ABSTRACT

The purpose of this paper is to illuminate the challenges associated with developing innovative technology-based services based on big data. The paper presents and analyzes a case study of GO:SMART, a project with the aim to develop an innovative service for promoting sustainable transportation in urban areas. The challenges identified relate to epistemological and methodological directives that affect the process and outcome of big data-based new service development projects.

INTRODUCTION

Big data analytics, a closely related field to that of business intelligence, has gained increased attention by both academics and practitioners lately. It has been identified as one of the most important technology trends and as a result firms and organizations have initiated experiment projects to explore its merits (e.g. IBM, 2012; McKinsey Global Institute, 2011; Moore, 2011; The Economist, 2012). This is not surprising given the upsurge of internal and external sources of information and their outcome in terms of massive amounts of information produced and collected by service organizations on an everyday basis (e.g. Kallinikos, 2006; 2013; Hand 2007; The Economist, 2010; Chauduri et al., 2011). Despite the fact then that service organizations of today are operating in information rich environments they are often characterized to be fundamentally short on knowledge (Caesarius and Lindvall, 2011). The application therefore of big data analytics is said to offer a solution by enabling the transformation of information into actionable knowledge and providing thereby service organizations the possibility to make decisions based on evidence and knowledge rather than on intuition (e.g. Davenport and Harris, 2007; Bollier, 2010; McAfee and Brynjolfsson, 2012). By drawing on the large flows of data from multiple sources, big data analytics is understood as a powerful vehicle that can help assemble the big picture and explicate previously undiscovered relations and underlying trends that can ultimately assist service organization by strengthening their competitive advantage (Bollier, 2010; Brown et al., 2011; Kallinikos, 2013). Admittedly simplified, such knowledge can be used by service organizations to increase the efficiency and effectiveness of both internal and external processes. Increasing the efficiency of
internal processes can for instance entail making the service production processes smarter by devising actions when and where they are needed. Increasing the effectiveness of external processes can for instance entail the creation of completely new services that draw on a compilation of information to satisfy new customer needs as a result of evolving customer preferences.

While the advantages of big data analytics are highly interesting and titillating, the narrative of big data often tends to overlook the underlying complexity upon which these advantages are based on. Among other things, the outcome of such endeavors are often conditioned by at least the satisfaction of two key requirements: (1) understanding the end-product, i.e. understanding what knowledge is and how it is formed (2) understanding how to organize and act in order to be able to take advantage of the knowledge developed.

The purpose of this paper is to illuminate the challenges associated with developing innovative technology-based services that draw on big data. To the best of the authors’ knowledge, earlier studies of new service development have not dealt with big data analytics as the foundation for new technology-based services. Since the trend of exploration and implementation of big data analytics is expected to grow, particularly among service organizations, there is a need to investigate and understand the merits of big data analytics and explicate the challenges in new service development.

We begin with a review of the constitution of big data, the potential advantages and challenges. Following the review we present the autoethnographic method employed and declare the process of data collection and analysis. In the third part we present the longitudinal case study of the GO:SMART project and its outcome of the innovative service UbiGo to promote sustainable transportation of people in urban environments. The paper closes with an analysis of the case and some concluding notes.

**BIG DATA – CONSTITUTION, POTENTIAL AND CHALLENGES**

Big data as a phenomenon refers to the proliferation of information in modern organizations often characterized in terms of dramatically increased volume, velocity and variety of information. Seen from a macro perspective, it is possible to argue that big data is related to the process of digitization that has been taking place for decades following the infusion of information technology in organizations the last couple of decades (Zuboff, 1988). As such the phenomenon in question relies on the existence of a digital realm – an eco-system of interconnected digital
units that produce, collect, manipulate and consume digital objects (Kallinikos et al., 2010).

Seen from a micro perspective it is possible to discern four, and to a large extent interrelated, key driving factors that have coincided leading to the development of the big data phenomenon. A first factor is the Internet and which has created radically different conditions for among other things the management of information (Kallinikos, 2011; 2013; Rule and Besen, 2008). A second factor is the establishment of new social media channels following the introduction of web 2.0 (O’Reilly, 2005). These channels are based on a user-centric logic which together with their wide availability, due to converging technologies such as smart phones, have become highly popular (Bruns, 2008; Jenkins, 2006; Shirky, 2008). A third factor relates to the expansion of proprietary data and information in organizations. Spurring this development is the increased level of detail (granularity) and frequency by which data is produced, collected, manipulated and used in all types of operational areas and interactions with both internal and external actors. Finally, a fourth factor is internet-of-things, meaning detect-and-respond technology built in to connected devices enabling them to communicate and initiate actions themselves.

As mentioned previously, the potential of big data analytics is in assisting the assembling of the big picture and in explicating previously undiscovered relations and trends. If harnessed, big data can therefore yield major advantages to service firms by effectively turning them into more intelligent enterprises. This means for example that attention can be directed on issues that evidently have been proven important rather than just believed to be important. Moreover, it means that firms can optimize operations drawing on a superior measurement precision (Brynjolfsson et al., 2011). Finally big data analytics can provide the advantage of spurring the development of especially new services as a result of knowledge harnessed from information stemming from multiple sources.

The application areas of big data analytics have proven many in number (Chen et al., 2012; Kallinikos, 2013). They include but are not limited to biomedicine and healthcare (e.g. Reiser, 2009; Lang, 2011; Miller, 2012), environmental and climate issues (Overpeck et al., 2011), law enforcement, security and safety (Manning, 2008; Abbasi et al., 2012), financial risk management (The Economist, 2012) and a variety of areas related to market intelligence such as the prediction of changing customer demand and preferences (Carpenter, 2011; Brynjolfsson et al., 2012; Chau and Xu, 2012; Park et al., 2012).

Besides possible advantage big data is also related to a number of challenges that are often overlooked in the traditional narrative of the
phenomenon. First the understanding of the end-product, i.e. understanding what knowledge is and how it is formed, and second, understanding how to organize and act in order to be able to take advantage of the knowledge developed. These challenges can be summarized in two fundamental categories that pertain to the epistemological and methodological directives respectively employed in establishing and executing the analytical process. By epistemological directives is meant the consideration of cognitive variations, the management of multiple perspectives and truths as well as the given interpretation priority that together form the outcome of the process in terms of knowledge. The epistemological directives are fundamentally related to questions such as the definition of the core underlying problem and the definition of the type of knowledge sought after. By methodological directives on the other hand it is here meant the fashion by which analytical processes are set up and conducted, the skills and expertise in the group carrying out the analytical process as well as what information sources are used and how the final outcome is packaged, delivered and used.

METHOD

This paper presents part of longitudinal case study of an ongoing effort by a group of actors to develop and test an innovative digital service. According to Kimberly (1976:329), longitudinal research consists of “those techniques, methodologies and activities which permit the observation, description and/or classification of organizational phenomena in such a way that processes can be identified and empirically document”. The data collection process relied heavily on an autoethnographic method drawing on the personal experience of one of the authors as a project member. Ellis (2004:xix) defines autoethnography as “research, writing and method that connect the autobiographical and personal to the cultural and social. This form usually features concrete action, emotion, embodiment, self-consciousness, and introspection”. Autoethnography is an ethnographic method and approach of qualitative research that focuses on describing and systematically analyzing the personal experience of a participant actor in order to understand the experiences of the group studied. It entails going ‘native’ in the sense that the participant actor operates as an insider and is granted full membership within the group studied.

As a project member the author took part in all project meetings and documentation which included: first, more than 15 project meetings aiming to define and describe the service (service description), define its functions (functional description) and illustrate the service as an app (mockup). Second, documentation and first hand reports from more than 10 project meetings with various prospective transportation service
providers (e.g. taxi operators, car pool sharing, rental car services, bike rental firms and City of Gothenburg’s public transportation authority) in order to find suitable partners to the service. In addition, several meetings with a selected pay service provider to jointly develop a counting function (tickets, time, punches, billing etc.) that could support the many and various functions of the service.

While autoethnography permits the participant actor to acquire an intimate familiarity with the group it does not necessarily mean that the insider’s position also enables capturing an unchallengeable truth of the group effort. As Hayano (1979:102) points out “interpretations of events among individuals in the same group are often highly variable, changing, or contradictory”. To balance the personal experience of the author participating as a project member the case study also relies on extensive documentation such as internal reports, technical specifications, meeting minutes, applications and memos. In addition the case study also relies on the outcome of a focus group session held once the idea behind the service became clear. The focus group session involved three different target groups: singles and cohabiting, families with children and people over 55 years of age. A total of 15 people participated in interactive dialogues based on the scenario description and a shorter survey was conducted asking the participants to identify and rate important factors of the service.

THE CASE OF PROJECT GO:SMART

Initiated in 2012, the GO:SMART project is a two year multi-party innovation and research project with the goal to develop, test and implement an innovative digital service that facilitates and promotes sustainable transportation in the City of Gothenburg, Sweden. The aim is to reduce the gap between private and public transport by an independent commercial operator that tailors everyday travel and where customers are rewarded for sustainable transport choices. The idea behind the project stems from the vision of city households preferring transportation mobility and flexibility before owning a car, choosing thereby to become customers of a reliable, flexible and full-service sustainable transportation solution. The solution, known as UbiGo, offers its users different service packages by combining a variety of transportation means and modes. Customers will have access to for instance public transportation, taxis, electric cars rental pool, electric bike rental pool and other electric vehicles. The GO:SMART project is expected to result in improved conditions for sustainable transportation of people as well as in new green business opportunities. Moreover, the project is expected to demonstrate how collaboration between different actors and new
business opportunities can reduce the need for privately owned cars and promote "mobility as a service".

The GO:SMART project group includes 60 people representing 16 different actors with a variety of knowledge and expertise and with different responsibilities. Four of these actors have a leading role, each with their own perspective that negotiates and shapes the process and outcome of the project. First, the service developers whose primary responsibility is to identify, define and describe the service offering and whose priority therefore is to consider the travellers’ (users) wants and needs and hence the customer value of the outcome. Second, the business developers whose primary responsibility is to develop a business model for the independent commercial operator that will handle the service. Their priority therefore is to create a sustainable and hence commercially viable business out of the project. Third, the system developers whose primary responsibility is to design and build the back-end and front-end of an IT-system and to develop its user interfaces (web and mobile application). Their priority therefore is to create a functioning system that can connect to external information sources, collect, analyze and present information in an easy, fast and correct manner. Finally, the travelers, i.e. the intended customers and users of the service represented by a focus group whose priority is to make sure that the end-product, UbiGo, becomes flexible enough to be a serious transportation alternative in their everyday lives.

Instigating what today is the GO:SMART project was the growing concern in the city council and its transportation authority for more sustainable transportation in the City of Gothenburg. Reports had indicated that the use of cars was far more prevalent in Gothenburg than in the country’s other two major urban centres, Stockholm and Malmö. Discussions commenced on how to create a solution that could compete with the ease and flexibility that a car offers and a small project was formed that delivered a report in 2011 containing ideas called “The flexible road user – business opportunities in K2020”. The discussions expanded to include parties from previous collaborations and the key question morphed into how to create a service for the inhabitants that offers the most suitable transportation mode without the need to own the means of transportation. Coincidently a research and innovation call for “Challenge-driven Innovation” was announced soon after by VINNOVA, Sweden’s Innovation Agency. The call was divided into three parts: a first part (A-project) to investigate whether the idea complies with the criteria of the Agency by potentially affecting at least one of the identified societal challenges mentioned. The parties formed a project group which applied for and was granted 0,5 MSEK to further specify the idea, to identify the main partners necessary to design and develop the idea into a full-scale
service and then to write and apply for the second part of the call (B-project). Less than a year later the B-project application was granted and the project now named GO:SMART received 10 MSEK from the Agency and 10 MSEK as counter funding from the parties leading to a total of 20 MSEK in budget.

Work in the GO:SMART project was initiated during early fall of 2012 focusing primarily on (1) developing the business model of the commercial operator of the UbiGo, (2) developing, formulating, specifying and planning the service of UbiGo and (3) thereafter gaining input from potential users through focus groups and interviews. During spring 2013 work commenced (1) by the system developers on the APIs, web and other IT-solutions while other parties of the project group focused on (2) contracts with suppliers of transportation, (3) on marketing and sales and (4) on developing the set-up of Living Lab, the planned large scale testing sequence for the fall of 2013 with hundred households in Gothenburg. Following Living Lab, the project will be evaluated and the service adjusted before it is offered to the public during 2014.

The service of UbiGo is based on a flexible subscription with the possibility of additional trip purchases. The service is paid in advance for the following month in addition to previous month's additional trip purchases. UbiGo offers a joint account for household, where several members of the household can be logged in at the same time and call off trips from the same account. Each customer will have a "My Account" website where it is possible to see how many tickets each member of the household has consumed. The “currency” in UbiGo is days, hours, and in some cases fixed trips. It is based on the finding that the use is about having access to and unlocking more or less precious resources, rather than how far you take it. You may save unused services for up to 3 months or until your agreement ends. This means that unused travel will vanish in case the user terminates his or her agreement. Users will be able to interact with UbiGo through a mobile application accompanied by a 24 hours customer support. To encourage sustainable traveling users will be rewarded an “eco-score” for eco-friendly travel behavior.

GO:SMART is expected to result in more sustainable travel in terms of reduced trips by fossil-fueled vehicles and emissions, increased trips by public transportation but also in new business opportunities. If successful, the GO:SMART project holds the vision to adapt the service of UbiGo to a number of cities around the world contributing to the overall goal of becoming greener, safer and a more attractive alternative to cars.

ANALYSIS
In the process of developing the project, the project group has constantly negotiated and interpreted the definition of the underlying core problem from their various perspectives. Moreover they have also negotiated and interpreted through their different perspectives the definition of the knowledge sought after represented by the information the system brings to the user and packaged and delivered in the form of a digital service through a mobile application, UbiGo. These epistemological and methodological directives have morphed both the process and the current outcome of GO:SMART. The four different perspectives have yielded different outcomes that have influenced the current outcome of the project.

The service developers worked intensively to translate the original idea into something that would add value to customers by solving their daily transportation needs. In the initial phase, they draw on the customer perspective that was represented by previous studies and interviews leading to a somewhat intrinsic perspective by the service developers of what would be interesting for the traveler. In this phase no consideration was taken to limited resources or technical limitations.

As soon as the service description started to take form it was tested against real travelers in a focus group with complementary interviews conducted. When the outcome was analyzed it became clear to the project group that the users’ perspective indicated the service could potentially be useful for travelers. However, it also became clear that some of the solutions where not considered flexible enough to cover the complete transportation needs. Consequently the project group had to re-design the solution to make it more flexible which also affected the original business model that now needed an update.

The business developers created a business model that was built very much upon a subscription solution but the project decided collectively to alter the subscription solution as well as the business model to better correspond with travelers’ needs and suggestions. The initial thought was that it now would be more difficult to find a business model able to provide value for the traveler and at the same time provide enough revenue for the commercial operator of the service. However, soon after the alteration of the business model new opportunities became visible making the new business model even stronger than the first one.

Once the service had been tested and adjusted according to feedback from travelers, functional specifications were developed for the system developers to proceed with their part. Describing the technical design of the service made it possible to estimate resources and technical limitations. To the disappointment of the service development team it
became clear that not all functions of the service were possible to develop due to technical and budget restrictions. For instance, to harness the information from various information sources was sometimes deemed too difficult and expensive. The project group member had again to negotiate a different outcome of the project now considering also the system developers’ perspective.

CONCLUDING NOTES

The service is made possible by navigating and orchestrating different, and sometimes, conflicting perspectives. In addition, the service is made possible by big data analytics in the sense that information collected from a plethora of sources is continuously and automatically collected, analyzed and presented to customers in the form of sustainable transportation options. For the individual customer such knowledge (in the form of options) would have been highly difficult and time-consuming to attain on a regular basis making sustainable transformation in urban environments less likely to occur.

REFERENCES


