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DATA-ORIENTED BUSINESS MODELS: GAINING COMPETITIVE ADVANTAGE

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ABSTRACT

Data has been widely regarded as a new treasure throw for contemporary organizations. Information technology sector has been experiencing a major shift towards data orientation. A recent explosion of digital data has significantly influenced a number of other economic sectors in developed economies. Exponential growth of data is expected to continue in a foreseeable future. Capitalizing on this trend is gradually becoming a necessity for contemporary businesses. Extracting value from data is a substantial challenge. Data acquisition is the starting point. Efficient processing of collected data is the next stage. Suitably processed data is used for designing data products and services. At each stage, there are significant opportunities for value creation and monetization—the core aspects of business models. Data-oriented activities also provide opportunities for gaining competitive advantage. Despite the growing importance of data-driven innovation, there is a considerable absence of studies addressing data-oriented business models. We explore the essential elements and enablers of viable data-oriented business models and pathways to competitive advantage.

JEL: C8, C81, C82, C88, D7, D8, D81, M15

KEYWORDS: Data-Oriented Business Models, Data-Driven Innovation, Data Economy, Data Engineering, Data Products, Data Services, Actionable Knowledge

INTRODUCTION

Data has been growing exponentially over the past decade. This growth is estimated to continue at over the following decade (Gantz and Reinsel, 2012). Many developed economies have achieved digital dominance around the beginning of the twenty-first century. That is, digital data has surpassed analog one, and it will continue to do so. That was the first milestone. The next milestone is anticipated to occur soon. It is estimated that emerging markets will outgrow mature markets in data production (EMC, 2014). Consequently, the capitalization of data economy may experience shift towards emerging markets. The rise of digital data and its dominance has been accompanied with both benefits and challenges (McAfee and Brynjolfsson, 2012; Charlesworth, 2009). Digital data is easier to produce. There is an abundant spectrum of devices that can rapidly produce large amounts of digital data. Devices range from large-scale systems, throughout mobile devices, to miniature sensors. Digital data is also easier to store and manage. High capacity data storage hardware and database software have been developed (Kroenke and Auer, 2013). Most importantly, digital data is easier to manipulate and process. The main processing tools have become digital computers. Vast variety of software tools can easily manipulate raw data from other devices and produce new data—thus, reinforcing the production loop.

The reinforced data production loop has brought unexpected consequences. Data is produced at a faster rate than we can adequately process and store it. The production has outpaced the processing (Gantz and Reinsel, 2012). Commercially oriented data processing is computationally vastly more intensive than the reinforced data production. Presently, the expansion of digital data is disproportional to the progress in data processing technologies. The disproportional growth of data to the desired processing capabilities has

led to the big data problems (Géczy, 2014; Fan et al. 2014). Since the expansion of data is faster than the capabilities of organizations to suitably process it, there is an increasing gap between the required and available processing capabilities. The increasing gap is central to the big data problem. When organizations experience the big data problem, they need to address it quickly. Failure to do so leads to diminishing abilities to utilize data and harness its potential.

Organizations have been striving to realize the potential and transformational powers of data (Redman, 2015). They started collecting extensive volumes of data both internally and externally (Provost and Fawcett, 2013; Manyika et al., 2011). Internal data may provide valuable insights on operational awareness and internal functioning. By utilizing such insights, organizations can innovate their business processes and improve operating efficiency. External data offers indispensable insights about their customers. Better understanding of their customers' needs helps innovating their products and services. Various data-oriented economic activities have started in an effort to realize commercial potential of data. Data economy has been gaining a significant influence (Géczy, 2015). The activities can be divided into three major segments: data collection, data processing, and data services or products. Data collection activities relate to acquisition of raw data. They encompass hardware and software systems for collecting and storing data. Data processing activities pertain to manipulation and analysis. They include systems for analysis, conversion, modeling, knowledge extraction, etc. Data services or products represent the final outcome in commercialization of data.

Thriving data economy gave birth to innovative business models (McCallum and Gleason, 2013). The early business models have been trying to apply the existing approaches to data-oriented activities, or focusing solely on data and its content. While applicable in some instances, many data-oriented activities have specific characteristics that make them unfit for the conventional business models. Analogously, focusing on the contents of data itself has led to simply collecting and reselling it in a raw form. Novel business models have been emerging with aim to accommodate specifics of data-oriented economic activities, or target only certain markets. Mobile communication markets have been attracting a significant attention—even from governmental and regulatory bodies (ACMA, 2011). Facilitation of novel business models requires perspective that encompasses specifics of data-oriented activities and traditional approaches. The presented work attempts to undertake this challenge.

The manuscript is organized as follows. The literature review section provides a concise overview of related works. It is followed by the section 'Methodology' where we explains our conceptual framework. The section, 'Data-oriented Value Creation' presents several pertinent styles for value creation from data. They are positioned within the introduced conceptual framework. The following section is 'Data-oriented Monetization'. Various pertinent monetization strategies are presented here. They are also mapped into the introduced conceptual framework. The next section 'Gaining Competitive Advantages—a Path Forward' highlights selected opportunities outlining how data-orientation can lead to competitive advantages for organizations. In the section 'Summary', we illustrate the overall perspective on data-oriented value creation and monetization. The presentation concludes with a concise summary of the essential points.

LITERATURE REVIEW

Data and information are the key assets in data economy (Newman, 2011; St. Amant and Ulijn, 2009). Data economy has been growing over the past years and it has been estimated to continue doing so. The growth has been fueled by the exponential expansion of data. Data economy has been increasingly influencing several sectors. Notable effects have been evident in commerce, labor, education and government (Géczy, 2015). Commercial economic activities have been ranging from data collection, throughout data processing to offering of novel data services and products. Data-oriented commercial activities call for new data professionals, such as data scientists and engineers. Shortage of skilled data

professionals gave birth to novel academic programs. Realization of the economic and social potentials of data requires involvement of regulatory bodies. Government must sensibly regulate the economic and social environments in order to balance the needs of organizations for data and the rights of individuals to privacy. Data has become an asset for organizations (Oppenheim et al., 2003; Tallon, 2013). This new digital asset has started replacing physical assets in value. Many modern technology companies have greater digital assets than physical ones. While physical assets have been commoditized, data has a potential for maintaining value and even growing in value (Lievesley et al., 1993). Value of data has been rising and companies have been aware of it. Organizations have been attempting to derive further value from data. Extracting value and insights from data has become the objective for many organizations (Vertesi and Dourish, 2011). They have been increasingly involved in a range of data-oriented activities. Organizations have started collecting volumes of data about their operations, suppliers and customers. The prevailing trend has been to collect as much data as possible, and analyze and explore it later. Operational data can be explored for insights into business processes and used for extraction of actionable knowledge. The insights have been utilized for alleviating operational efficiency (Géczy et al., 2007 and 2008). Actionable knowledge extraction techniques have been employed for improving core competencies and providing timely business intelligence (Laursen and Thorlund, 2010).

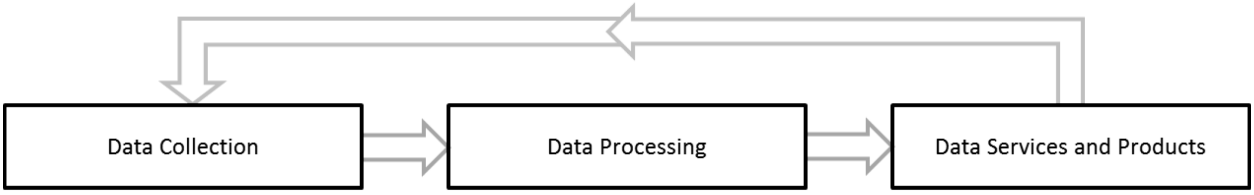
Data-oriented economic activities gave rise to business models based on provision, transformation and utilization of data (Redman, 2015; Timmers, 1999; Alt and Zimmermann, 2001). The emerging business models have been diverging from the traditional concepts (McCallum and Gleason, 2013). Business models are still a relatively modern concept and scholars are in a disagreement on various issues. However, several common grounds have been identified: a) the business model is representing a new unit of analysis, b) business models emphasize an encompassing approach to explaining how companies do business, c) organizational activities play the key role in conceptualization of business models, d) business models aim at explaining how values are created and captured (Zott et al., 2010). The last outline of what the business model represents has been gaining a notable attention. The business model presents the logic or strategies how enterprises create values for customers and how they monetize it for profit (Teece, 2010). Hence, the business models comprise of two main components: value creation and monetization. The presented work embraces this conceptualization of a business model. Commercialization of data and data-oriented activities has been exploited by organizations for gaining competitive advantages. That is, enriching or tailoring their business models for attributes that enable organizations to outperform their competitors (Porter, 1980). Data analytics have been utilized as a mean to attain competitive advantage for organizations (Davenport et al., 2007 and 2010). Taking into account the sensitivity of personal data and aiming at users trust has been also explored as a way to competitive advantage (Morey, 2015). Access to data and services via the Application Program Interfaces (APIs) has been outlined as another strategy towards competitive advantage (Iyer and Subramaniam, 2015).

METHODOLOGY

A business model represents the logic of an enterprise (Zott et al., 2010; Teece, 2010). It explains how the enterprise creates and delivers value, and how it gets rewarded for it. Hence, there are two main elements involved: value creation and monetization. In describing a business model, it is necessary to address both of these elements. The methodology presented in this work adds a new dimension in categorizing value creation and monetization strategies. The new dimension exposes associations with the major stages of data-oriented economic activities. Incorporation of the new dimension enables us to provide better perspective on characteristics of data-oriented business models and explore further details. It permits us to position the value creation and monetization strategies within the major segments of data-oriented economic activities. These features are beneficial for both data professionals and technology managers. The presentation of major data-oriented activities includes the data flows between them (see Figure 1). The illustration also resonates with the process of data product creation and data flow cycle. It starts with the collection of data. Raw data is collected for a specific purpose (e.g. creation of a data

product). Collected data needs to be suitably processed. During the processing, relevant information, knowledge and insights are extracted. These are utilized for designing a viable data product. Data product is marketed to customers. Use of a product generates additional data—the feedback. (also referred to as a 'data exhaust'). The feedback data is collected, processed and used for improvement of a data product.

Figure 1: Major Segments of Data-Oriented Economic Activities and Data Flows



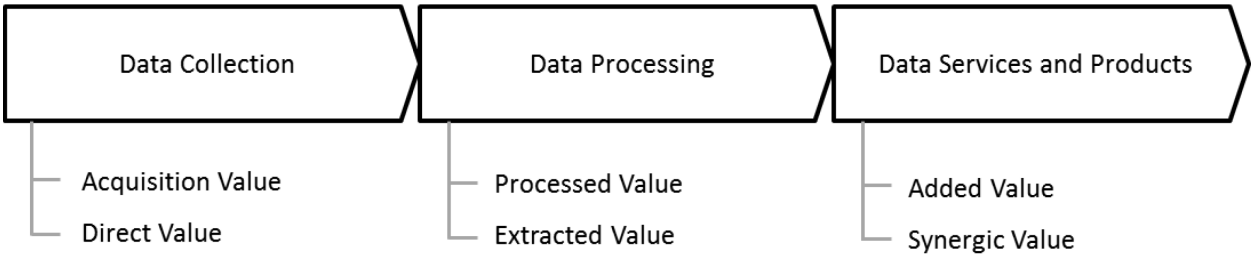
Data-oriented economic activities span across three major segments: data collection, data processing, and data services or products. Data collection encompasses activities related to the acquisition of raw data. Data processing segment includes activities related to processing and manipulation of raw data, and extraction of knowledge or insights from data. Data services and products are designed utilizing processed data or extracted insights. Arrows illustrate the major data flows between the segments.

The cyclic process is depicted in Figure 1. As described in the former paragraph, it outlines the major segments of data-oriented economic activities. Three major areas of data-oriented economic activities pertain to data collection, data processing and data services or products. Data collection segment covers economic activities related to gathering of raw data. These include, for instance, sell of devices for data collection and digitization, or sell of raw data itself. Data processing segment highlights economic activities related to manipulation of raw data and extraction of valuable insights. For instance, sell of software products for data processing, analytics and modelling, or timely insights. Data products and services delineate the final segment of the chain. It encompasses economic activities associated with broad-ranging services and products. Understanding of the major segments of data-oriented economic activities and data flow cycle is crucial for positioning of value creation and monetization. We map the presented strategies for value creation and monetization directly into the corresponding segments. This allows us to clearly see which value creation and monetization strategies are viable at which stage. Furthermore, mapping of value creation and monetization strategies into appropriate segments allows managers and data professional to creatively combine them when devising their specific data-oriented business models.

Data-Oriented Value Creation

Data is the enabler for creating value in data economy (Newman, 2011). Value of data can be realized immediately, or over an extended period of time. Organizations are gradually recognizing this fact and treating data as a valuable long-term asset (Oppenheim et al., 2003). However, many organizations are unable to derive desirable value from data. They lack knowledge of and perspective on value differentiation and derivation. We present a perspective on value differentiation and creation with respect to the segments of major data-oriented economic activities. Data holds different potentials for value creation at various stages. We distinguish three pertinent stages of significant data-oriented economic activities: data collection, data processing, and data services and products utilization. Different kinds of values can be derived from data at different stage (as illustrated in Figure 2). Data collection stage generates direct and acquisition values. Data processing stage presents opportunities for deriving processed and extracted values. Data services and products provide grounds for deriving added and synergic data values. The following paragraphs concisely outline the mentioned data-oriented values.

Figure 2: Data-oriented Value Creation at Various Stages



Value derived from data varies depending on the prevailing economic activity. At each stage, there are two major values. Data collection stage distinguishes acquisition and direct values. Data processing stage underlines processed and extracted values. Data services and products are characterized by added and synergic values.

Acquisition value: of data reflects the demands and needs of organizations for acquiring data. If an organization wants to acquire certain data, what would it need? Would it require a purchase of new hardware, software, changes in infrastructure or processes (or other aspects of operation)? Data acquisition is inherently linked with costs (e.g. hardware, software, labor, etc.). The costs reflect the acquisition value of data. Organizations can create a notable acquisition values by providing cost effective data acquisition solutions.

Direct value: underscores the direct sale value of raw data. Collected raw data can be sold to organizations (or other entities) directly or via platforms—such as data marts. Organizations collecting raw data may add new revenue streams by simply selling it. If the data is unique, or hard to collect, it can have a significant direct value. For instance, high-resolution hyperspectral satellite images for finding oil and mineral deposits.

Processed value: of data is derived from its processing. Data processing is desirable in numerous instances. For example, privacy laws in various legislative regions do not allow sale of raw data containing identifiable information, but only aggregate data containing items that vary among different regions (i.e. processed or anonymized data). In another instance, organizations may require data be in a specific format, in order to smoothly integrate with their internal systems. Hence, the processed value can be created from the manipulation of data as well as from the processed data itself.

Extracted value: pertains to information, knowledge or insights extracted from data. Analysis of data may provide new knowledge or insights about certain aspects that are highly valuable yet are not directly noticeable from the data itself. Extraction of such knowledge may require utilization of advanced algorithms. For instance, product suggestions generate significant value and revenue for Amazon. They are provided by complex systems, called recommendation engines that extract recommendable products from large data about customers and their purchases.

Added value: refers to value creation by adding data to products or services. Bundling data with products or services results in an increased value of the combined offering. Added data can be raw, processed or extracted from other data. Take an example of a cloud-based platform for development of targeted analytics. Providing ready-to-use data for testing of developed analytics in various target domains increases the value of the combined offering: platform plus data.

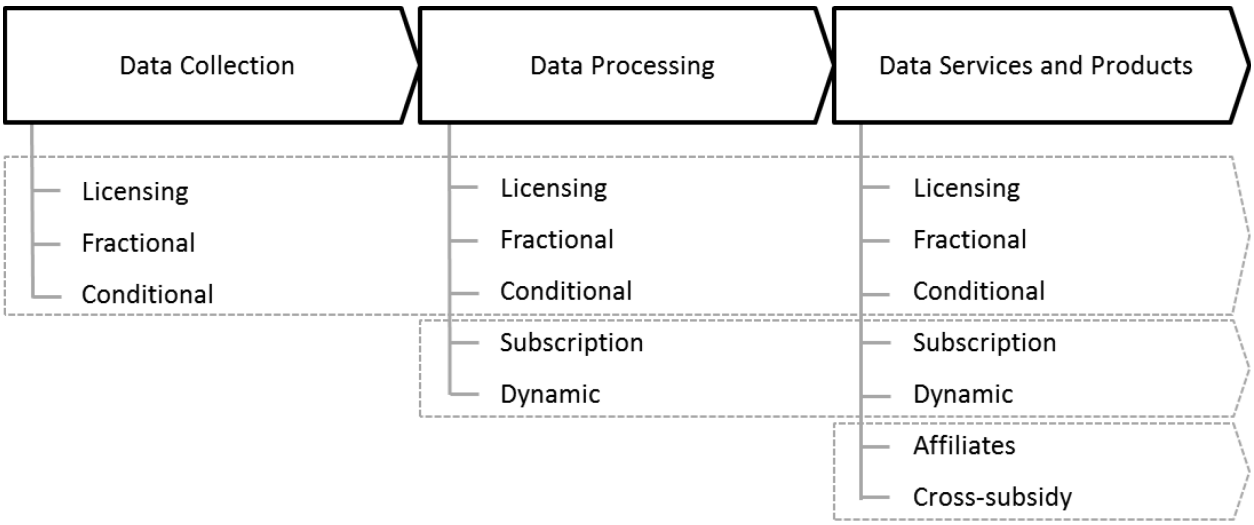
Synergic value: is derived from the symbiotic relationship between data and services or products. Removing the data from a product or service would result in a loss of value and service or product itself. Hence, the synergic value creation differs from the added value creation. In the former, the product or service would have no value without the data. In the later, it would retain some value even without the

data. Consider a movie streaming service (e.g. Netflix). Without the digitized movies data, the service would not exist.

Data-Oriented Monetization

Monetization of created value is an integral part of business models (Teece, 2010). Businesses must generate sufficient revenue in order to strive and compete in economic environments. Data-oriented activities provide several novel opportunities for revenue generation. Understanding such opportunities is indispensable to creating both core and supplementary revenue streams. We present several major monetization strategies and map them into formerly introduced three major stages of data-oriented activities.

Figure 3: Data-Oriented Monetization at Different Stages



Monetization of data and data driven activities is achievable at all three stages. Different stages are indicative of varying spectrum of monetization strategies. Range of monetization strategies expands at each stage. Data collection stage features licensing, fractional and conditional monetization strategies. In data processing stage, the range is expanded for two more strategies: subscription and dynamic monetization. Data services and data products provide the most options for monetization—further expanding the range for affiliate and cross-subsidy monetization strategies.

Value created by data driven activities, or data itself, can be variously monetized. We map the monetization strategies to the major data-oriented activity stages: data collection, data processing, or data products and services (see Figure 3). Different stages provide different monetization opportunities. The spectrum of opportunities expands at each successive stage. At data collection stage, the major monetization strategies include licensing, fractional, and conditional monetization. At the data processing stage, two additional monetization strategies are viable: subscription and dynamic monetization. The third stage, data products and services, has the largest spectrum of monetization strategies, including affiliates and cross-subsidies. Individual monetization strategies are concisely outlined in the following paragraphs. Licensing is a common monetization strategy that grants users certain rights in exchange for money. Data, services and products can be monetized by licensing. In a broad sense, this monetization strategy also includes temporarily granting certain rights in exchange for money, as in lending, renting or leasing. Licensing is generally used for monetization of protected intellectual property in digital or other forms. For instance, digitized music or movies can be licensed for use in streaming services over networks.

Fractional: strategy underlines monetization of divided and metered segments of value creation. Generally, this encompasses the schemes of the form: 'pay-per-X', where X denotes various metered entities, such as amounts of data, transmission speeds, usage times, etc. Variants of this scheme are also referred to as pay-as-you-go, micropayments, etc. For instance, data storage services (e.g. Dropbox) structure their monetization schemes depending on the amount of allocated data storage.

Conditional: strategy refers to monetization that is subject to certain conditions. For example, online weather data service (e.g. Forecast.io) may provide free data access until certain number of requests per day (via API - application programming interface), and then charge for every request exceeding the free limit. That is, monetization occurs only when certain conditions are satisfied (minimum number of access calls are exceeded).

Subscription: is a commonly used monetization strategy where users pay subscription fees to have access to data or services. Rather than monetizing data or products in a single instance, a subscription strategy offers periodic (e.g. weekly, monthly, annually) monetization of data, products or services. Content providers such as magazines or newspapers often use the subscription-based monetization (e.g. online version of The New York Times).

Dynamic: monetization strategy underscores the variation of value according to outside conditions. Dynamic pricing strategies are often used to incentivize certain economic behaviors or maximize revenues (e.g. increasing prices of airline tickets during the major holiday seasons). However, contemporary data driven pricing models can offer virtually real-time dynamics aimed at various goals (e.g. maximization of revenue or sale volume). For instance, the transportation service Uber changes prices dynamically by accounting for location, driver availability, local traffic conditions and other timely data. Cross-subsidy monetization strategy is a practice of subsidizing lower prices for one group of customers by charging higher prices to another group of customers. Differentiated pricing may relate to a single product or several different products provided to different customer groups. Cross-subsidization is an enabler for provision of free services or products. For instance, search engines offer free search services containing advertisements (e.g. Google). While search services are free, advertisers pay for relevant display of their advertisements. Vast data collected from users fuels the platforms for display and pricing of advertisements.

Gaining Competitive Advantages—A Path Forward

Contemporary economic environments are highly competitive. Organizations are facing competitions from inside their primary business domains as well as from outside. Competitors come in form of both established players and novel entrants. To survive in competitive environments, organizations must outperform their competitors. They must devise forward-looking strategies that enable them to gain competitive advantages (Porter, 1980). Data-orientation presents novel avenues for gaining competitive advantages. Data is a valuable asset. It permits creation of superior products and services, erection of barriers to entry, and monetization. Many organizations have been collecting vast amounts of data, but have been lacking capabilities to effectively explore them. Similarly, many companies have been involved in data-oriented activities, but have been unable to realize their full potential. Data and its effective utilization have significant potential for differentiation, hence enabling companies to gain desired competitive advantages. We explore several viable opportunities for gaining competitive advantages from data and data-oriented activities.

Creating Valuable Datasets: Valuable datasets are hard to create. They can serve as an effective barrier for new entrants. Valuable datasets should contain accurate, clean and timely data. Datasets should have useful applications. They could be used for building valuable products or services, or high valued direct monetization. Data should also appreciate in value over time, with greater active use, or with more users.

Developing Data-driven Pricing: Data-driven pricing can provide desirable dynamics to pricing strategies. From extensive historical transaction data, companies can develop pricing strategies optimized for meeting their needs (e.g. maximizing revenues or sale volumes). Data-driven pricing can be tailored to specific demographics. Tailored data-driven pricing is difficult to replicate for competitors, thus providing additional competitive advantages.

Extracting Actionable Insights from Data: Actionable insights are difficult to extract from data. Bigger data provides potential for greater insights. Valuable insights require complex data analysis. Complexity of analytic algorithms generally rises with depth of insights. Deeper actionable insights are more tailored to the specific characteristics of a company. Thus, they contribute to valuable internal or operational know-how.

Innovating Operations Based on Internal Data: Operating efficiency improvements and internal innovation are pertinent for organizations. Improved operations lead to lower operating costs and higher productivity. Collecting data about internal operations is the starting point. Effective analysis of the data is the next requirement. The more internal data organizations collect and effectively analyze, the better they can streamline processes towards their core business activities.

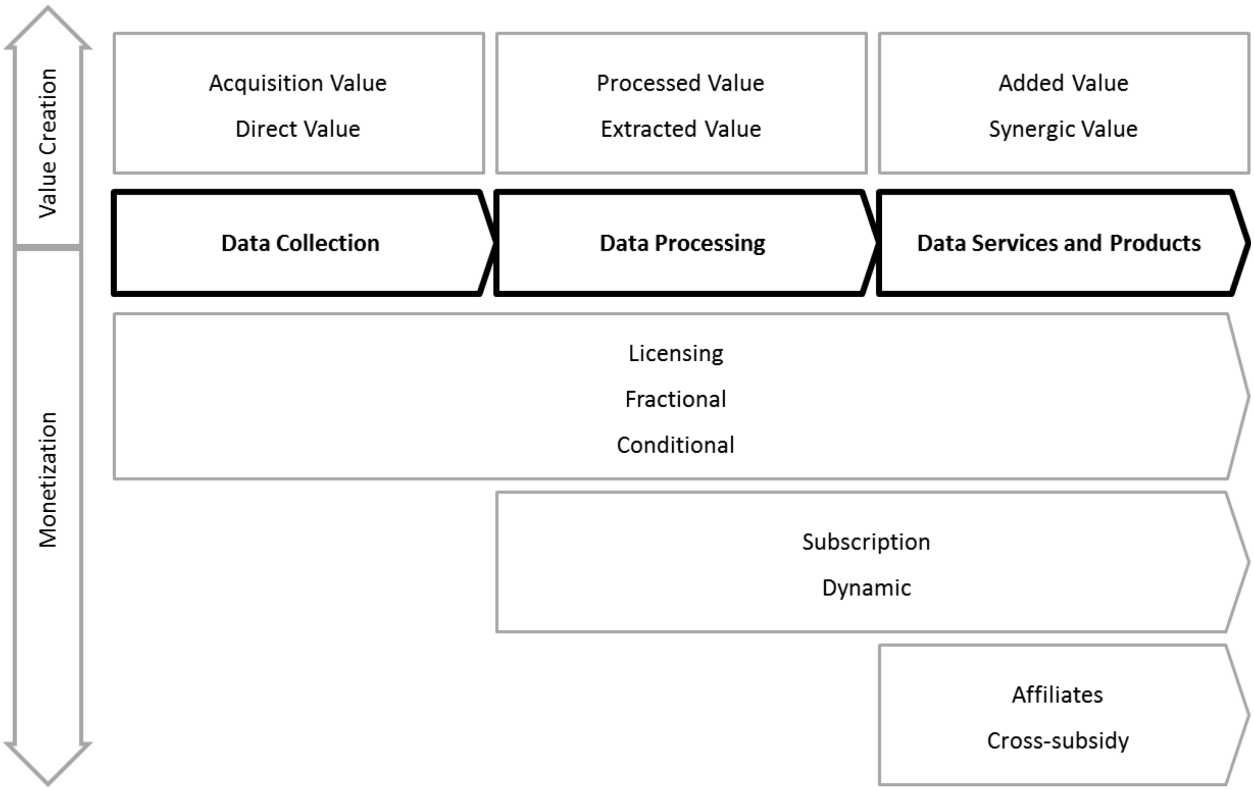
Learning About Customers from Data.; Every company strives to gain better information, knowledge and insights about its customers. The better information it has, the better it can understand and serve its customers. Transaction and interaction data from their customers may provide valuable insights about customers' needs and preferences. Serving those needs and preferences leads to greater customer satisfaction and retention.

Building Accurate Decision Models and Predictors: Accurate decision making in the face of uncertainty is a highly valuable and desirable feature. Consider, for instance, credit scoring or fraud detection businesses. Accurate models and predictors about the core business issues help lowering the level of uncertainty for decision making. Good data helps to build better models and predictors.

Summary

Digitization has led to extensive rise of digital data over the past few decades (Gantz and Reinsel, 2012). Rapid expansion of digital data has not been met with adequate progress in data processing technologies. This increasingly widening gap have resulted in big data problems (Géczy, 2014). Organizations have been confronted with notable challenges due to the problems with big data (Buhl et al, 2013; Hunter, 2013; Klein et al., 2013; Walsh et al., 2012). However, availability of data presents also opportunities for organizations. Innovative companies have been increasingly trying to harness the potential of data. Data is the core asset for many data-driven and technology-oriented enterprises. Small number of them has been able to realize its potential and create large businesses around data. Unfortunately, many organizations are struggling to tap into the economic potential of data. They have been unable to beneficially incorporate data-oriented activities into their business models. Some lack capabilities to create a value from data and others to adequately monetize it. Moreover, they lack a suitable perspective on value creation and monetization strategies. This work attempts to illuminate these issues.

Figure 4: Illustrative Perspective on Data-oriented Value Creation and Monetization Strategies



Data-oriented value creation and monetization strategies at the stages of data collection, data processing, and data products and services. Data-oriented value creation strategies are generally more distinctive at various stages. Monetization strategies are generally more spread. Licensing, fractional, and conditional monetization strategies span across all three stages. Subscription and dynamic monetization strategies extend over data processing and data services stages. Affiliates and cross-subsidy monetization strategies are used for data services and products.

We presented a beneficial perspective on value creation and monetization strategies at the stages of data collection, data processing, and data services or products. This perspective is illustrated in Figure 4. Each stage features its distinctive strategies, but some span over multiple stages. Data-oriented value creation strategies are relatively aligned with individual stages. Monetization strategies are stretched over several stages. Data-oriented value creation strategies are more stage specific. That is, different stages offer different opportunities for creating value from data or data-oriented activities. Data collection stage provides prospects for creating acquisition or direct values. Data processing stage presents possibility for creating processed and extracted values. Added and synergic values are representative of data services or products. The highlighted values are by no means definitive but rather indicative of individual stages. Future developments in data-oriented economic activities may give rise to new value creation strategies.

Monetization of data or data-oriented activities has expansive characteristics. In other words, the spectrum of possible monetization strategies expands with each successive stage. At the data collection stage, prevailing strategies are licensing, fractional and conditional monetization. At the data processing stage, the range is expanded with dynamic and subscription-based monetization strategies. Data services and products provide additional possibilities for affiliate and cross-subsidy monetization. The presented monetization strategies are representative instances. One can ascertain other monetization strategies that may prove viable in data economy. Data orientation provides opportunities for gaining competitive advantages for organizations. Effective utilization of data can be the key differentiator in competitive economic environments. There are various avenues for exploring data and data-oriented activities for competitive advantage. Building valuable and unique datasets serves as a high barrier to entry.

Developing data-driven pricing allows flexible maximization of revenues. Extracting actionable insights from data enriches valuable organizational know-how. Innovating operations based on internal data helps streamlining processes along the core business activities. Learning about customers from transactional data is beneficial for improving customer satisfaction and retention. Building accurate models and predictors helps lowering the uncertainty levels in decision-making. Data and data-oriented activities can lead to gaining competitive advantages in numerous other ways.

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