

Generating and Leveraging Customer Data Assets: Solutions Business Models

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ABSTRACT: Filling a gap that has been largely ignored by the literature on technology and digital strategy we explore how machine learning (artificial intelligence) has brought about two mechanisms that create superior value from the data that customers generate from their consumption experiences. We then explore how these two mechanisms can increase demand and shelter the firm from competition; and how the resulting business models give rise to significant profit opportunities. We do this first in the context of the single firm having a simple dyadic relationship with its customers; and then for the platform firm and their complementors. To gain the greatest benefits, firms generally, and platform firms in particular, need to choose business models (value creation-capture combinations) that trade-off the value of extending the range of complementary offerings, with the need to control the complementors ability to capture value from those data. In the final section we consider how the firm might organize itself internally – and why they need to adjust the relationships between the central authority of top management and the front line – that has day to day contact with customers.

KEY WORDS: Complementary Assets, Customer Data, Business Models

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INTRODUCTION

In his seminal paper, Teece (1986) argued that exploiting new technologies requires firms to identify, build and leverage complementary assets. And the usual interpretation is that these complementary assets reside with other firms typically labelled complementors, that have to be bought in-house or contracted with through alliances. The insights of Teece's has been utilized many times to discuss the speed and effectiveness of innovation in the non-digital world, see for instance the review of (Chesbrough, Birkinshaw, Teubal, 2006). More recently, researchers have leveraged the same ideas in the study of the digital world generally and of platforms in particular, where digital technology (by which we mean the combination of computing power and the world wide web) has facilitated firms and complementors to join together to create and exploit consumer value (e.g. Gawer 2014). However, until now, no-one has considered the situation of customers as those who generate the complementary assets (see Dahlander and Wallin, 2006 for an exception who studied user communities).

The consideration of customers as generators of the complementary assets not only challenges our idea of who might be the complementary organizations, but it also challenges traditional notions of the business model choice. Chesbrough and Rosenbloom (2002) argue that leveraging complementary assets requires careful choices among business model possibilities – that is firms need to select from various combinations of value creation and value capture (the mechanisms that define a business model), and that choosing the right business model (that is the right combination) enhances the value of the complementary asset, a point echoed by Teece (2010). The strategy literature generally, and the literature on platforms in particular, pays a lot of attention to how digital capability has been empowered by the use of novel multi-sided business models (Rochet and Tirole 2003 and 2006, Hagiu and Wright, 2015), but this discussion has focused almost completely on the complementary assets being made or supplied by other firms in the form of goods or services that are bundled and offered on either a physical or digital platform (see for instance the review by McIntyre and Srinivasan, 2017). This literature has almost totally overlooked how technology mobilizes another kind of complementary asset: data created by customers (consumers) about their behavior and preferences.

So, the purpose of this paper is to consider a most unusual situation which is a powerful technology - machine learning, being leveraged via a complementary asset – customer generated data, and the consequences of that combination on the business model choices for the firm. And we go further, we trace how this technology-asset-business model combination challenges our thinking about competition, about how to organize platforms, how platform envelopment may occur and how to organize vertically integrated firms.

Let us be more precise about the technology challenge. The combination of faster connectivity such as 3G and 4G, coupled with greater computing power, has caused a new complementary asset to emerge, that is not created by complementary firms but by customers. This new asset is digitized data on how customers (most importantly consumers) buy, consume or otherwise mobilize a firm's offerings. Such data have been labelled *behavioral data*, that can be distinguished from other forms of data such as *environmental data* (about things like ambient temperature), or *public data* (such as news stories) – see for instance McKinsey (2015 page 44).

Customers produce behavioral data when they consume, and it is the act of consumption that gives rise to behavioral data. Without consumption, there are no behavioral data, and with consumption consumers become producers of data¹. Moreover, much of these data could not have been known to either consumers or the firm in advance of the consumption experience (that includes the contemplation of consumption and the acts of purchasing).

These data assets are potentially valuable to the firm because machine learning (by which we mean the algorithmic processes of supervised and unsupervised learning) allows firms to identify, cluster, classify and therefore predict from data two very important things: first what alterations in the firm's offer might improve customer (consumer) experience and second what the customer might like the purchase again in the future. Both of these possibilities lead to higher prices and greater volumes of purchases and hence profits. In addition, these data assets are "sticky", because they are not easy to recreate except by another firm engaging with the customer (consumer) in a similar manner, and there is a virtuous circle for the firm. Although these data assets are expensive and time consuming to collect, the more the firm responds to the data, the greater the potential consumption and so there is possibility of an upward spiral of more data and more reward.

We start by examining two core mechanisms by which firms collect and create novel value from these data, and our examination links our two mechanisms to four different streams of the strategy, innovation and marketing literatures in an integrative way. Our exposition of the mechanisms emphasizes that our two mechanisms, separately or jointly, generate potentially valuable digital assets of customer data that are "sticky" and "hard to replicate" that can lead to significant competitive advantage for the firm. This opening discussion allows us to make some novel and important points that contribute to our understanding of competitive dynamics.

In the rest of the paper, we leverage these opening insights into two different settings. The first is that of platform firms. The strategy literature has made it clear that the firm can benefit greatly from having an open stance towards the providers of complementary products and services

¹ Prosumers in the words of Toffler, 1980, and Kotler, 1986

because complementors can provide attractive supply side assets (Teece, 1986). Complementors not only increase the scope of the firm by adding resources, but they can also create network benefits, speed up the improvement of components of the firm's offer, and add additional components and services not yet considered that can lead to advantages (see for instance Boudreau, 2000, Gawer, 2014). We add to this literature emphasizing that the platform leader may leverage co-creation with customers to achieve additional competitive advantages, that extend to reducing competitive threats from powerful rivals.

The literature has hitherto explored extensively the supply side risks and opportunities firms face when opening themselves to complementors. Here we examine a different set of risks and opportunities coming from the demand side and from the potential coming from exploiting customer generated data assets. Allowing other firms to freely join with the subject organization with complementary products and services can greatly increase the attractiveness of the host firm to customers but these benefits have to be offset against the loss of control over customer generated data assets. Failure to control the complementor's customer engagement data can diminish the platform owners' ability to create and capture value, whereas strong controls over customer generated data occasioned by the arrival of the complementing firm diminishes the attractiveness of the platform to the complementor. We suggest that these considerations give rise to important contractual considerations relating to the demand side that have hitherto been ignored in the literature. The different contingencies are presented as a 2 by 2 matrix.

In the third part, we consider the internal, organizational challenges facing firms adopting any or all of the solution business models, exploring why it is non-trivial to transform customer consumption data into new product offers, and why it is that many firms underestimate the challenge. Just as there are tensions between a firm and its complementors, so to there is a tension between the firm's top-management and its own front line. In the traditional product business model, design follows a sequence, and a key role of top management lies ensuring coordination between internal firm actors and outside contractors either explicitly or by producing governance rules that deal with hand overs and disputes. Our core insight is that in the solutions business model, things are different: anticipation, design, production and consumption all take place to a greater or lesser extent in front of the consumer. Whether the customer/user is an active or passive actor, there is also an element of experimentation and discovery, absent in the product business model. Achieving this requires top management to see a trade-off between having an oversight of the big picture and giving up some power, passing authority down to the front line – closer to the customer where the firm's staff are more able to comprehend and respond speedily to the customers' needs.

Our paper is important for several reasons. First, we elaborate precisely on two important value creation mechanisms and their related business models that has been largely overlooked in the literature (see for instance, Massa, Tucci and Affuah, 2018). Secondly, we point out how the leveraging of these business models challenges a central strategy paradigm, namely that superior supply side resources are necessary for competitive advantage – because here it is demand side resources that matter. And thirdly, we open-up the appreciation of the semi-closed platform – firms that invite complementors but restrict the way they present themselves and interact with final customers. These semi-closed platforms feature strongly in a new generation of platform firms (often called the super app) that is commanding considerable attention. And lastly, we challenge the traditional hierarchical view of firms.

REVIEW OF THE LITERATURE ON CONSUMER ENGAGEMENT

We find four themes in the literature that identify customer engagement mechanisms related to value creation, and we first list them all before exploring how they work in the digital setting. The first and most obvious strand relevant for strategy scholars is the literature on the “demand side” of strategy pioneered by Priem, 2007, who discusses strategies that traditional product business model firms can undertake to improve their customers’ selection and experiences. He argued that producers need to devote more effort in giving value by reducing consumer search costs; he suggests producers can provide a better selection of products to offer to customers/consumers that exploit what they have revealed they want, what is known to be lower perceived risk, and what is similar in consumption pattern to what they have already consumed (see for instance Priem, 2007 pages 11 - 13). Ye, Priem and Alshwer, 2012, explore further extensions of these ideas by showing how producers can leverage consumer preferences by combining hitherto disconnected products and services, and Priem, Wenzel and Koch, 2017, deepen these ideas still further. In the next section we will probe how Priem’s challenge is addressed in the digital sphere, where fully private and semi-public data on customer/consumer past consumption patterns, current location and other personal characteristics allow firms to offer uniquely designed combinations that prove to be highly attractive on a consistent basis.

The second important stream comes from innovation scholars, led by Von Hippel, 1976, who have emphasized that customer-led innovation often leads to greater value being created, and a good profits stream for the firm. Baldwin and von Hippel, 2011, go further to emphasize the value of “open innovation regimes” where customers do the innovating, perhaps away from the eyes of the firm. Both these streams of literature emphasize the fact that the traditional product business model can be challenged by a more “demand side” view of strategy. In our digital context, unlike the

situation conceived by von Hippel, the customers/consumers are typically unaware of their contribution to the innovation process. They may not realize that their consumption process generates valuable data that machine learning can exploit to improve new product development; through feedback processes and dynamic experimentation.

The third stream of literature comes from marketing science (Bateson, 1977, Langeard, 1977, Vargo and Lusch, 2004, Gronroos and Voima, 2013) that pinpoints the essential differences between those businesses where production and consumption take place sequentially and those where production and consumption take place simultaneously. In the latter case the consumer can directly engage in value creation generating data that assists producers in their ability to match, create or even co-create demand. By definition, in such cases, we have moved away from the “product business model” used by most goods and service firms. This marketing science view of consumers, labelled by Vargo and Lusch, 2004, *service dominant logic* has been largely ignored by strategy scholars, even though it is significantly different from the first stream of Priem and his followers, because in the marketing science view, new demand is co-created rather than simply unpacking existing preferences. We will build on these ideas shortly, filling the gap in that literature that has not fully considered issues surrounding digital, noting that joint production and consumption is common in the digital world, and that digital also enables it to be undertaken more easily in the physical world. In particular, we examine the impact of the ability to “scale” at low cost and issues about “who owns and can access the data” in the co-creation process that until now have been left largely silent.

The fourth stream comes from service science (Chesbrough and Rosenbloom, 2002, the literature on servitization and the service science group at IBM). Starting with Davies, 2004, it has been noted that there are new business models available to those involved in the production of goods that require complementary services such as capital equipment and maintenance, or in the digital context hardware and software. In the case of capital goods, the producer of the capital good can greatly reduce the costs and improve the quality of the stream of services provided by engines using digital technology provided the user is willing to “open-up” and integrate many of their processes with those of the capital goods supplier. In the specific example of airplane engines, Smith, 2013, notes that this business model increased value to the customer by many millions of dollars in one year, because the data involved in those processes was proprietary to the supplying firm, and not easily unpacked by the user, there were many millions of additional profits to be made. Visnjic, van Looy and Neely, 2013, unpack more cases.

CONSUMER CO-CREATION POSSIBILITIES IN DIGITAL WORLD

Building on the themes of the literature, we identify two (theoretical) mechanisms for creating value from behavioral data generated by customers during the consumption process that are: anticipating what customers might like to buy next, improving the consumption experience. Exhibit 1 below gives summary of the argument that follows concerning these mechanisms, the relevant literature and their application to consumer and producer markets.

EXHIBIT 1 NEAR HERE

Our first mechanism is the use of behavioral data to anticipate (non-obvious) future needs, and subsequently exploit that superior anticipation through enhanced offerings. Let us unpack this mechanism first in consumer markets and then in producer markets.

When consumers engage in the consumption process, they reveal many different kinds of data: some relates to the environment – such as temperature, data that can also be obtained from other sources such as building sensors; then there is data about the characteristics of the consumer – such as date of date of birth, place of schooling, approximate location, that are the customer's *innate characteristics*, that are not unique to this transaction, and finally there are behavioral data that are related to the transaction itself and unique, such as what the consumer bought and how the product or service was consumed. All these data have potential value to the firm, but it is the last kind of data that is of the greatest interest because it is potentially the most valuable being proprietary to the firm.

As signaled by Priem, (2007, pages 11-13) firms can leverage *customer data* of all kinds to improve future consumption possibilities. A person's current location is typically transmitted to many parties from the apps on a mobile phone, and these data can be used to provide all sorts of very general information such as a weather forecast, location of local hotels. Although these data do reduce search costs, in general they not unique to any one single provider. In contrast, *behavioral data* about past purchases can provide unique opportunities for providers to reduce search costs and purchase risks, by offering the customer/consumer *non-obvious* items related to the original purchase and characteristics of the purchaser. Netflix uses data on past movie watching to suggest new titles that a customer might like to watch, based on such things as pattern similarity with other viewers who have similar movie watching histories. Such algorithms are also found on market-place websites such as Amazon, that hold extensive data about past purchases of the customer/consumer. For reasons elaborated by Priem (2007), such hints and suggestions can and do provide superior value over the traditional retail store that has no ability to tailor its suggestions individually (leading

to one of the reasons why a digital marketplace can be more attractive than its physical counterpart).

The same idea of generated suggestions about what to purchase exists in B2B markets. As explained by Anand, Sharma and Coltman, 2016 p.260, companies such as General Electric (GE) Aviation Solutions use real time data on wind speeds, ambient temperature and engine thrust collected in part from the user and in part from other sources to optimize the use of fuel during each phase of the flight resulting in (GE claims) millions of dollars of savings for customers such as Southwest Airlines. The critical element of these algorithms is the ability to leverage the unique data of the consumption moment to provide something superior to that offered by others that do not have access to this consumption experience data. Likewise, SunCloud is a website designed to assist producers of creative music identify audiences, themes and paths of development based on submitted creations. SunCloud uses sophisticated algorithms to analyze submitted tracks and compare them along many dimensions with other previously written pieces of music and their data bases on how such music was exploited.

Another sophisticated use of *behavioral customer data* to anticipate future needs occurs in the design of new products and services. This picks up the theme of customer led innovation identified by von Hippel, 1996. In the case of streaming service companies, there is an opportunity to gain valuable unique insights into many aspects of consumer need such as: the most preferred movie length for particular genre for particular groups, the knowledge that certain kinds of music tracks are preferred over others for particular groups and genres, and the sequences in which purchases are best preferred. And in undertaking this work, there are also many other opportunities to generate consumer engagement in the innovation process, such as gauging their reactions to “live experiments”, engaging them with problem solving sites such as “Mechanical Turk”, and other digitally enhanced creative mechanisms. These insights can then be transferred to those divisions involved in creating new materials that pick-up hitherto overlooked possibilities, exploit emerging trends and on occasion utilize inventions initiated completely by potential consumers. In the case of making of new movies, there is still considerable human intervention, including script writing, direction, acting, and shooting, but insights from “big-data” can give significant hints to all about what is likely to be appreciated. A recent example was Netflix’s success in making the movie “Roma” that won awards at the Academy and significant revenues by (reputedly) exploiting internally generated insights on consumer preferences (Fernandez-Manzano et al. 2016).

In each of our cases, the engagement between the producer and customer leads to valuable data being acquired, typically not available to other firms – which leads to the possibility of competitive advantage being created for the firm that first engages with the customer. This

competitive advantage comes from an effect that is similar, but not the same as, “lock-in”. Lock-in occurs after customers create explicit contracts with suppliers or make firm specific investments concerning suppliers’ products, but in this case the customer/consumer is a passive actor in the value creation process who is not making any explicit contract or any specific investment. Rather, we have a supplier engagement based on machine learning, that uses historical and real-time data on purchasing and location information. The process creates large data sets that have to be analyzed speedily sorting out irrelevant information (such as location changes that are routine or minor from relevant significant location changes), and then focusing on sending value added messages.

Proposition 1: When firms mobilize unique proprietary behavioral customer data to give non-obvious value adding anticipation of future customer needs, the superior customer value can translate into competitive advantage

We now move onto our 2nd value creation mechanism where customers/consumers actively assist and engage in the production and creation process, and in this case the generated data are clearly *revealed from that engagement process*. As indicated by marketing science scholars: Bateson, 1977, Langeard, 1977, Vargo and Lusch, 2004, Gronroos and Voima, 2013, co-creation through engaged consumption shifts out the demand curve and improves customer experience. Until recently, the costs of co-creation have been large, as evidenced in high class dining experiences and the highly engaged strategy consulting project. In both cases, customization is expensive, and the markets for the offer are limited. Digital products in general can be tailor made much more simply and cheaply, at a high fixed cost and low marginal cost. This means that the co-created offer in the digital world is simpler to construct.

A digital example of co-creation is the streaming services of music and video, where the provider of the service can engage with the consumer and their device through relatively simple machine learning algorithms to ascertain the optimal method of delivery taking account of the dimensionality of the screen, the speed of connection, the size of storage and many other factors that influence consumption experience (for a discussion of some of the issues directly related to video streaming see: Aversa, Hervas-Drane and Morgane, 2018; Netflix, 2018). Note all of these benefits require the customer to be involved, albeit passively, in the improvement process. These relatively small adjustments (non-trivial in terms of fixed costs but capable of being easily scaled) have been shown to lead to very significant increases in consumer benefit. In addition, because the data are proprietary to the provider, a rival cannot obviously recreate the experience for a potential customer without having to engage that customer who has to experience for a period of time a

diminished level of service whilst the new learning takes place. The inability of rivals to obviously match creates a significant “customer loyalty” effect, and the opportunities for significant profits to the first provider.

The opportunities to use solutions business models to shift demand and collect valuable rents is not exclusive to B2C, it has existed for even longer in B2B industries in capital goods, which gives rise to our 3rd business model – that of “servitization”. Here, the process of co-creation is much more complex, but also relies on digital augmentation of otherwise inflexible physical products. Again, we use an example drawn from airplane engines to explain what is happening. Rolls Royce designed engines with digital sensors that could be used to optimize performance and report faults to a central control location within the company even whilst the plane was in the air and being used by a customer. Rolls-Royce then engaged with customers to gather data about intended engine use, and with the combined data, allowed Rolls Royce was able to provide engines to military and commercial airlines as a “solution” commonly termed “power by the hour”. In this “solution” the performance of the engine is formally guaranteed, airline service departments totally eliminated and operational costs significantly reduced in exchange for airline customers giving the engine companies un-rivalled access to details of the airlines’ operations (Davies, 2004). Smith (2014) explains that for the initial contract with the US navy in 2003, savings from the new contract ran to more than \$60 million over the first 3 years. These new arrangements have a far greater “stickiness” than old engine contracts because it is hard for airlines to “switch” suppliers as they do not have the relevant information to secure a meaningful rival bid. And when a switch occurs there is a “honeymoon period” that might be quite lengthy whilst the new provider discovers how to deliver to the required performance levels.

Proposition 2: When firms mobilize unique proprietary behavioral customer data from past or current customer consumption experiences to co-create value by improving that experience in either B2C or B2B situations, then superior value can be created from unlocking hidden demand.

Once again, it is stressed that only those providers that actually engage with consumers can gather these consumption-produced data. And because the consumer is engaged in the generation of the data, those data are likely to be unique, valuable and in the sole ownership of the provider: the consumer cannot “unpick and take these data to a new provider”. To recreate these data, the new provider has to recreate experiences from scratch - something that might take considerable time and run the risk of aggravation and inconvenience for the customer/consumer.

IMPLICATIONS OF DIGITAL CO-CREATION ON TRADITIONAL STRATEGY PARADIGM

The principal manner in which most firms exploit customer-generated data is through selling their own products or services. But there is a difference from the standard situation, each customer is likely to be receiving a slightly different offer: whether it is the curated suggestion on what to purchase next or the enhanced consumption experience. This “differentiation of the offer” gives rise to more opportunities for individualized pricing of outputs; an opportunity that is further enhanced when the engagement is digital. In the digital world, each device is uniquely identified, and modern technology allows firms to curate what customers see on an individualized basis. Such possibilities reduce transparency, and makes price-discrimination easier. All of these factors suggest that the move from a “traditional product or service business model” to a fully engaged “solutions business model” gives rise to the possibilities of greater profits.

Because we are dealing with concepts of value and profit, we use economic language and say that the solutions business model transforms the utility of the underlying offer by a combination of altering the consumers preferences (revealing desires that the consumer perhaps did not know they had) and by shifting the resulting demand curve (due to the perception of the improved product quality). As noted above, this demand shift typically comes at a cost to the producer of providing the necessary engagement and subsequent product variety. Providing the costs are not too great, there will be more profit, and in Exhibit 2 below gives an illustration of the demand effects using Marshall’s demand and supply curves; and Exhibit 3 gives a summary comparison between the two business model types. In the case of the digitally augmented solutions, where the firm holds the critical customer data, it is noted that there is a further possibility of profit enhancement arising from the possibility of price discrimination – that is raising the price to the customer based on each one’s willingness to pay, sure in the knowledge that customer switching is unlikely. The critical question of whether these enhanced valuations turns on some important cost and organizational issues that we will probe later.

EXHIBITS 2 & 3 NEAR HERE

Proposition 3: When firms mobilize unique behavioral customer data to co-create value then competitive advantage can be created, and that competitive advantage is the consequence of being the first to engage with customers, unlocking hidden demand and retaining the key data that prevents rivals from recreating a similar experience.

With the digital experience, the user/consumer may not be aware of the nature of the information about their preferences and behaviors that are valuable. To the user/consumer, such information might be tacit and hidden, but it is revealed to the producer in the algorithms of the digital

interfaces. This asymmetry, namely that the user/consumer may not know what is the information that is valuable, and even if they do know, they may not be able to articulate that information simply and cheaply, means that the consumer is subject to the “hold-up” problem. Unlike the Akerlof (1970) situation where the asymmetric information can lead to market failure (no one providing a solution) here we have the opposite problem that the first to market captures the potential rent from the innovation as the consumer faces few alternatives.

To create competition, the user/consumer has to either access the data that the firm possesses (a right that currently only exists in a few places) and then package that data in a format that is useful for the rival firms (likely to be costly), or the user/consumer has to find another producer that is willing to engage in the same learning process – without knowing in advance the benefits of the engagement. This shopping around creates costs and uncertainty. It is costly for the user/consumer because until the new provider has “learned” about their preferences, their shopping and consuming experiences maybe inferior. And it is costly and uncertain for the entering firm, that will find it hard to judge the potential profits of the venture. The new producer will have to engage in a “learning process” to identify the hidden consumer preferences (that have perhaps been revealed over many engagements) and the data needed for co-creation. The new firm must be able to offer credible promises of superior experience and value to dislodge the user/consumer, promises that may be costly. More seriously, rivals will have a high degree of uncertainty as to what the first firm offers, it is unlikely to be able to observe the consumption experience first-hand. **EXTENDING**

CO-CREATION WITH CUSTOMERS ON PLATFORMS

The value capture mechanisms for the solutions value adding mechanisms can be extended to beyond the simple single firm to platforms. But first we need to explain what we mean by platforms. As explained by Thomas, Autio and Gann (2014) the use of the word platform has proliferated and has been applied to many different circumstances in many different ways. In this section, our focus is the market-based contracts that firms have with complementors (firms that provide complementary services or goods). This definition includes but extends beyond the transactions involved in a single business model. And, in open platforms, complementors may set up transactions beyond the control of the platform leader and even compete for users and business (Eaton et al, 2015).

The strategy literature has made it clear that the firm can benefit greatly from having an open stance towards the providers of complementary services because complementors can provide attractive supply side assets (Teece, 1986). Complementors not only increase the scope of the firm by adding resources, but they can also create network benefits, speed up the improvement of

components of the firm's offer, and add additional components and services not yet considered (see for instance Boudreau, 2000, Gawer, 2014). In this section, we add to this literature emphasizing that the platform leader may leverage co-creation with customers to achieve additional competitive advantages, that extend to reducing competitive threats from powerful rivals.

Business model types and platforms

Platforms enable the owner to form potentially exclusive relationships with complementors and customers and add value by connecting them in one transaction that exploits externality-based network effects (Parker and van Alstyne, 2005). The critical sub-set of transactions that happen on a platform are those that are inseparably linked in order to create economic value and allow for value capture by the focal actor – giving rise to a business model both as a model and as business strategy (Baden-Fuller and Morgan, 2010, Teece, 2010). Platforms enable triadic or multi-sided business models that involve more than two parties. This situation is independent of the technology underlying the platform: a traditional newspaper connects readers and advertisers and the newspaper itself functions as the platform and the publisher as its owner. The importance of paying attention to the distinction between dyadic and triadic business models is reinforced by the literature in management on value networks and technology strategy. The classic work of Thompson (1967), Stabell and Fjelstad (1998) show that chains and shops are dyadic, whereas the value networks often (but not always) join two previously disconnected parties. In order to extend the solutions business model to a triadic setting on platforms we need to first clarify why the structure of the platform matters and how customer data can be mobilized as part of a solutions business model independent on the control exerted on other platform participants. Surprisingly, we can demonstrate that platform control is only a necessary but not a sufficient condition for competitive advantage.

Our considerations will recognize the differences between two kinds of triadic-brokerage business models: those that mediate (connect directly) two (or more) parties (*iungens*) and those that intermediate between two (or more) parties without connecting them directly (*gaudens*), and we observe this distinction in our discussion of how “solutions” work in the “platform world”. A traditional market match-maker mediates between two parties and joins them. In the physical world, the auction house connects two parties allowing them to trade and asks for a fee from market participants. The newspaper represents the second case (*gaudens*), it does not directly connect readers with advertisers. Structurally, the relationships remain the same in digital business yet the ability to co-create and offer solutions now multiplies because the platform has a chance to

collect and leverage behavioral data from the customer. In analogy to proposition 1 we start with the ability to improve customer choice on platforms.

The case of improving consumer choice

Analogous to our first case where the firm had a dyadic relationship with the customer, a platform owner may anticipate future needs and generate direct suggestions or offer new product innovations to one or both sides in the triadic business model. In general, regardless of whether the platform is match-maker or intermediary, providing it has digital capability, it will be able to collect behavioral data on customer choice-making. This information about the product choice can be leveraged by the platform owner for future reference in connection to either party. We see match-making platform owners such as Airbnb using customer data to improve the searching experience, and making curated suggestions on what to purchase, and we also see Airbnb packaging complementary travel offers to tourists and additional services to hosts including insurance and product presentation (photography etc.). Since the transaction links parties together in one business model, the multi-sided platform owner may equally collect information about product and service choices of all sides involved and create a sophisticated database that can learn and improve upon offerings for future transactions. The following proposition is the platform analogy to Proposition 1.

Proposition 4: Platform firms that wish to offer the service of better choice by suggesting future purchases may be able to collect the key data from more than one customer group at the same time and the superior customer value can translate into competitive advantage over other platforms or competing platform participants.

The case of improving the consumption experience

We now explore through a series of cases the second value creation mechanism that mobilizes machine learning technology to improve the consumption experience. In all these cases, the firm needs to position itself carefully towards complementors that provide potentially distant or distributed services. We identify obvious examples that illustrate the risks involved when exerting the requisite control and the potential for value creation and capture when managed well – franchised fast food and capital goods after-sales service, and app-based taxi services and hosting platforms, which are match-makers. They all illustrate how companies that offer solutions as part of triadic business models are aiming to improve the consumption experience and exert a high degree of control over their complementors.

In the case of franchised fast food, the outsourced complementors are franchise outlets and the relationship between the final consumer and the platform is arm's length because the franchisee

stands in the middle. In this case we know that selection, training and monitoring of the activities of these complementors is subject to very rigorous standards by the platform owner as is the control of the brand the outlets have to use. In the case of the capital goods manufacturer that outsources its after-sales service the platform has direct and indirect relationships with its customers. Those partners who interact with customers are typically required to undergo training, to share data about the customer problems and to allow the firm to control the overall process. Platform owners attempt to control the consumption experience by regulating the input to services or the output and, if possible, even the process itself. It is here that we observe a limit that control can grant simply by virtue of the type of brokerage.

Match-makers are limited in their capacities to alter the consumption experience because the two parties are connected directly only after the match has been made. App-based taxi companies such as Uber and Lyft attempt to control their drivers who ultimately provide the service of hosting and driving customers despite the vehicle tracking devices that captures critical customer behavioral data. Beyond the choice of destination or vehicle, the driving experience remains elusive to the platform owner. Similarly, Airbnb connects tourists and hosts and it is the hosts (not Airbnb) that create the consumption experience *in situ*.

In contrast, in the case of a multi-sided business model that is partly match-maker (*iungens*) and partly brokering (*gaudens*), by keeping some parties separate, the limitations only apply to the match-making business. This could be the case, for example, for an online job or referral marketplace that is advertisement supported. Here, the experience remains privy to the parties to a transaction (match-making) yet the advertisement complementors are fully mediated by the platform owner. From a value creation point of view the triadic business models only make sense in the presence of strong externality-based network effects. The ability to co-create, collect and leverage customer data during the consumption experience is critical due to the nature of the externalities that generate the synergies between the customer groups. The two common externalities are the one-stop shop effect and the network effect (Ye et al., 2012) where the first one offers almost unlimited opportunities for enhanced and complementary offerings to the customer. The network effects tend to affect choice: the more drivers subscribe to an app-based taxi service the more likely a customer is to choose the app due to likely proximity of a driver. Similarly, the more houses are listed on Airbnb the more likely the customer will search on Airbnb to book their stay. The consumption experience itself, however, offers a myriad of further options if and when the experience can be observed. A taxi driver might advertise a venue or event and an Airbnb host might sell additional items to guests - hence the familiar term one-stop shop. The value created runs both ways and the platform owner may be ideally positioned to capture the value thus created. Rochet

and Tirole (2003; 2006) famously pointed out that the type of market brokerage impacts the ability of the platform owner to influence the volume traded by pricing. In other words, the ability to capture value depends on the type of business model (match-maker or multisided) if and only if it is possible to observe the co-created experience in detail and build upon the data to learn and offer further opportunities for value creation. *We summarize the whole of the above discussion in our next propositions that is analogous to Proposition 2:*

Proposition 5: the case of a multisided business model platform with strong network effects, platform owners can adopt the solutions customer engagement mechanism for superior consumption experience to each side separately, but platforms that can offer such solutions to both sides in an integrated manner offer potentially superior value creation and value capture possibilities.

Our propositions 4 and 5 suggest some necessary but not sufficient conditions for competitive advantage. To fully understand the situation, we dig deeper in the next section.

Platform competition driven by superior customer data

Platform competition has been shown to be complex where there are winner-take-all outcomes (Parker and Van Alstyne, 2005; Cennamo and Santalo, 2013). A particularly striking feature of this platform competition has been described as envelopment in a paper by Eisenman, Parker and van Alstyne (2011) who stress that firms with a range of offers can envelop rivals (that might have strong network effects that seem to make them invincible) if there are exploitable overlaps. A critical part of the mechanism of this envelopment is the willingness of customers to switch between the old and the newer “enveloping” platform. Building on the use of superior customer data we can articulate an exception and show how envelopment can be resisted or even reverted in the case of a firm that mobilizes customer behavioral data to give its customers a superior customer experience (and superior experience of choice).

We point here to the under-documented case of the “super apps” in Asia. Consider the firm KakaoTalk that provides its messaging services in an open platform environment of Android and iOS platforms with the situation facing the platform owners – Apple and Android. KakaoTalk, Line and to some extent WeChat (apps that exists on both platforms) have managed to *envelop* the host platforms with their own service offering. These messaging services invite others into their messaging app but exert a strong control over the complementors. For example, KakaoTalk invites developers for services (such as emoticons), and makes a selection among bidders to offer their

services wrapped in the KakaoTalk label and offered on their closed platform. Only invited suppliers can appear on the platform, and they all have to abide by KakaoTalk's rules that denies them full access to customer data. This means that when someone sends a message on KakaoTalk's platform and subsequently wants to send them a gift, KakaoTalk is able to contact the recipient through its network without divulging details to the giver of the sender's location and vice-versa. Likewise, the search engines on all three platforms are outsourced to partners, but the searching user only sees the brand of the host and the data is intermediated by the host. In this example, KakaoTalk limits the extent to which complementors can innovate, but trades this off with a greater degree of control over customer data assets. All this takes place outside of the control of Apple or Android that run the platform on which the KakaoTalk app is based. These messaging app ecosystems (often labelled super apps) have managed to resist envelopment by both Android and Apple, circumventing features of the host whilst the app is being used.

Our KakaoTalk case shows that the way in which co-creation allows platform owners to mobilize customer behavioral data can be decisive for the outcome of competition as well as competitive advantage, an important extension and exception for the Eisenman, Parker and Van Alstyne general theorem. Platform boundaries, particularly for open systems, are less than clear cut. As Jacobides and colleagues (2018) point out, the emergence of ecosystems depends on the presence of externalities both on the supply side as well as on the demand side. The externality-based network effects in consumption which we discuss here lead us to conclude that the business models in operation play a key role for mobilizing customer data. In the example of KakaoTalk, arguably, the platform can be defined as the super app or the operating system of the device and, in one view, the operating system and potential enveloper (Android or Apple) are reduced to mere core infrastructure providers rather than platform players (Henfridsson and Bygstad, 2013).

Business model types and customer data

The co-creation of value with customers shifts the customer engagement to the center of strategic attention and it is this engagement that *business-models* model (Baden-Fuller and Morgan, 2010). We suggest that 4 types of business models capture the essence of the choice businesses face and we suggest (but do not expand due to space constraints) that these choices are "ideal types" (Baden-Fuller and Morgan, 2010). We note that this set of ideal types is the first to explicitly look at issues of solutions engagement; and builds on other categorizations that discuss platform sides (see for instance Rochet and Tirole, 2003 and 2006; Parker, van Alstyne, 2005; Hagiu and Wright, 2015; Jacobides, Cennamo and Gawer, 2018). Our 4 types are divided by single (dyadic) and multisided (triadic) business models and between those situations where firms do not leverage digitally

customer behavioral data and our two solution business models that do leverage through machine learning unique behavioral customer data, see exhibit 4.

EXHIBIT 4 NEAR HERE

We summarize the above arguments in Exhibit 4 that shows the four basic business model types: Product Business Model with the passive approach to customer engagement (that includes the platform offering a set of complementary offerings – the null position at the start of the paper); Solutions business model that mobilizes customer engagement to a higher level that was outlined in our first section (that includes the platform with a set of solution offerings); Match-making exchange (simple engagement mechanism) and the multisided-solutions based business-model where the sides have solutions styled engagement that were elaborated on in our section on platforms. We argue that these 4 types capture the essence of the business model choices (with sub-divisions possible within each type); and suggest (but do not expand due to space constraints) that these choices are “ideal types” (Baden-Fuller and Morgan, 2010).

Our Exhibit emphasizes the value of mobilizing behavioral customer data by delivering superior customization, be it in choice or experience. Even before the digital revolution, some firms have always been customized, but this provision has typically been expensive to provide, and difficult to scale. Mass customization has become possible for new applications and new depth into the production process using digital technologies (Franke and Piller, 2004). And we suggest that for the platform owner with the triadic business model, such data mobilization is particularly important because combinations can be exploited with more than one group of customers at the same time. Platform owners have the opportunity to exploit their engagement with customers in a contested space where other complementors and competitors may become privy to the nature of the exchange depending on the openness and the control of the platform owner. Gathering information about customer choice seems contractually possible in most cases where a triadic business model operates yet the consumption experience may fall outside the direct observability of the platform owner. This insight means that for solutions to fully take advantage of superior customer data the business model type matters.

ORGANIZING CHALLENGES FOR PLATFORMS WISHING TO OFFER SOLUTIONS

Can a firm take its current product business model, and adjust to become a solutions business model – thereby gaining the previously outlined benefits? Along some dimensions the answers appear to be yes, but along others it appears to be no. Consider, first, the challenge of making suggestions on

what to purchase based on past interaction data. The design of algorithms to facilitate this appears to be widespread across many platforms and adoption of these techniques do not appear to be a significant organizational challenge (but has some ethical and legal considerations).

When it comes to the co-creation activities, here the challenge is somewhat greater, and it appears that the product business model approach is not compatible with the solutions approach. As said earlier: in the product business model, the job of the research department alongside the marketing department is to anticipate and articulate market needs that are then passed over to the design department to construct blue prints that are given to the production departments; with the subsequent output passed back to marketing to distribute and sell. As said earlier, top management plays a key role at every stage of the sequence ensuring coordination between actors either explicitly or by producing governance rules that deal with hand overs and disputes. In the language of dynamic capabilities, top management has to over-see the sensing and seizing of opportunities (Teece, Pisano and Shuen, 1987; Teece, 2007). This organizational design rule is only changed slightly when the firm runs a platform with many products provided by outsiders – the search for suitable complementors, their screening and choice for acceptance on the platform. provides a critical role for top management.

In the solutions business model, things are different for several reasons. Anticipation, design, production and consumption all take place to a greater or lesser extent in front of the customer/consumer, and the role of top management is much diminished as power is passed to the front line. The process of co-creating value with customers/consumers is a form of open innovation – because the firm is engaging in an open manner with new ideas coming from outside its normal boundaries. But in this case, it is not other firms at the same or earlier stages of its value chain that are providing the ideas, but rather the customers/consumers actors who are down-stream. To be properly responsive to customers, and to command customer resources, those who are in contact with the customers (the front line) have to be (fully) empowered, and when there are many customers (as in say a B2C) the firm has to decentralize much of its decision making. Sensing and seizing must take place on the front line, with the role of top management being to set the tone and some very broad rules.

Note, it is not open innovation per-se, but open innovation that involves customers that requires this power shift. Digital platform firms engaged with the product business model are often involved in open innovation, as with platforms that list their products for others, seeking complementarities across multiple domains. In these cases, there are many critical issues that need the attention of top management, particularly the principles behind design of the rules for the interfaces and the incentive structures and levels for participants (see for instance Baldwin & Clark,

2000). For example, Google and IOS run rival operating systems for mobile devices, and each of the two firms has paid great attention to providing a single centralized-system across that encourages independent app makers to design new offers and to list these on platform. They try to encourage innovation by the partners and creates a positive ecosystem for the benefit of the final user (for an exposition of some related issues see for instance Nambisian, Siedel and Kenny, 2017; Parker, van Alosty and Jiang, 2017).

In complete contrast, firms operating a solutions-based business model have strong incentives to adopt a completely different approach: one that down plays the role of the center and focuses on the importance of the front line. To understand what empowering the front line really means, and why it is such a challenge, we draw the readers' attention to two very important studies.

In the first study, Randhawa, Widen and Gudergan (2018) examine theoretically and empirically the design structure of a very important anonymous digital platform firm labelled Nexus involved in providing digital solutions business model in the open innovation B2B sphere. Leveraging insights from a careful study of 18 projects in Nexus, that engaged in crowd sourcing ideas from consumers and intermediate users for a wide variety of clients, Nexus noted that there were significant challenges in getting their clients to understand the potential value of customer/consumer led innovative ideas. Whilst lack of understanding of the value open innovation is one barrier, the most significant challenge is linking across the internal interfaces of Nexus' clients. Nexus (and the researchers) found that top management of clients were often reluctant to allow decision making to be passed down the line to the front, and that this "holding back" seriously impeded the co-creation opportunities.

In detailed studies of Haier, the world's largest domestic appliance producer that is largely involved in B2C (or B2B where the second B consists of SMEs), Meyer, Lu, Peng and Tsui (2017) had the benefit of access to the operations of the company, and were able to document how "micro-divisionalization" of the company, and empowering front line micro teams with unprecedented amounts of decision making power were key elements of successful customer engagement strategies. By dividing the company into more than 2,000 front facing business units, this giant \$32 billion enterprise were able to unlock creativity resulting in superior value creation and profits (twice the growth rate and twice the net margin of its rivals). Haier's policy of decentralization, that they labelled Renanheyi, has been established for more than 12 years, and has strong digital elements (Frynas, Mol and Mellahi, 2017).

These two studies reviewed above, coupled with the observations of the marketing experts on more traditional non-digital firms leads us to suggest that:

A firm cannot simultaneously run a customer-engagement business model with a product business model, the two models require different managerial logics and different competencies. These differences will be more manifest and accentuated in firms that are engaged with physical products.

DISCUSSION

Over the past two decades there has been much research on the impact of digital technology, focusing first on the ability of firms to be flexible and creative in their offerings, and second on the changing nature of competition driven by the arrival of the world wide web, and the possibility of firms adopting multi-sided business models. But this research has not caught up with the recent developments in machine learning that allows firms to leverage customer behavioral data through machine-learning. In this discussion section we summarize our finding above, and explore even more fully why such an omission is really serious, emphasizing the new insights into new strategies that have been hitherto impossible to execute: strategies that change the competitive landscape not just for digital platforms but for all firms – large and small.

Adjusting traditional notions of competitive advantage

The resource-based view of the firm theorizes that firms with superior resources can plan, design and build attractive products and services that will capture greater market share and superior profits (Barney, 1991; Grant, 1996). A key assumption underlying this theorization is that the firm and its competitors engage in a single common business model, typically the “product business model”. Rival business models of customer engagement that we label the solutions business models have long been evident in “consulting” firms an elsewhere in pockets of the economy, but the issue has received very little attention in the strategy literature for several reasons, the most important being the challenge to executing these solutions business model effectively at scale. These challenges include (1) the high cost of unplanned variety, (2) the difficulties of engaging closely with a large number of customers in design, production and consumption at scale, and (3) the difficulty of capturing the full value of the increase in value resulting from that engagement.

Recent advances in digital technology and the internet availability and density have transformed the landscape and allowed a large number of firms to overcome these challenges, some of these firms operate platforms but others are more traditionally organized and operate in the physical world. These advances mean that firms can engage in a number of customer engagement strategies: collecting data from customers/consumers to improve choice; engaging directly with customers to improve the consumption experience and jointly engage with production and

consumption; and allow customers/consumers to engage directly (but perhaps passively) in the design process. Each of these advances relies on data collected from customers, and manipulation of that data, and each of these advances gives rise to the possibility that firms can gain advantage over other firms not related to “initial resource positions”. As a result, competitive advantages accrue to the first adopters of the solutions business-model, and are rather different from (most of) the traditional first mover advantages emphasized in the entry literature concerning secret or protected technology, commitment and industry evolution (see for instance a recent review by Fosfuri, Lanzolla and Suarez, 2013). And these solutions-oriented business models are also applicable to platforms, particularly those that are “closed” on one or several sides.

The economists’ discussion of “experience goods” (Nelson, 1970) and the discussion of the challenges of harnessing asymmetric information (Akerlof, 1970) lays the foundation of our discussion, but does not provide a full analytical base to examine the issues in detail. The work of Priem and his followers (referenced above) about demand side thinking, moves us closer to a better understanding, but neither of these literatures provided a full explanation of the solutions business model possibilities.

It is the deployment of machine learning on a large scale to harness customer generated data that allows us to challenge the standard assumption in strategic management about the value of production resources that is dependent on *everyone can know or easily find out customer/consumer preferences* (see particularly Brandenberger and Stuart, 1996). The “product business model” is no longer the norm for the future. Rather, customers (and firms) have preferences for goods and services that can be labelled “experience goods” in economists’ terms (see for instance Nelson, 1970), where production is service oriented in the sense that consumption and production take place (almost) simultaneously. The boundary of the firm now moves outwards to include the consumer². Neither side may understand the importance of the knowledge until they meet, because the knowledge is complex and capable of being made explicit and so exploitable (see Polyani, 1966, amplified into the business context by Nonaka, 2000).

² Akerlof (1970) was the first to formally articulate how the asymmetry of knowledge between consumers and producers could influence each sides’ behaviours. Whilst his concerns were with sellers not revealing information to buyers, rather than our concern of sellers not knowing about buyer desires or about production and consumption occurring simultaneously, his work revealed important ways of thinking and understanding. To elaborate, in his famous piece, he articulated the challenge of asymmetric information when buyers know less than sellers about the seller’s offering – creating a difficulty for both buyers and sellers: sellers of high-quality products or services will be under-cut by rivals offering cheaper, inferior products – because ex-ante buyers cannot tell the difference, and buyers will shun these markets because too many offers are inferior. The problem is most serious where transactions are “one off” but sellers who operate at scale are strongly incentivized to create a “quality brand” that invites buyers to know that their offers are of good quality. In markets where there are repeated transactions, sellers can signal quality through branding, and if the brand quality is maintained, the market reaches a new equilibrium, but the high-quality sellers can charge a potentially significant premium.

We speculate that the historic lack of attention to these issues has been driven by several factors: the common confusion between solutions and services; the small size of most businesses that historically adopted the solutions business model, and the lack of serious challenge of the solutions business model to the core strategy concepts of resource driven competitive advantage. About the first points, consumers and intermediate users have always known that purchasing mass produced items contains serious risks of a mismatch between the offer and the experience, something that is only partially resolved by branding and segmentation. In this respect, firms that offer product-services rather than true solutions only go part way to resolving the challenge. Product-services offered by product firms are not especially tailored to customer needs, and are typically offered to lower the user's costs of acquisition and thereby create some (marginal) differentiation. Such offerings are associated with lower profits in the pre-digital era (Suarez, Susumano and Kahl, 2013). Solutions that are focused on serving pin-pointed customer needs can be physical goods or intangible services, but they are not the traditional unfocused product-service offerings.

Adjusting traditional notions of openness and ecosystems

The burgeoning literature on platforms, openness and ecosystems makes much of the value of platform strategies that encourage many complementors; who solve problems of resource availability and accessibility to complementary assets that improve customer/consumer experiences. However, as pointed out in our piece, much of the literature ignores the challenges that openness brings to the collection and curation of customer experience data that needs to be shared across the platform. Our theorizing suggests that there are trade-offs, and that untrammelled openness can hinder collecting and mobilizing data assets that improve customer experience. we suggest that exploring these trade-offs is an area that is ripe for future research.

Privacy and customer data

The collection of revealed preference data from customers is a hot topic, of great concern to many. The standard suggested solution to the problem, manifested in European legislation (called GDPR) that gives customers the right to demand that digital firms stop collecting behavioral customer engagement data. This standard solution does not really help the consumer as much as it might. This is because customers generally, and consumers in particular greatly value the curation services that firms offer, but dislike other aspects of their manipulation of data – in particular the habit of utilizing the data to price discriminate and to pass on data to other providers (maybe within the same organization) without knowledge or permission.

We suggest that regulation should be modified and reduce its emphasis on collecting data *per se*, but rather emphasize the need to specify the mechanisms that firms may use to leverage the data; and the outputs where they use the data. Whilst such controls might seem a little harder to specify, they would surely give rise to greater value. In particular, our analysis suggests that users/consumers would like firms:

- To be able to choose if firms can collect and mobilize behavioral customer data to improve the prediction of what the user/consumer might want next so as to reduce search costs and reduce uncertainty in the buying process;
- To be able to choose if firms can collect and mobilize behavioral customer data to improve their new product development processes
- To be able to choose if firms can collect and mobilize behavioral customer data to improve the consumption experience
- To be able to prevent firms from utilizing behavior customer data to price discriminate
- To be able to force firms to be more transparent about their price offers and prevent them from making offers dependent on unjustified differences in consumer taste and situation

In our case, much of the data that firms collect and leverage for the solutions business model is not a person's innate characteristics (such as age, sexual orientation, nationality, place of birth) but rather another kind of personal data – what we consume, how we consume, where we consume and what combinations we consume together with whom. Such data is of value to companies, and when properly used can lead to superior consumption experiences. Whilst there is an incentive for companies to keep these data secret, it is clear that they do not always do this on account of imperfect data security and on account of the incentive to sell the data for ready cash. Our framing gives a clear account of why the consumer might still wish for these data to be collected, yet have clearer rights over these data – and provides a framework for legal scholars to make further progress on this important topic.

The literature on business models as models:

Finally, we note our contribution to the business model literature. As has been noted by many, whilst the definition of a business model is that it is the set of mechanisms that creates and captures value (Teece, 2010), the necessary classification of these mechanisms has remained elusive (Baden-Fuller and Morgan, 2010, Massa, Tucci and Affuah, 2017). Our central claim is that we can clearly define two important value creating mechanisms that differ from those emphasized in the past literature (Baden-Fuller and Haefliger, 2013). These business models help firms generate and exploit customer data and turn these data into valuable exploitable complementary assets, and that these

business model choices also feed into the wider sets of possibilities concerning platform choices of openness and control with respect to complementors. Before we go further, we need to explain quite carefully what we mean by the words business model. Since early 2000, the literature on business models has blossomed; and according to Massa, Tucci and Affuah (2017) it falls into three strands. The majority of the literature examines business models as attributes of real firms (see also the review of Zott, Amit and Massa 2011), and in this conception business model types are highly situated into the firm context, and the words business model and strategy can be seen as closely intertwined (see for instance Amit and Zott, 2001). In this literature there are no widely agreed business model typologies, rather a plethora of taxonomies (such novelty and efficiency) - that are specific to particular contexts and not necessarily replicable to new times and new places.

In contrast, a smaller but similarly influential dimension of the literature looks at business models as cognitive schema or conceptual representations. In these dimensions, business model types emerge as central constructs that are quite separate from strategy (Teece, 2010; Casadesus-Masanell & Ricart, 2010). These constructs are typically ideal types (Baden-Fuller and Morgan, 2010) being: “..a heuristic logic that connect technical potential with the realization of economic value” (Chesbrough and Rosenbloom, 2002) that is quite akin to the cognitive heuristics examined by Porac, Thomas and Baden-Fuller, 1989 in the business models of Scottish Knitwear firms, the analysis of Tripsas and Gavetti (2000) of Polaroid, and Gavetti, Levinthal and Rivkin (2005) on Kodak. These conceptual and cognitive constructs are capable of manipulation and bringing insight. Teece (2010) looks at historical business model types in manufacturing and Baden-Fuller and Haefliger, 2013, examine different business model customer engagement mechanisms (taxi and bus). This sense of being difference is in accord with the principles of modelling laid out by Herbert Simon (who argued for simple models that could be manipulated), and adopting the basic principles of modelling economic actors with models laid out by Morrison and Morgan, 1999, and explored in the context of the instruments that economists use in Morgan, 2013, we can see that there is a long history of this style of thinking that spans a whole range of economic issues.

CONCLUSIONS

Strategy is about identifying choices, understanding the reasons behind these choices, and their consequences. The digital world has completely changed the nature of information surrounding customer demand and thrown up new strategy choices concerning how firms can exploit that information to maximize their benefits. Until recently, strategic management has paid only marginal attention to these demand side issues that give rise to the possibility of new business models that are in “conflict” with the traditional “product business model”. These changes shift our

understanding of the fundamental precepts of strategic management and the resource-based view, de-emphasizing the importance of resources and increasing the importance of agility and customer selection and co-creation. With the solutions business model, many of our traditional ideas of the dynamics of competition must be altered along with changes to our centralized notions of how to effectively organize a business.

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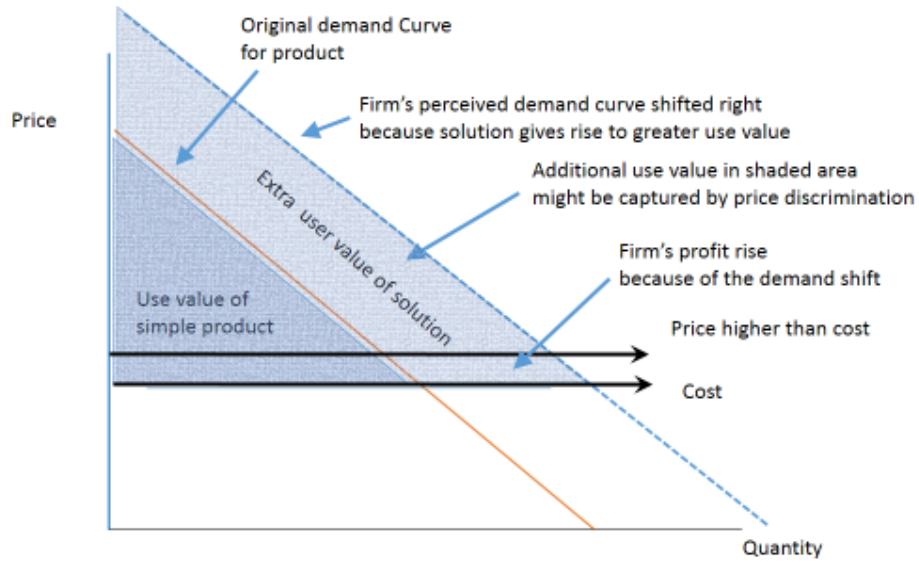
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Exhibit 1: Solutions Mechanisms for Superior Value Creation

Mechanisms for Value Creation – with examples	Relevant Academic Literature	Source of competitive advantage
IMPROVING CONSUMER CHOICE		
Using past purchasing data of customer compared to other customers to suggest non-obvious purchases – Amazon making product suggestions	Priem, 2007, Ye, Priem, Alshwer, 2012 -reduce search costs for consumers, also reduce uncertainty when making choices.	Customer data that reveals preferences is held by only the supplying firm
Using data on purchasing behavior to design superior offerings for the customer – SunCloud	Von Hippel, 1996; Baldwin and von Hippel, 2011 – harness customer knowledge to improve new product development	Customer data that reveals preferences is held by only the supplying firm, and the innovated product or service has some intellectual property rights to prevent copying
IMPROVING THE CONSUMPTION EXPERIENCE		
Using data about the user (and the device) to improve the quality of service offering – Netflix streaming	Bateson, 1977, Langeard, 1977, Vargo and Lusch, 2004, Grootenboer and Voima, - improve the consumption experience and reveal or create new demand	When the key customer data that is revealed through consumption is not accessible to rivals, without similar investments in customer engagement
Jointly engaging in production and consumption Servitization of capital goods by optimizing the hardware and integrating the maintenance services – GE and Rolls-Royce “power by hour”	Davies, 2004, Cambridge Institute of Manufacturing – save system costs and allow new demand to be identified and captured	When the key customer data that is revealed through consumption is not accessible to rivals, without similar investments in customer engagement

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EXHIBIT 2: Simple Marshallian Demand Comparison of Product and Solutions



3

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EXHIBIT 3: Comparing the Product and Digitally Enhanced Solutions Business Models

	Product (Business) Model – without enhanced engagement	Digitally Enhanced Solutions Customer Engagement (Business) Model
Demand	Demand curves are known and fixed: All firms know the demand curves of all customers/consumers or can ascertain them easily. Switching between firms is relatively costless	Demand is uncertain, is co-created by customer/consumers interacting with firms. Firms collect data from customers about their consumption patterns in a fine-grained manner. Rivals cannot easily ascertain these consumer preference data and so it is costly for customer/consumers to switch between suppliers
Costs	Resources are key inputs into lowering costs, increasing efficiency	The firm’s resources are augmented by the resources of its customers/consumers and it is the combination that determines costs and efficiency
Innovation	The pace of innovation is determined by the firm’s level of resources	The pace of innovation is jointly determined by the resources of the firm and its customers/consumers
Value Capture mechanism	Price and volume of the offer. Price discrimination is typically difficult because of the lack of granular relevant customer data.	Price and volume of the offer. Price discrimination is typically easy due to the ability to identify demand at the individual customer level.
Organizing	The critical role is that of top management that has to orchestrate the sequence of design, production and distribution that is typically undertaken by specialist departments.	The critical role is the front line that has to engage with consumers proactively, react to their needs, orchestrate creation of new possibilities and exploit those opportunities. Top management’s role is limited to setting the tone and the rules.
Competitive Dynamics	Competitive advantage and superior profits come to firms with superior resources and superior capacities of top management.	Competitive advantage comes to the agile and creative first movers – who choose the right kinds of customers and empower their front-line workers to engage with those customers to assemble superior positions that are not easily assailable.

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Exhibit 4: Four Fundamental Business Model Types in a Digital World

	Passive Simple Engagement	Customer engaged Solution
Mobilize customer data	NO leveraging	YES leveraging behavioral customer data is critical
Dyadic	<p>Product Business Model</p> <p>Product or service offer via a value chain with limited or no after-sale interaction (most traditional products and services).</p> <p><i>Customer data cannot be effectively mobilized</i></p> <p>Examples: home furniture, haircut, web-based resources</p>	<p>Solution Business Model</p> <p>Customized products and services leave data traces, often long-term interaction and consumption experience matters.</p> <p><i>Any combination of superior customer data can be mobilized, customer choice or experience or both.</i></p> <p>Examples: servitized capital goods, medical treatments</p>
Triadic	<p>Matchmaking Business Model</p> <p>Connecting complementors with customers on a platform, enabling their direct interaction during consumption.</p> <p><i>Customer data can be mobilized for predicting choice but experience usually remains elusive.</i></p> <p>Examples: farmer’s market, app-based taxi, online dating</p>	<p>Multisided Solution Business Model</p> <p>Brokering between multiple parties such as suppliers, advertisers, complementors, and end-users, keeping some or all parties disconnected and fully intermediating the transaction on a platform.</p> <p><i>Any combination of superior customer data can be mobilized, customer choice or experience or both.</i></p> <p>Examples: newspaper, social media, streaming services</p>