The Impact of Datafication on Service Systems

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Abstract

The digital economy is often regarded as providing potential for new business models and services. While much has been written about digitization, the area of datafication within the context of service systems is much less explored. This paper attempts to highlight the implications of datafication on different types of service systems. Applying the characterization of the four types of customer inputs as defined by Lovelock and Gummeson and realworld examples, we develop a framework based on the work of Frei to analyse the potential impact of datafication on their service delivery systems. The paper also identifies future research possibilities as a result of datafication.

1. Introduction

The digital revolution is often termed the 3rd Industrial Revolution, following the first Industrial Revolution of the 18th – 19th Century driven by steam and the second wave caused by the electrical revolution of the late 19th and early 20th centuries: these two revolutions created huge changes in economics, communities. In contrast to the changes that were brought about by new power sources, the digital revolution (or Information Age) is driven by a transformation in what is being processed rather than creating efficiency improvements in how products are manufactured. In this paper we consider some of the implications for business and economic models brought about by the Information Age, focusing on changes to service systems.

There are two processes at work in the digital economy – digitisation and datafication. Digitisation refers to the process by which analogue content such as books, music, photos or other information products are converted into formats that can be stored on digital media, e.g. MP3s, CDs, eBook formats, etc. This process has been going on since the beginning of the computer industry in order to speed up the processing of information for e.g payroll, accounting etc... The rates of change of the digital technology industries means that we now have the processing and storage capacity to store and analyse significant quantities of data in a way we have not been able to previously (McKinsey, 2011).

Datafication (Lycett, 2013) refers to converting aspects of human existence into data, e.g. health statistics, what I look at while using Google Glasses, or what I tweet about, into digital formats. This sort of data provides new insights that may disrupt existing service models or even create completely new ones. As an example, Fitbit is a device that allows end-users to track their calories, food consumption, activity, etc… as part of their health and wellness regime. The data collected, however, allows Fitbit to create new business models based on selling this information to insurance companies. Datafication, in contrast to digitisation, generally relies on sensors and actuators to generate the data about a person or an object. This is fundamentally different to digitisation, which converts e.g. text from the pages in a book via an OCR to a digital format on the Internet. (Cukier and Mayer-Schoenberger, 2013).

The disruption to economic and business models caused by the digital revolution was considered by Normann (2001). In his highly influential text (see for example direct links to Vargo and Lusch and Sampson) relating to new economic models emerging from the digital revolution he considers how dematerialization has made it possible in principle for information to exist everywhere and in real time [P31] which in turn has created an expanded value space [P33]. As Normann points out its not the dematerialisation that is important, this has been around a long time eg 1792 for semaphore, but it's the ability to de-materialise information about almost any asset be it physical (goods or people) or information that is so exciting and provides huge opportunities for new business models to emerge.

Whilst there is some contention about the precise components of a business model (Al-Debei and Avison, 2010) usefully summarise this as having four parts. The value proposition with an associated method of value creation and value capture (see for example Teece 2010). To these a fourth component, the integrative mechanisms of governance (Amit and

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Zott 2001) can be added which, as we will highlight later, has strong echoes of systems thinking and the systemic interaction of the parts. Whilst there has been extensive consideration of value propositions and how datafication has enabled the forming of new businesses and new business offerings, this paper will focus on the implications for value creation and the integrative mechanisms. We also recognise that has been relatively little research into the different forms of value capture or monetisation but that is beyond the scope of the paper.

The impact of datafication on the business models of manufacturing has been widely commented upon. For example, a recent economist article [Economist Apr 21/2012] discussed the 3rd Industrial Revolution in terms of how 3D printing may radically transform our lives both in terms of how things are made but also where . However, there has been much less consideration of the impact on services. One of the main challenges in service research is in the variety of types of service eg from health care to hairdressing or banking to plumbing. In our consideration of service we use systems theory as our theoretical underpinnings, specifically the well-established concepts of transformation, boundary and perspective. In the following sections we define a service system and their particular characteristics focusing on the impact of datafication on four different types of service system; customer self, customer mind, customer belongings and customer information.

2. System

The term system is often widely used but rarely defined.

A simple definition is that a system is a set of components, elements or "things", within a boundary, which are in some way more connected to each other than they are to the environment outside the boundary (Weinberg, 2001). The relationships between the parts, or members of the set, determine the behaviour of the system. The essence of a systems approach is the focus on the relationships between the parts, rather than the parts themselves, in studying the whole system. (Muller Merbach 1994, Forrester, 1956). We should also recognise that implicit in the way a system is described is dependent on the viewpoint of the observer. The observer describes the boundary of the system, (Weinberg, 2001, Ulrich, 1987) and in so doing makes a judgement concerning what is in the system and what in the environment, and this also sets limits on the function and purpose of the system under analysis.

Implicit in a systems approach is the idea of a transformation. In an open rather than a closed system, this involves receiving an input from the environment across the boundary, acting upon it, and passing output back to the environment and out of the system. Feedback received allows for control to be established. In a comprehensive review of more than 50 research articles defining 'systems' Atkinson and Checkland (1999) distilled out four fundamental systems ideas which Checkland (1999) later combined into two pairs of concepts emergence / hierarchy and information / control.

Emergence / hierarchy may be considered to be the antithesis of reductionism. The practice of reductionism assumes that a system can be analysed by breaking it down into its constituent parts, understanding the behaviour or makeup of each, and that the behaviour of the whole system can then by understood by re-aggregating the parts and their behaviour. It assumes weak relationships and effects between the parts. The principle of emergence – hierarchy suggests, due to strong relationships between the parts, that different forms of behaviour emerge at different levels of aggregation within the system and that this behaviour is not predictable from simply studying the parts.

Information / control is developed and apparent in cybernetics and the works of inter alia Beer (1984), and Ashby (1969), with the description of the attributes of a viable system. Beer's description of the viable systems model built on the work of Ashby who proposed the law of requisite variety, which identifies the requirement that, for a system to achieve satisfactory and viable outcomes, it needs to be able to internally match its variety with the variety in the environment.

In a recent paper Maull, Godsiff and Ng (2013) have developed a systems model of a service organisation that takes the whole service organisation as the unit of analysis. Using as their basis the Enterprise model from Checkland (1999) they developed a control model of the whole enterprise. Their focus is on the operate processes which are those that meet the requirements of the customer. This is essentially the same as Miller and Rice's socio-technical systems research into the nature of the primary task (Miller and Rice 1967) which they describe as the dominant process in an organisation and one that an organisation must perform to survive. Using this framework and reflecting our business model focus on value creation the boundary of our system is therefore fulfilment or delivery process, often termed operations or more specifically in a service context; service delivery (Johnston and Clark, 2005).

3. Services Systems

What constitutes a service is notoriously difficult to define, with some scholars using service as an adjective (service sector), noun (a service), adjectival phrase (service-dominant logic) or verb (to serve) all of which contribute substantially to the confusion around the term. For example, the most commonly used definition of service refers to the 'service sector' as an area of economic activity. Historically, it is associated with the development of government classification schemes (SIC codes), which typically represent around 70% of economic activity. Such definitions fail to distinguish for example between making a mobile phone call and medical treatment and provide little insight about the features or characteristics of a service other than what it is NOT e.g. extraction or manufacturing.

An alternative that emphasises the noun is the view taken by Lovelock and Gummesson (2004) who contend that services involve a form of rental or access. They identify five broad categories;

1. Rented goods, examples include power tools, cars, furniture, houses

2. Place and space rental, this is where customer can use part of a larger space. Examples include aircraft, hotel rooms,

3. Labour/expertise rental, this would include most professional services including lawyers, doctors, architects, plumbers, car repair etc

4. Physical facility access, this includes fitness suites, theme parks

5. Network access, here a customer has access to a network such as fixed and mobile telecommunications, banking network, specialised information networks like Reuters.

Rather than emphasise what service is NOT, Vargo and Lusch (2004) propose a logic or paradigm through which everything may be viewed as a service. In their seminal work on Service-Dominant Logic (S-DL) they consider service as the applications of competences for the benefit of a party and that all firms are service firms. This perspective draws heavily on the concepts of value in use and value co-creation as opposed to Goods-Dominant Logic with its emphasis on value in exchange.

However, the weakness with this perspective (to be fair Vargo and Lusch are clear that the focus of the work is on implications for marketing, markets and economics) is that it provides no insight on how a service system works: the focus is on the what with the how effectively treated as a black box. In this paper our focus is not on how datafication might provide new service offerings or value propositions but on how it will affect the processes of value creation. To consider the how we need to consider service as a process.

In their Unified Service Theory (UST) Sampson and Froehle (2006) define a service as one where the customer provides significant inputs to the production process and where production relates to the activities that contribute to sales. Using Lovelock and Gummesson (2004) we can characterise these inputs as taking one of 4 forms:

1. customer's physical presence, this is the processing of a person's body e.g. taking a flight or train journey.

2. customer's mental presence, these services are directed at people's minds such as a theme park or education.

3. customer belongings, these process people's belongings such as parcel delivery or veterinary services

4. customer information, these are directed at processing people's information and include, legal services, banking, insurance, telecoms etc. This is recognised to be the largest category e.g. Apte and Nath (2007) estimated that the information sector contributed 63% US GNP in 1997 and had received relatively little research attention.

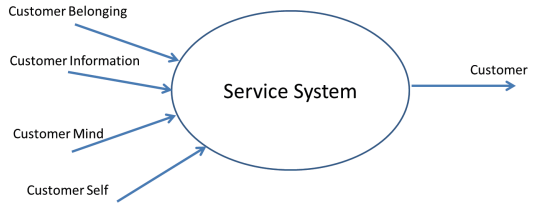

Figure 1: Service System

Combining customer input and the production process provides a useful definition that includes custom manufacturing within service, placing within 'non-service' make to stock or make to forecast manufacturing. Because of the focus at the process level, this definition distinguishes between processes that have both service and non-service components, where service processes have a significant customer input and non-service processes take place independent from the customer. Therefore, individual service firms may have combinations of service and non-service processes. In later work Sampson (2012) has further developed this analysis through his use of Process Chain Network (PCN) diagrams which explicitly distinguish between three zones of interaction; independent processing by customer or provider, surrogate interaction where a person acts on the resources of another entity and direct interaction between the provider and customer.

Frei (2006) takes a similar perspective to Sampson and considers that service is distinguished from manufacturing by the 'throwing the customer into the works' and that dealing with the variety produced by the customer is 'the key challenge to making a service offering profitable' [P93]. Support for the importance of variety on service success has been addressed in a number of studies. For example, Aranda1 analysing the relationship between service operations strategy and service flexibility concludes that whilst flexibility might enhance customer satisfaction it has a negative effect on financial performance whilst Kastalli and Looy in a recent study of servitisation have shown that short term gains quickly lead to a profitability hurdle and that only those organisations that can scale their service capability can achieve sustainable profitable growth. This view has also been strongly supported by a number of other service scholars (notably Chase, 1978 Silvestro, 1999, Buzacott, 2000, Roth and Menor, 2003)

In arguing for the importance of variety on operational performance Frei distinguishes between five types of variety;

1. request (different requirements for each customer);
2. arrival (peaks and troughs in service demand);
3. customer capability (customers have differing skill levels);
4. customer effort (some services require customer input/ participation and customers will have differing willingness to make effort);
5. subjective preference (customers have different and contradictory views of what constitutes good service)

We would make two adjustments to Frei's categorisation. Firstly, we consider that both customer capability and effort are part of co-production. Bowen (1986) describes this as a movement from considering the customer as passive resource to one where the customer takes an active role and supplements or substitutes for the labour of employees and becomes a partial (Mills and Morris, 1986) employee. The issue here is the boundary of the system and the role the customer plays in carrying out or contributing to the various activities and the potential for co-production (Bitner, 1997). Secondly, we would contend that subjective preference is a measure of service experience or outcome and not an independent variable. From the provider's perspective the customer might vary in terms of what they want and when they want it and how much effort and capability they will put in and that this will affect the outcome which will be subjectively assessed by individual customers.

Our conceptual model is therefore that datafication will affect request variety, arrival variety and the potential for co-production which in turn will affect the performance of the service delivery system. The nature and extent of the affect will be dependent on the service type.

Research question - what are the implications of datafication for service delivery systems?

To recap the forms of variety we are considering are represented as follows: When (arrival pattern); What (request); Volume (how many); Customer effort and Customer capability, the last two of which we consider as the customer participation in coproduction.

We will evidence an example of each service transformation (information / self / belonging / mind) and seek to analyse how the various types of variety are currently managed or regulated using an illustrative example of service delivery in each case. We will then explore each example to identify how the opportunities afforded by datafication will change and potentially enhance the service delivery of each.

Customer Information: Transforming a customer's information generally involves either moving it from one place to another as in a mail delivery system, a banking transfer, a telephone call, an instruction. We will use the example of a banking transfer from one customer to another. Prior to digitisation, a bank payment transfer required the use of a paper check/cheque being transferred between customers and physical bank buildings, both branches and then clearing centres for bulk processing. Internet banking made possible by digitisation means that this can now be done using the customer's internet access mechanism.

Arrival **variety** was managed by restricted access through limited branch opening hours and overnight processing with transfers in the UK taking 3 days or more. Request variety was limited to simple mechanisms (paper cheques pre formatted, simple transfers and limited to bank account holders. **Customer effort** was extensive, often involving both customers (payee or recipient) either travelling to the branch or using the postal system. **Customer capability** was required to ensure the cheque was correctly completed (e.g. date, words and figures) and any errors were rejected for subsequent correction by the customer.

Through digitisation many of these constraints were overcome by providing increased access to the banking infrastructure based on the use of digital technologies.

For example, EFTPOS (Electronic Funds Transfer Point of Sale) was an early example of the digitisation of financial services. Through providing

the customer with a card and access to the banking infrastructure 24 x 7, customer effort was significantly reduced, as they no longer needed to go to a physical bank to withdraw money or ensure that the cheque was filled in correctly. This evolution has continued with the extensive use of online transactions, allowing customers to pay bills and perform more complex financial transactions whenever time allows them to, rather than having to rely on the staff in a bank to do it for them. Cheques are replaced by online transactions, the customer is now involved in more extensive co-production and transfers can be made any time and close to real time using a wider variety of access mechanisms, enabling the sharing of capacity. Capability variety can be better dealt with through validation and security routines.

Datafication can enable further changes through e.g. allowing for micropayments. Micropayments cover those small amounts, e.g. a few pounds for a cup of coffee or a snack at a local coffee shop. This allows for the datafication of the small-scale purchasing habits of customers on a more granular level. Previously banks have only been able to see the larger scale purchases completed using credit or debit cards. Shops have also often had a minimum spend to use cards. This would allow a more detailed understanding of when a person was in a store buying a small item. Datafication of individual and group spending routines could enable better fraud protection; knowing the location and spending ability of the customer could allow both better targeted advertising from retailers and suppliers, but also expenditure level warnings from the customer's bank. More and different access mechanisms could be used for balance enquires and expenditure – e.g. mobile phone payments through the network contract supplier rather than a traditional bank, or through devices such as Google glass. In addition, micropayments are starting to affect how companies interact with customers – for example many shops in Sweden are refusing to accept cash (http://www.dn.se/ekonomi/allt-fler-butiker-vagrarta-kontanter/)

Customer self: Customer self as input to a delivery system tends to organise around transportation, but would include elevator system, and e.g. rides on a theme park health services, restaurants, etc. We will use the example of a bus transport system.

Arrival **variety**; the arrival pattern of customers is traditionally managed through a scheduled timetable or a frequency pattern for the bus service, with limited predefined access points (stops). Request variety , is limited by a fixed route, requiring the customer to access and end their transformation at fixed points and to commence or continue their journey by other means if necessary. **Capacity** is managed through a queue and limitations or otherwise on passenger numbers per vehicle requiring unfulfilled demand to wait for the next scheduled service. Opportunities for co production are limited. **Customer effort** and **Customer capability** may be limited to the need to get to particular specified points on the chosen route, and to be able to board the vehicle.

Datafication could enable a range of different solutions for both the supplier and the customer. Knowing better details of customer movements and habits could provide a better focussed schedule and potentially route alterations where sufficient and timely demand exists, allowing route and schedule to be more flexible, impacting solutions to "request" and "arrival" variety. Such information could also stimulate different vehicle sizes to better match when variety, or for an outsourced provider to supply a more focussed taxi-like service.

A further example of datafication in this context is the use of twitter streams to analyse and understand the state that the railway network is in. For example, end-users often complain on twitter when their train is delayed or cancelled. This can give the transport companies an opportunity for co-production with the end-users, e.g. through actively managing the process by delivering an updated schedule or identifying an alternate route for them (either via twitter, SMS, or an app). In addition, at an aggregated level, endusers are able to actively manage their own travel route rather than rely solely on the input from the rail company in question. For example, by searching on the hashtag for delays on their route, an end-user may be able to know in advance that there is no point in turning up to the district line station, but may instead take a bus or an alternative train line route.

Customer belonging: Customer belongings to be input to a service delivery system can range extensively where a 3rd party is required to carry out a specialised activity from e.g. parcel transportation, dry cleaning, vehicles for repair and maintenance. We will take the example of a veterinary service provided for a customer's pet.

Arrival variety is managed by a pre-booked appointment system with some limited capacity for emergencies, restricted generally to standard working hours; "emergency" care may be provided by a more remote centre. Request variety is subject to high variety owing to the number of animal types treatable and the nature of the ailment. This is regulated by the degree of training and knowledge required of the vet. Customer effort and capability is limited generally to

identifying the need for treatment and the requirement to transport the animal to the vet's premises, although for larger and commercial animals customer site visits may be necessary.

We can imagine a number of scenarios on how datafication could impact on this existing delivery system. A medical/movement sensor fitted to the cat could, as well as recording location data, would record vital health information. This could enable the vet to monitor health remotely allowing the vet to schedule customer visits as required thus smoothing capacity, or for the owner to become more involved in co-production by administering certain treatments without any need for a visit to the vet office location. Including a camera on the fitment that would enable the gathering of real time information on activity could enhance this data further. Collecting data through a group of such devices could enable even more information for the vet and upstream suppliers on animal health and behaviour, or for example to the developers of pet foods, health supplies, pet toys, etc… who can use the extra information to improve their products and services.

Customer mind We now turn to the processing or transformation of a customer's mind. Examples of this include entertainment such as theatre and film, educational and broadcasting services,. Let us examine the example of tertiary or university education. The desired outcome of this is increased or changed knowledge or other virtues, e.g. maturity and/or analytic capability. Traditionally this is delivered within an institutional and campus framework, with access restricted by various entry requirements, courses are generally menu driven and appointment based. For example, sufficient ability must be demonstrated in the form of pre-existing academic achievement (and often finance); lectures are given at specific times in specific places. The cohort convoy generally moves through as one set of classmates, all starting and finishing at the same time with outcome quality measured by exit grades and in some cases employability. The capacity of the offering institution is restricted by access to physical resources and suitably qualified staff. The service is time defined, generally on a semester basis. Although the education service is offered, in many institutions a more significant outcome is seen as research.

Arrival variety is fixed by the institution but has significant peaks and troughs, with some capacity remaining unused at certain points in the year. A daily pattern is set by fixed lecture times. Request is menu driven by module and course being offered, which are generally not frequently updated in response to changes in demands from employers/job market, or changing student tastes.

Customer capability is restricted by assumptions about ability based on academic entry requirements. Customer effort is often said to be down to the student and measured often by periodic testing through assessments or exams or lecture attendance

Digitisation can remove some of these traditional constraints as evidenced by the development of Massive Open Online Courses (MOOCs) **(March 10 2103, FT**). Students in any volume are able to access educational material (e.g. a lecture series) at times suitable to them, removing scheduling and capacity problems from the institution. At present most are limited to providing "information" and education universally rather than being viewed as part of the institutional procedure and subject to e.g. annual performance grading or entry requirements.

Datafication of the learning experience could take these departures from the accepted norm for this delivery system further. The ability to monitor and manage progress either on individuals or groups would provide feedback allowing for modification and corrective action for both the individual and the course if particular course elements were seen to be not functioning properly.

Students could be equipped with something similar to a Nike sports band that would allow for the monitoring of stress levels, heart rate, boredom etc… Through this, a lecturer could receive real-time feedback about the quality of their lectures, what aspects that the students were really finding difficult, or who had slept through most of the talks, etc… to measure real participation levels. Students could also be informed of the best time for them to study, when their body was displaying the optimal levels for learning, rather than pushing through on all-nighters, etc…

A key aspect that will need to be overcome for concepts such as MOOCs to take off as fully graded courses is the ability to analyse when a student has cheated. Many students admit that they are more likely to try and cheat when using online tools than by standard examinations (Economist ref). Digitised methods have been developed to help analyse when computer science students have not written code themselves, but have instead outsourced their projects to 3rd party developers, often located overseas (guardian Ref). Similar methods would be developed for MOOCs, allowing lecturers to tag data sets, set reading passages and other learning milestones in order to ensure that it is the actual student that has really read and completed the assignments. Without such digitised techniques, it would be impossible for MOOCs to be more widely adopted.

Customer	Customer	Customer	Customer	Customer

Input	Belonging	Information	Mind	Self
Customer "variety"				
Customer Arrival time				
Customer request variety				
Customer willingness / ability to co-produce				

Table 1 : Framework

We hypothesise that the design of the service delivery system with respect to the customer induced aspects of variety will be different depending on the context of the type of customer input

4. Future Research Questions

We have developed a framework in which the effect of customer variety on the design of service delivery systems can be considered within the different contexts of the nature of customer input be that belonging, information, mind or self. We have briefly explored these with the use of illustrative examples. We now need to consider the broader research agenda and potential areas within our research question of the effect on this framework of digitisation and datafication.

The case of "cat cam" raises illuminates a variety of ethical questions over data security, personal privacy and control. What are the structures for data ownership and exploitation around the datafication of "being" and "seeing". Should for example such a system be considered for alzheimers sufferers, or prisoners on parole?

The example of "mass" transport being replaced by more tailored individual solutions raises questions around the effect on the business models of existing providers, and what new business models will emerge from the new forms of provision, in which potentially customers may be paid by the transport provider for example in exchange for exposure to targeted advertising or specific routes. What will be the effect on business models and operating processes in moving from a "push" system to a "pull" system? What happens at the boundaries when a public good becomes more of a private good?

The impact of MOOC's on university and other providers is already being discussed in many forums. Issues under discussion include concerns over access (restrictions and identity) will be the effects on the student and providers of moving from a push to a pull system? Within a broader societal framework the current education system in which cohorts are moved in age groups allows society to match educational stage with age and access to social "systems" and membership categories? e.g. age of consent, "adulthood", entry to the labour force or pensionable age. What will be the impact of changes in educational provision and qualification on these existing boundaries?

The case of digitisation on the provision of banking services and the datafication of personal attributes and behaviours allows for the provision of new services afforded by the aggregation of data from currently different sources and industries, and thus has a potentially wider impact on business models and service offerings than the other cases. The aggregation of location, expenditure patterns and creditworthiness, and offering availability may allow for better targeted advertising and purchasing options. Who, or which industry will aggregate and control this data? What will be the ethical and privacy restrictions and who will control these?

5. Contribution

This paper integrates the twin concepts of datafication and service delivery. This is achieved through the use of the framework proposed in Table 1. Building on a series of potential service developments that are emerging as a result of datafication we can draw some general implications for service offerings in three main areas. Firstly, as predicted by Normann (2001) we are observing dematerialization and an expanded value space which is offering the potential for many new start ups. Research is needed both into the extent of these developments and the development processes that companies are going through ie how are they using big data to develop new business models, what are the commonalties, do these differ across service types? Secondly, dematerliazation is also affecting incumbents through enhanced decision making. In our example banks are able to know more about micropayments and therefore reduce fraud and enhance their services. In a recent paper Brynjolfsson et al (2011) have estimated the value of this enhanced data driven decision making on output and productivity to be 5-6% and to also have a significant impact on market value. Such studies need to be replicated and extended to differentiate across service types. Furthermore, more case examples of how datafication has (directly or indirectly) led to new services are required. Thirdly, datafication has the potential to be disruptive and completely change a market structure. The case of 'fitbit' illustrates how returns across the value chain may change radically because of access to data. As Evans and Wurster

(1996)state its not so much the customer relationship that's important as proprietary information about the customer. It is the asymmetry amongst the members of the value chain that determines returns and may enable new players to re-shape the entire architecture of the network (Jacobides, Knudsen and Augier 2006).

6. Conclusions

In this paper we have attempted to identify the implications for service systems of datafication. We recognise that the implications will differ across the different types of service organisation and have used the characterisation of four different types of customer inputs as provided by Lovelock and Gummesson: information, belongings, self and mind. In considering the impact of datafication we have recognised the importance of managing variety and have developed a framework based on the work of Frei (2006). We have taken each of the four different types in turn and considered how datafication might impact on their service delivery system.

There are a number of future research possibilities emerging from this research. Firstly, datafication provides potential for understanding far more about customer arrival variety and may be managed either through providing better real time data to the customer (the queue in casualty is currently x minutes) and/or enabling the provider to gain much earlier insights into customer arrivals and therefore better able to manage resourcing. For request variety, datafication enables much better micro segmentation eg a better focused bus schedule. Co-production (through customer capability or effort) is now extensively used in banking environments but it may be possible that through better data on pet behaviour, vets many be able to educate customers on how to better manage the health of their animals. We have provided examples of developments in each of these areas, however their full potential has yet to be realised. Datafication provides the often unrealised potential to radically transform not just what services are provided but how these services are carried out.

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