinary person in the public. To do this we needed a system to handle all these challenges and more.”

To overcome the problem, Nationwide in 2014 adopted a big data system to identify, collect, store, manage and analyze data from its varied service providers. Nationwide subscribed to a big data insurance claim system called Rx Claim which integrates with its NatMed system used within the intranet of Nationwide. The solution involved the setup and integration of the Rx Claim system at Nationwide’s health service providers end through relevant APIs as well as a web based platform. Given the developing country context where constant internet availability was not readily assured, management demanded that the Rx Claim system should be able to work both online and offline (O2O) mode simultaneously. This demand of (O2O) was met by the developers of the Rx Claim system.

The Rx Claim system based on certain protocols exchanges data in real-time between Nationwide’s NatMed system and its service providers using APIs and web services. The data collected comes as structured, semi-structured and unstructured. The structured data includes membership data - corporate, family and individual data-, health plans and benefits data, disease diagnosis related data, drug prescription data, HSP payment and claims data, WHO generics, therapeutic areas, ICD 10 and ATC coding data. The semi-structured data mainly comes in the form of XML and JSON. It includes disease adjudication rules, multiple diagnosis data, dental related data from HSPs, log files from HSPs, GPS data from mobile application, SMS data, member feedback data and mobile clicks data by members. The unstructured data includes diagnostic document data, laboratory document data and medical notes document data. The data uses both RDBMS and NoSQL databases to handle the data. The RDBMS consist of MySQL and Microsoft SQL. The NoSQL databases consist of Google’s Big Table and Oracle’s MySQL 5.6 with NoSQL support and mainly hosted in the cloud, due to the high cost of setting up data centers at Nationwide and the need for Nationwide to focus on its core business instead of focusing on technology.

The system does real-time validation checks, fraud detection, benefit limit enforcement as well as real-time analytics at the HSP’s end and at Nationwide’s end. This led to great improvement in the data analytics that Nationwide carries out. Furthermore, for each claim submitted on behalf of a member by an HSP, an SMS of the visit summary is sent to the member. In addition, Nationwide through the Rx Claim system introduced a mobile application and a web-based internet version of the system which is used by members on nationwide health plans to check their health and insurance records in real-time throughout the entire country. The mobile application gives members, the ability to interact with HSPs and the insurance firm in real-time. The mobile application, predictively suggests the nearest service providers to members as well as give them value added services such as descriptive, diagnostic, predictive and prescriptive analytics on a member’s health in real-time. The big data system has greatly improved the payment of insurance claims to HSPs and the collection of insurance premiums. The big data approach has greatly given Nationwide the much-needed value it requires to dominate the dynamic market space in the Ghanaian health insurance industry.

Nationwide as a result of the big data system and its integration with the internal NatMed system, had to go through the development of big data capabilities by acquiring certain big data technologies and modifying its technical processes. Some of the technologies have involved using and reconfiguring existing infrastructure owned by Nationwide, to handle the big data system. In other cases, Nationwide has had to acquire new infrastructure such as cloud computing systems with Hadoop support to deal with the big data.

The development of the big data capabilities has led Nationwide to acquire new human skills by upgrading the skills of its existing staff as well as employ the skills set of other people. The development of data science capabilities and business analytic capabilities has been very challenging for Nationwide. This is as a result of the acute shortage of data science skills on the Ghanaian market. A participant of one of the focus group discussions commented on this by saying; "...NoSQL has been around for long but a lot of schools in Ghana, do not even know it or let alone teach it. We need data scientist who can manipulate NoSQL databases. Maybe, it is high time the schools change their curriculum to teach NoSQL. NoSQL is the future of databases."
Due to the shortage of data science skills, Nationwide had to outsource its needed data science skills to a third party. Though business analytic skills exist within Nationwide, they are embedded or scattered in different departments namely IT, Actuarial and BDU. Health insurance industry domain knowledge is one skill set that the CEO of Nationwide emphasizes that business analyst and data scientist must have to be useful to the firm.

Nationwide in developing big data capabilities, had to develop certain organizational capabilities such as the reliance of the firm on data from the Rx claim system to make real-time decisions. This led to Nationwide creating a data-driven culture as well as develop organizational learning capabilities using big data. Nationwide as a result of the big data system also created a greater awareness in the firm for data privacy, transparency, and confidentiality. This was key due to the sensitive nature of the health data as well as data collected from members through the mobile application. It also created new policies to govern its big data capture and use at the HSPs end and in the use of the mobile application by its members. Managerially, Nationwide’s top management created a culture which pushes for more creativity and investment in big data related innovations. Management also pushed for staff to make use of the innovations. This managerial approach greatly helped the big data system to succeed. From the case study and the proposed typology of big data capabilities in Figure 1, discussion and analysis are done in the next section.

Discussions

Technological Capabilities

For a firm to form technological capabilities as a core capability of big data capabilities, it’s imperative that the resources should be targeted towards achieving a specific goal in the firm as stipulated by Wang and Ahmed (2007), Collis (1994) and Winter (2003). This ensures that the resources assume first-order capabilities which have the potential to improve performance in the targeted area. For example, Nationwide had to seek an O2O network mode technology to ensure that, the network and system availability is always assured, given the developing country setting where internet availability is unreliable. Moving on from there, Nationwide had to collectively through strategy ensure that, its first-order capabilities -infrastructural capability, data management capabilities and analytical capabilities- work hand in hand to surmount its large volume of data problem, as well as ensure real-time delivery of data, data accuracy, and real-time analytics. This movement from first-order capabilities to the bundled core capabilities like the technological capabilities is affirmed by Wang and Ahmed (2007), Collis (1994) and Zahra et al. (2006). For example, to achieve this, different capabilities like the predictive analytic techniques, had to be used by Nationwide to help clean the data whilst the O2O network mode ensured system availability, whiles the data sharing capabilities ensured that users provided feedbacks which go back to improve a member’s prescriptive analytics on the mobile application. It is important to note that, the various capability dimension transformations, do not occur if a purpose and strategic direction is not given to the various resources and capabilities, as they move up the hierarchical order of capability development.

Human Skills Capabilities

Having technological capabilities alone, do not ensure that big data capabilities lead to the dynamic capabilities in firms. Human skills capabilities ensure that a firm has the necessary skills to fully use and manipulate the technological capabilities that big data resources offer. For instance, the data science skills in Nationwide ensures that some data management capabilities and analytical capabilities are well utilized to achieve strategic objectives such as ensuring real-time analytics and data veracity in the firm. Collectively, the different skills capabilities need to work together to ensure that, the technological capabilities yields the maximum big data benefits. Wamba et al. (2017) and Akter et al. (2016) also suggest the combination of these capabilities leads to benefits for the firm. The authors reiterate this combination of resources and capabilities by suggesting that, sociomaterialism presents a view which makes it difficult to disentangle these combined resources since one resource depends on the other. Despite the need for human skills capabilities to give direction to the technological capabilities, Nationwide lacks having key in-house skilled personnel in developing big data capabilities. For developing countries such as Ghana, Nationwide’s example shows how big data can help in a transformation agenda. However, the lack of data science skills is of concern and academia in developing countries, must address this need by reorienting their curriculum to accommodate the opportunities that big data era presents. Beyond the skills acquisition, having the relevant domain or industry knowledge like that of health insurance helps to focus the data science
and business analytics skills to be relevant to the industry using them. Though not part of the original typology proposed, the case study shows that domain knowledge is a critical capability which is worth building capacity in.

**Organizational Capabilities**

Organizational capabilities such as organizational learning and data culture encouraged by Nationwide are key in developing big data capabilities. No wonder, Gupta and George (2016) also found this assertion to be true in their research. Such organizational cultural capabilities coupled with management capabilities and data ethical capabilities like data privacy ensure that, in the developing big data capabilities, the right rules and procedures are socially adhered to, whiles management gives direction, planning, coordination and investment into big data for their firms. Organizational capabilities generally bring harmony and orderliness in how big data capabilities are developed to ensure that, big data benefits are achieved within the right framework for working. Failure of management to bring this harmony leads to undesired consequences. Strategic direction through organizational capabilities helps to constantly assess the state of big data resources, their investment, reconfiguration, renewal, and modification when necessary to achieve dynamic capabilities in the firm. For example, in Nationwide, management had over the years being desiring, planning and investing in its adoption of big data. Management ensured that staff, HSPs and members are all broad on board as big data was being adopted. Without management, big data capabilities are difficult to achieve, especially to use big data capabilities to achieve dynamic capabilities in a firm.

**Achieving Dynamic Capabilities through Big Data Capabilities**

Dynamic capabilities through big data capabilities are achieved, when the core capabilities - technological capabilities, human skills capabilities and organizational capabilities - enter into a state where the resources involved as well as the core capabilities are constantly been reconfigured to sustain benefits in the firm as suggested by Ambrosini et al. (2009). Nationwide, for example, had to acquire some human skill set like data science from outside the firm to properly utilize its infrastructural capabilities to an optimal best, whiles management planning capabilities had to ensure that even future investments in big data are well planned. Management ensured that these resources and capabilities were constantly focussed with adjustments or modifications made based on the control capabilities of the management capabilities. Achieving dynamic capabilities through big data capabilities along the hierarchical order is not obtained by just having big data-related resources. However, dynamic capabilities are achieved when the resources are brought together, given a goal and strategic direction by management, whiles the resources undergo reconfiguration, modification or renewal using the relevant capabilities to respond to needed changes.

**Conclusions**

In a nutshell, this research has being able to put forward a comprehensive typology of big data capabilities based on a firm’s big data resources. The research has further shown, how these resources along a hierarchical order lead to first-order capabilities by giving the resources a goal which leads to improvement in a targeted area. The research also has shown, how firms achieve the big data related core capabilities or second-order capabilities - technological, human skills and organizational capabilities- by management giving the first-order capabilities a strategic direction to follow in fulfilling the firm’s vision. The research has also brought to bear how big data leads firms to achieve dynamic capabilities through the renewal, modification and reconfiguration of resources so as to obtain benefits. The use of the typology of big data capabilities especially to achieve dynamic capabilities, will help guide firms, especially health insurance firms in developing countries on the different capabilities needed to develop big data capabilities.

For future research, the application of the typology of big data capabilities in different industries should be looked at to give a greater understanding to firms. Furthermore, research into the academic curriculum in developing countries will help address the big data skills shortage in these countries.

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