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Article

Insight into the Calculation Process to Decide Business Customer Value on the Digital Transformation Market

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Abstract: As a service business models have been ranked by management consultants the management innovation of 2020, and yet are scarcely theorized. Therein, value stipulations in customer contracts lead to the shift from product to service. However, there is no available research about the nature, formula and decisional process about these value stipulations. The motive for this research is to fill in this gap. The goal is to provide first insight about value stipulations in as a service business models: their formula and decisional methodology. The article is a multiple theory building case study on leading platform as a service providers, which aims to construct the paradigm of the value decision methodology to invest in this technology by purchasing it from dedicated vendors. The methodology works to identify the management instruments involved in the decisional activities to invest in digital technology, where each management instrument is assumed to match an activity at seller and buyer; the sequence of the activities using the Critical Path Method gives the decisional process. Dependent variables are the elements of the as a service business contracts: the customer offering (product-service solution) and the value created, captured and delivered by the solution. Independent variables are given by empirical data analysis. Findings show a relationship between dependent variable value in the as a service business model contracts and independent variables governance objective, strategy, as a service business model type, activity management techniques (roadmap, program, project, operations, lean start-up), capital allocation techniques (equity, debt, options, venture capital typology). If innovation is exploitative, then the customer offering is known and value is determinable via roadmap – project management techniques (program, project, an operations) and capital allocation techniques for predictable environment, If innovation is radical, then the customer offering is not known and value is a target used to architect the solution via lean start-up innovation techniques funded by venture capital. The contribution is a new theoretical construct and deep insight into the practice of digital transformation considering all inherent issues.

Keywords: digital transformation; digital sector; management instruments; paradigm; business models; as a service business models; value based contracts; value creation; capture and delivery; value calculation

Introduction

The past years have noted the shift from product centered business models to service centered business models. The new business models stipulate the product-services to be marketed and the customer value contribution guaranteed to be created for, delivered to and captured by the customer. The status of academic research about this topic is rudimentary. Recent empirical data, however, shows otherwise. Empirical data shows the outcomes based business model rated innovation of year

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2020 at BCG [1–3] and EY [4]. Accenture [5–8] and the World Economic Forum [9–11] argue the progress of business models - from product centric to service centric – is the degree of sophistication of the Internet of Things enabled economy and business. Strong differences arise between the importance granted to as a service business models in management theory and practice, giving the rationale for this research.

The goal of this article is to build theory with the marketing process for digital business vendors and the investment process for digitalized business customers. The article aims to construct the paradigm of the digital transformation marketing decision.

The methodology is a phenomenological, exploratory, explanatory, constructivist, paradigmatic and instrumental multiple case study. In simpler terms, it uses empirical data to identify the independent variables which give the elements of as a service business models and identifies the connections between these independent variables in a coherent logical model or paradigm. The dependent variables are the elements of as a service business contracts: the type of business contract; the solution architecture; the value based stipulations in as a service business contracts. Particularly as a service contract, this may be the decision to invest in digital technology which business customers make, driving the marketing decision at Digital Sector vendors. Value particularly is scarcely theorized at all. The classic definition of value in as a service business models is value in exchange [12]. Additional definitions are added: co-created value, value in use, value in context [13–15]. Methods have been sought to compute costs and benefits in as a service business models [16]. This value may be consistent with shareholder value or stakeholder value. The independent variables are the management instruments used to decide the elements of as a service business contracts in the vendor – seller transactions or relationships, as identified in empirical data. The relationship between the independent variables and the dependent variables is searched therein; it has complex and systemic nature.

The case study elaborates on the dependent variables in the literature review. Arguments to employing a case study are: the independent variables are discovered by dint of this case study; similar logical connections are only elaborated in books [17]; mainstream Digital Sector analysts argue 2020 is early for Industry 4.0 and may show nascent empirical trends or a newly emerging market for digital solutions, making a qualitative approach recommendable to discover the new recommended and a quantitative approach to test the hypotheses not supported by sufficient data in terms of time and scope. The case study begins by exploring and discovering the independent variables in the empirical data analysis section, and structures the empirical findings according to the assertions of the data proprietors. The first part of the methodology is therefore the variable discovery – using empirical data to make out the article variables. Then a logical relationship amongst the variables is constructed by assuming the article variables match decisional activities sequenced via the Critical Path Method. There are activities which encompass the path between the first and the last management instrument in two scenarios, where the second is to be used if the first is insufficient. The first part of the case study concerns identifying the variables, which answer Wh questions: what, when, where, who, whom, which, whose, why and how. The answer to these questions is the text in the case study content. Questions ”Who?”, ”Which?” and ”Whose?” are answered at the end of the methodology section, as explanations to the choice of data subject – the companies displayed in the multiple case study, and the rationale for choosing them which is the market they hold leading positions on. End of the case study text, the management instruments are structured by the Wh questions, according to empirical data analysis. Furthermore, the discussion and analysis part uses Table 1 to identify the logical relationships between management instruments and the empirical evidence for these logical relationships. An explanatory model is constructed which should give the elements of as a service business models that are dependent variables: the type of business contract; the solution architecture; the value based stipulations in as a service business contracts or the investment decision at customer in all. Details are provided in Figure 1. The logical model is commented based on empirical data and mainstream literature review in all, going way beyond the scope of literature review. The conclusions section compares literature review with empirical data analysis.

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Digital Sector			Customer value
sales -			
- the markets and where to play	- the markets and where to play	- the markets and where to play	
product-service sales business model	*output as a service business model*	*- outcome as a service business model*	
- product is known and prearchitected before the contract	*- solution is known and prearchitected before the contract*	*- solution is not known and architected specifically for the customer after the contract agreement*	
- value stipulations are not enclosed in the contract	*- value stipulations in the contract are calculated for the chosen solutions amongst several options*	*- value stipulations are agreements that work as objectives and shape a newly innovated customer solution*	
Digitalized Sector			Business value
investment -			
- no value stipulation in the contract	- value exchange in as a service business contracts	- value exchange in as a service business contracts	
- the push strategy	- the resource based push strategy	- the value based pull strategy	
	- value calculation as marketing	- value targets as outcome decided by marketing and purchasing	
	- output as a service business model	- outcome as a service business model	
	- capability maturity index or use case	- radical innovation	
- business processes inherent to business information systems	- business processes inherent to business information systems		
- the roadmap - technology in known scenarios	- the roadmap - technology in known scenarios	- lean start-up - technology in new and innovative scenarios	

Figure 1. The constituents of the as a service business model.

Findings are that a previously not theorized theoretical model explains sales decisions on the Digital Sector and investment decisions in information technology on the Digitalized Sector. The logic is its original elements and the relationship amongst them. The elements are: business information systems; business activities and processes (the roadmap); strategy (the initial workshop); the governance objective, business value. A relationship between the elements in this case study is previewed in Figure 1. This contributes to theory by hypothesizing a theoretical model which statistical research remains to confirm. The advantage to this approach is that digital transformation literature is very early, allowing the first qualitative case studies as argued by Acatech [17]. From an empirical perspective, this gives a new instrument to be used by all practitioners in their decisions to sell digital solutions or to invest in them as information technology. The main contribution of the research is to pioneer the topic. The shortcoming is a lengthy and cumbersome approach.

Methodology

The research is a multiple case study, according to the methodology proposed by Yin [18] and Gummerson [19–22]. The methodology intends to build theory via novel empirical data which has not been theorized yet. As such, the dependent variables are: the type of business contract; the solution architecture; the value based stipulations in as a service business contracts. The independent variables are discovered via empirical data analysis. The same goes for the logical relationships

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amongst the independent variables, which are discovered, analyzed, commented, and induced based on the assertions of the data subjects. The output will be the process to decide and calculate the value created, delivered and captured by as a service business models and the marketing processes that shape them.

The research methodology of this empirical study is based on the focus group method [23–26]. In this view, focus groups may be classified into: phenomenological interaction-centered focus groups (designed to share the experience of a group of people and to participate in the shared understanding), clinical focus groups (used to obtain even deeper understanding of individual behaviors) and and exploratory research (used to examine a topic quickly and at low cost before conducting follow-up survey). This research combines the former and the latter methodologies. The focus group comprises leading market players on the platform as a service cloud market, as reported by Forrester throughout time. The market players are also leaders on the most important software as a service markets for today's technologies: SAP and Oracle are market leaders on Enterprise Resource Planning software; PTC and Siemens are market leaders on Product Lifecycle Management software. The marketing process that decides the value created, captured and delivered by as a service business models is offered by PWC to Oracle, and PWC also advises Siemens concerning the same process. The research refers to these four data subjects, chosen on the basis of their importance to cloud platforms and in use software as a service.

In order to build theory with the empirically discovered independent variables and the relationships amongst them, the research uses the constructive method [27,28]. This method solves problems that emerge in running business organizations by using models, diagrams and plans. Due to importing empirical data, this type of research is co-creation [28]. The constructive method has several phases [27]: finding a practically relevant problem that also has research potential; obtaining a general and comprehensive understanding of the topic; innovating, i.e. constructing a solution idea; demonstrating that the solution works; showing theoretical connections and the theoretical contribution of the solution concept; and examining the scope and applicability of the solution. This research has the following stages: the first is searching the empirical data about as a service business models and the value they create, capture and deliver; the second is clustering empirical data around the independent variables ascertained by empirical data to impact the dependent variable; the third is deciding whether the independent variables represent management instruments or not, according to the definition by Kuhn; the fourth is seeking relationships between the management instruments, in accordance with Table 1; the fifth is devising the overview paradigm of value creation, capture and delivery activities and process.

The constructivist approach aims to find the paradigm [29] of value creation, delivery and capture for as a service business models. The management instruments are integrated to show the connections amongst them that shape the decision to invest in digital transformation technologies, an intermediate variable which helps explain the dependent variable. The decision to invest in digital transformation solutions is defined as both a capital allocation and digital transformation decision. It is treated as a process made up of several activities, where the empirical implementation of every management instrument is an activity. The management instruments are sequenced as the first, next, following or last in the sequence of decisional activities. The Critical Path Method or the Logic Model are used to sequence the activities into processes: the first, the critical and the last activities and management instruments. A paradigm of the management instruments is sought and induced in the conclusions section. This is a highly elaborate approach, which has resulted in a lengthy article nonetheless kept to a minimum necessary to make a point. In order to shape a coherent pattern, W and H questions are used, imported from empirical data analysis, to see if theoretical literature review matches. The management instruments are classified by W and H questions: "Where?", "How?", "What?", "When?" in the process of constructing the paradigm. The plural instrumental approach may be used as an elaborate general review of the digital transformation decision paradigm. This should cover all issues in using the instruments and making the decision in the multiple scenarios involved. The outcome supports both the digital transformation decision and the capital allocation decision therein.

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The case study has inherent pros and cons [18–22]. Pros are: the methodology attempts to derive general conclusions from a limited number of cases; it may seek to arrive at specific conclusions regarding a single case; it might be a powerful means in educating students; cases can be can be exploratory, descriptive or explanatory; they can be used both for generating theory and initiating change; cases may obtain a holistic view of a specific phenomenon or series of events. The downside to case study is that it lacks statistical reliability and validity. Therefore, the methodology can be used to generate hypotheses, but not to test them, and not to generalize based on the conclusions.

The case study refers to four market players: Siemens, PWC for Oracle, SAP and PTC. All four market players have held leading positions on the Forrester Wave market analysis for cloud platforms as a service [31–37]. Forrester Wave Research is a leading market analyst which singles out Internet of Things platforms as a service as a distinct market worth reporting as one, with dedicated products, solutions and vendors. The rationale for this research is that the platforms as a service market and the leading market players PTC and Siemens have been nominated by BCG the most important management innovation of year 2020, as technology and as usher of as a service business models. The empirical data analysis considers these leading market players and additionally SAP and Oracle. These latter market players are leading vendors on the classic information technology for business market, Enterprise Resource Planning software. This type of software – hosted on premises or on cloud, as product or as service – is the classic business information system used by companies since the 1990s [38]. The market has emerged then and grown steadily since. The former players, the market leaders nominated for management innovation, are also leaders on Product Lifecycle Management software market [39,40], a market which has similarly emerged in the 1990s and grown to the date, as market reports show [39,40]. The leading positions for cloud platforms as a service and in use software as a service argue the choice of data subjects Siemens, PTC, SAP and Oracle for this multiple case study. This case study is specific to the Digital Sector offering information technology solutions to the Digitalized Sectors.

As a Service Business Models and the Role of Value Therein

A large number of studies dealing with business models can be found in the theoretical literature [41–60]. However none of these studies show a relationship between as a service business models and value stipulations therein. This research aims to find those scarce sources that do argue in favor of value in the as a service business model. Scientific literature review furthermore argues the Digital Sector emerged in 2000, with customers on the Digital Sector then and Digitalized Sectors 2010 onwards [61]. This has lead to an extended adoption of digital information technologies and digital business models across industries. This is the ground to treat digital transformation as a phenomenon not solely at the buyer business, but also in the transaction or relationship between buyer and seller organizations.

Business models become a key tool for innovation [62], competition [63–65], financing [66,67], organizational design via the lean start-up [67,68].

Around the years 2010, business models have become a central tool in strategic management, organizational design and financing. Ovans [65] attributes the first proposal of business models to Drucker in 1994, where business models are defined as sets of assumptions about what a business will and won't do, these assumptions are about markets; about identifying customers and competitors, their values and behavior; about technology and its dynamics, about a company's strengths and weaknesses. These assumptions need to be made explicit in order to face changing market conditions. Drucker described business models as choices about who is the customer, what does the customer value, and how to deliver value at an appropriate cost [63]. Tackling discovery driven planning, Mc Grath also pointed to the importance of assumptions as means to deal with the uncertainty of early lifecycle. Already in 2000, Hamel points to new business models that comprise four elements: customer benefits; core strategy; strategic resources; value network linked by customer benefits, configuration and company boundaries. The four key factors that determine the success of business models are: efficiency; uniqueness of customer value proposition; fit between business models; profit boosters. At their own turn, profit boosters comprise increasing returns, competitor

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lock-out, strategic economies, flexibility or agility. They will allow companies to lead the foreseen management revolution [69–71]. This is the stage when innovation moves from incremental to radical, especially supported by new business models. Magretta [40] claims business models answer questions: "Who is the customer?", "What does the customer value and how do we make money in this business?", and "What is the underlying economic logic that explains how we can deliver value to customers at an appropriate cost?". In this scenario, they also work as assumptions. Osterwalder's business model canvas [42–44,72–76] is centered on customer value proposition, and includes the external view of customer relationships, customer segments, channels, revenue streams and the internal view activities, resources, partners, cost structure. Another business model proposal comes from consultant Johnson, Harvard Business Review professor Christensen, and SAP chairman Kagermann. In this view, a business model consists of a customer value proposition that fulfills an important job for the customer in a better way than competitors' offerings do; a profit formula that lays out how the company makes money delivering the value proposition; and the key resources and key processes needed to deliver that proposition. Kavadias, Ladas and Loch [62] write about the transformative business model, mainly defined as the way a company creates and captures value. In this view, the features of the model define the customer value proposition and the pricing mechanism, indicate how the company will organize itself and whom it will partner with to produce value, and specify how it will structure its supply chain. The elements of business models interact, often in complex ways, to determine the company's success. According to Chesbrough [49], a business model has the following functions: to articulate the value proposition; to explain the value created for customers by the offering; to identify the market segments; to put forward to whom the offering is useful and for what purpose; to define the structure of the value chain required by the company to create and distribute the offering; to determine the complementary assets needed to support the company's position in this chain; to specify the revenue generation mechanism for the company; to estimate the cost structure and profit potential in producing the offering, given the value proposition and value chain structure chosen.

As early as Drucker, business models have been centered on customer value. In the business canvas view, the customer value proposition is what distinguishes the company from its competitors [52–54,72–76]. The customer value proposition may be quantitative: price and efficiency or qualitative: overall customer experience and outcome. Other views confirm that the customer value proposition is the source of competitive advantage [77]. The most important authorities in marketing management, Kotler and Keller point to traditional product selling push models and the better customer oriented pull models. The customer pull defines marketing management as exploring, creating and delivering customer value to fulfill the needs of a target market profitably [78]. Customer value proposition motivates customer choices in strategy maps [79], comprising price, quality, availability, selection, functionality, service, partnership, brand. In the growth strategy, customer value proposition expands revenue opportunities and enhances customer value [79]. In the efficiency strategy, cost efficiency (cost structure) or asset efficiency (asset utilization) summarize competitive advantage [79]. Strategy is based on differentiated customer value proposition [79].

Kontes [80] recognizes in business models a tool for competitive advantage. Casadesus-Masanell and Ricart [63] describe business models as tools for competitive advantage. The authors note that the way via which companies create and capture value via business models is undergoing radical transformation worldwide, from the surge of the bottom and middle of the pyramid and new technology based and low cost rivals. Competition may be conceived in terms of how business models interact with each other. Good business models create virtuous cycles that, over time, result in competitive advantage. Competition via business models means strengthening their virtuous cycles, weakening those of rivals, and even using their virtuous cycles to turn competitors' strengths into weaknesses. In this view, business models are choices and have flexible and rigid consequences; rigid consequences are the source of competitive advantage. For example, good business models lead to vicious circles. Kavadias, Ladas and Loch [62] claim that, in any given industry, a dominant business model tends to emerge over time. In the absence of market distortions [62], the model will reflect the most efficient way to allocate and organize resources. Most attempts to introduce a new

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model fail—but occasionally one succeeds in overturning the dominant model, usually by leveraging a new technology. If new entrants use the model to displace incumbents, or if competitors adopt it, then the industry has been transformed.

Management consultants [74–90] agree outcome based contracts are the most important evolution of the Internet of Things. This is known as servitization [61,91–95]. Consensus exists about the content of the business model canvas [52,53,72–76,96]. However, some authors believe a special business model canvas needs to be designed for as a service business models, which maintains all constituents of the business model canvas and adds the customer. This is intended to manage the close customer relationships which as a service business models entail [63]. Other authors also propose a designated as a service business model canvas [2]. Much like in the former research, they emphasize the role of the customer as primeval in the value creation, capture and delivery process. The argument is that value does not exist until the customer experiences it enabling the other processes. Some authors argue that, in as a service business models, the customer is the value creator and the company the value enabler or co-creator [97–101]. Results part from the business model canvas and add the customer dimension [96] or additional blocks to the customer's world and desire for ideal value; value creation; interaction and co production; mobilizing resources and partners [42].

As a service business models are important to the digital economy [102]. Scientifically accredited opinions concur that the digitalization of the manufacturing process is leading to outcome based contracts [103]. An important component of servitization is the outcome based model [104,105]. Outcome based contracts are recognized as a new business model [98,106,107]. Several types of outcome based contracts exist [75,76], and the issue is pricing. Outcome based contracts represent one way via which manufacturers tailor solutions to their customers' needs, as part of an ongoing process of servitization [108–110]. Examples of outcome-based contracts are value-based contracts in pharmaceutical contracts [108–110]. Value based contracts are performance-based reimbursements in which the price, quantity and nature of reimbursement are tied to clinical, intermediate, or economic endpoints [108–110]. Outcome based contracts create networks and eco-systems [108–110]. The ecosystem of an economic outcome based contract involves value such as: economic outcome (ROI); availability guarantee; performance; revenues; private capital; flexible energy [108–110]. An issue in research is the value drivers which outcome based business models provide [58,59]. Outcome based contracts are open business models [91,92].

In an outcomes based contract, the manufacturer sells the outcome that a manufacturing process creates instead of the resources necessary for outcome creation [101,110,111]. In some views, outcome based contracts may be viewed as synonymous with performance based contracts [99,101]. Outcome based contracting is a result oriented contracting method [105], which incentivizes outcomes related to customers' processes instead of the resources required for them [111]. In outcome based strategy, the firm guarantees the outcome that the customer requires and combines various products and services to meet that outcome [58]. Integrated solutions [112] and outcome based services [91] are deemed to represent the most advanced form of servitization [91,112]. Integrated solutions are value in use, which is defined as the hindering or achievement of customer's goals [113]. The value in use depends on the supplier's and customer's resources and is continually created through the solution processes [113]. Value may be co-created [113]. Outcome based models are known to involve close customer-supplier relationship and collaboration, which means the two parties co-create value [106,107].

Sourcing reference books [114] describe business models rated as starting higher transactional to higher strategic: transactional business models, via basic provider model and approved provider model; relational business models, via preferred provider model, performance based or managed services model, vested business model; investment business models: shared services business model, equity partnerships. The most advanced type of new business model is the outcome based business model or vested business model. In another taxonomy, by the International Association for Contract and Commercial Management mixes economic models (transaction based, output based, outcome based) and relationship or contract model (transactional contract; relational contract; investment) and the following business models emerge: basic provider; mismatch; mismatch; preferred provider;

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performance based (managed services) agreement; vested; equity partnerships or transaction based shared services; equity partnerships or performance based shared services; equity partnership; vested shared services.

Digital consultants [82,83,115–133] and scientific literature reviews share the definition of digital transformation as the use of digital technology to change a business model and provide value-creating opportunities or to improve performance quantifiably. Accenture [5–8,74–76,116–118,122–125] argues smart connected products, IoT-connected, software-enabled devices, offer extraordinary opportunities for business in the form of performance enhancement. The large literature review about business models and digital disruption in this article shows the customer value focus. On business to business markets, consultants indicate the purpose of digital transformation is return on investment [134–136].

Capital allocation shows three possible scenarios: certainty, risk and uncertainty. These scenarios are used in shareholder value or multi-stakeholder value governance. Business cases are the management instrument for investment decisions. As will be argued further on, business cases are preceded by all other analyzes and decisions so they reflect operational, investment and financing decisions in their interdependency in creating shareholder value [137] for the duration of competitive advantage. Business cases are a standard tool in financial management, project management, and business analysis and defined by professional standard setting bodies [138–142]. Typically value indicators are conceived for a certain, risky and uncertain environment. In a certain environment, valuation and capital allocation to investment projects are made via the Net Present Value of Discounted Cash Flow or its mathematical equivalent, the sum of Economic Value Added and Capital Employed [143–160]. Investment may be in tangible assets or intangible assets. A classic issue in intangible assets [138–141,160–163] is that the concept of intangible assets in management accounting is inconsistent with financial accounting. Intangible assets include financial accounting data as capital expenditure, financial accounting data treated as operating expenditure such as the project activities that precede operations, and capitals that are not owned by the firm but stakeholders or the ecosystem in all. Valuation theory argues that market value added is largely attributed to the impact of intangible assets not booked [160–163]. In a risky or uncertain environment, when future scenarios can be created with probability of occurrence or without this probability, real option valuation is used instead [143–160]. Real options are already a classic valuation and financial management tool, in the manuals of world class references Damodaran and Mc Kinsey. Real options are typically computed using the Black Scholes formula. The Monte Carlo simulation is used to price real options [164]. Real option valuation is strongly connected to strategic scenarios in classic strategic management theory, Luehrman in 1998 [165,166]. In addition to intrinsic value, a company may be impacted by risks and opportunities. Regulations such as the Sarbanes Oxley Act, the USA Patriot Act, the Basel II Accord demand risks and opportunities be reported to shareholders. There are designated methodologies for enterprise risk management [167–171] Another form of capital allocation uses venture capital. Since the lean start-up movement in the 2010 decade, venture capital has been used more widely in banks and internally in companies [172,173]. Venture capital is important to financing innovation. Venture capital refers to investments provided to early-stage, innovative, and high growth start-up companies [172,173]. In the corporate world, venture capital is used for open innovation, particularly in internal start-ups, in the proposal of the author of open innovation, Chesbrough [172,173]. Companies allocate a percentage of their capital to venture capital, typically to fund open innovation [172,173]. Innovation has made possible the shift from shareholder value to multi stakeholder value [174–183]. In the view of prominent management consultants PWC, integrated reporting is the future of corporate reporting. The International Corporate Governance Network issued the revised Global Governance Principles in 2017, which include the recommendation that boards should produce an integrated report. An integrated report is a concise communication about how an organization's strategy, governance, performance and prospects, in the context of its external environment, lead to the creation, preservation or erosion of value over the short, medium and long term [176]. This definition is recognized by the standard setting body of integrated reporting in 2021 [177].

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Empirical Data Analysis the First Management Instrument in Digital Transformation: Digital Strategy

According to Siemens' statements, the first state in digital transformation consulting is the business strategy and performance analysis workshop. This is the responsibility of an internal consultant, Advanta [184,185], which employs 8000 systems integration engineers [186]. At Advanta, there are two types of digital transformation services: innovation and Product Lifecycle Management; operations and supply chain management [185]. Digital transformation is defined as "leveraging digital technology for concrete customer benefits'' [186,187] or a change in the way value is created in an organization, via changes in business models, business processes, or organizational set-up triggered by digital technology [187]. Either definition adopted, creating value for digital customers is central to Siemens' strategy [186,187]. In Siemens' philosophy, customer business value is what it takes to succeed in digital transformation [186]. It is the starting point of strategy and explains why Siemens' core technologies are united in solutions to create, capture and deliver customer business value [186,187]. Across time, statements have been provided by Siemens their strategy placed customer business value first [186–188]. It constitutes the "Why?" in the digital transformation pursuit [189]. Customer business value may be defined as return on business customer investment [190] or simpler key performance indicators that Siemens provides to customers [186]. Siemens digital transformation overview, Xcelarator, begins with the strategy and roadmap consulting workshop between Siemens and customers [190].

Siemens' strategy overarches all digital solutions and considers an integrated approach [190]. This integrated approach matches Figure 2 and presents a portfolio of digital solutions and their matching processes and customer business value [190]. This is a use-case based approach [188]. The strategy ties together the best practice catalog offered by customer maturity analysis, the value map that ties these maturity indices to value, the solution map that matches value with predefined technology and process scenarios, the prioritization of solutions and their review from process and technology possibilities, benchmarking, and concrete return on investment calculation for the chosen business solution [190]. Return on investment is computed via the business case [190]. When the solution is marketed to the customer, the return on investment is stipulated in customer contracts [190]. When the solution is implemented at the customer, the realization of the contractually stipulated solution is verified [190]. Results are a value driven and phase solution deployment plan with quantified value [190]. The management instruments which strategy overarches will be presented individually by Siemens to customers and by this empirical data analysis following. The scenario begins with predefined value and searches for solutions that may be predefined and pre-architected or innovated [190].

Figure 2. Siemens' strategy for known solutions overview (source: [190]).

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Other reports confirm strategy consulting is about setting goals and getting started [191,192] in this management consulting process [192]. If the management consulting process is different, radical innovation will be used to co-create solutions together with Siemens' customers [193]. The basic management consulting scenario overarches four prevailing solutions that constitute the most commonly used solutions by Siemens' customers [194]. An example of this approach is for pharmaceutical business customers [195,196]. Siemens management will report on customer results to track the performance of this approach [197].

Alternatively, when value is known and the customer solution not known, Siemens will co-create this solution with business customers [198–201]. This helps build strong customer relationships [201]. To do this, Siemens uses two as a service business models: pay-per-use and pay-per-outcome [202–208]. Siemens moves business models from managed service to software as a service, availability as a service, insights as a service, outcome as a service [203–208]. The as a service business models are explained to Siemens' customers as such [203]. They are centered on customer business value being stipulated in customer business contracts along with the solution [204,205]. When customer business value is higher, Siemens gains competitive advantage [186,206,208]. The performance contract is the climax of the as a service business model [209]. In order to achieve this mission, Siemens has partnered with Atos [210–213] towards a common vision: co-creation with their customers and pay-per-outcome business models. Siemens calls this outcome orientation "value based services" [214–216]. Siemens CEO and Nigeria President [217,218] signed a contract based on the roadmap alone, with responsibility to Siemens for the programs and projects to achieve the roadmap. Stipulations in the contract cover the goal of the roadmap, alone: to upgrade the electricity network to achieve operational capacity of 25,000 megawatts (MW) from the current average of around 4,598 MW. This is achieved through a series of projects spanning three phases in a newly co-created solution. These numerous examples confirm Siemens' strategy to offer pre-architected or co-created customer solutions to match customer value requirements - its strategic approach [219] to megatrends [220].

PWC in 1988 [221,222] for Oracle Consulting [222–227] uses the predictable value approach. The integrated approach covers business strategy, performance analysis, roadmap, and strategy development. The primary scenario is that customer requirements are predictable in known use cases: the strategy will overarch use cases, maturity indices, roadmaps, and business cases. If customer requirements refer to emerging technologies, the solution is co-created in a radical approach to innovation.

At SAP [229–234], the vision to value journey aligns on business and information technology strategy. Put simply by SAP [229–234], the vision to value involves four main stages: align on vision and desired outcomes; build the business case; plan the path forward; deliver business value. Vision to value begins with answering questions: "Why?", "What business objectives do we enable?". In a more elaborate approach, the "Why?" and related questions are: "Why change?"; "What is your strategic objective?"; "Why now?"; "What strategic needs prevent realization of that strategic objective?"; "Why SAP and partner?"; "How to reduce time to value and reduce customer risk?". The outcome of this stage is to build an initial benefit case for specific business scope; understand SAP solution capabilities, value drivers and business impact of that scope; understand high-level project and transformation plan well enough to define initial cost estimates needed for the future business case.

PTC's [235–237] portfolio may be described as products, solutions and business initiatives in the form of value drivers. Products are: Arena, Creo, Onshape, ThingWorks, Vuforia, Windchill. Solutions are: Digital Engineering, Digital Manufacturing and Service Optimization. Business initiatives are: Improve Efficiency, Maximize Revenue Growth, Reduce Costs. The digital transformation management consulting process begins with strategy consulting for customers. The strategy is aligned to business goals. This is a value based strategy [238–240]. This is the digital transformation management strategy. The digital transformation management strategy comprises the following stages: financial goals; value drivers; use cases; operational impact; financial outcome. The PTC [235–241] methodology is marketed to customers using the "What?", "Why?", "How?" benefits example. The question "How?" refers to how PTC helps customers. The question "Why?"

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refers to the rationale of serving customers. The question ”What comes next?” refers to the solutions that will follow the current portfolio of solutions. Financial goals are: revenue, operating margin, and asset efficiency. Financial goals are broken into value drivers, such as design efficiency, equipment availability and performance, and first time fix rate. Use cases are: ”Change Management”, ”Asset Monitoring and Utilization”, and ”Augmented Remote Assistance”. The operational impact ist o improve design efficiency by a percentage, improve equipment availability and performance by percentage, other operational key performance indicators. Follows the realization of financial outcome by percentages. The PTC Value Roadmap methodology begins with value drivers and their current state challenges and reason to need improvement; it continues with processes and best practices (use cases) to improve these value drivers; the measures to improve value drivers end up in the improved value driver after digital transformation. Use cases span the technology solutions, business processes and the value drivers they generate. Use cases are predefined scenarios that move from the current state to the targeted state.

Management Instrument Used in the Predictable Business Environment: Maturity Analysis

Siemens employs its own maturity index [242,243]: connect and monitor; using the data at the connectivity level to perform descriptive, diagnostic and predictive maintenance; digital twin; systems of systems; self-optimizing systems.

PWC [221,222], the diagnostic of digital maturity is the next stage following the strategy scoping workshop.

PTC [235–237,240,241] notes digital twins and digital threads integrate Industry 4.0 technology in several generations of digital maturity. According to PTC, digital maturity is given by the digital twin and moves along the following stages: basic (physical: connectivity, compute and digital: digital definition, security); full (physical: HMI dashboards; enterprise systems and digital: ERP, MES; IOT platform and analytics); enhanced (physical: augmented reality, edge computing and digital: cloud application, real time IOT simulations); next generation (physical: additive manufacturing, and digital: artificial intelligence, blockchain).

At the analysis stage, SAP [244,245] uses the best practice maturity model for benchmarking and idea generation. The maturity index was built based on use cases.

Management Instrument Used in the Predictable Business Environment: Roadmaps, Programs, Projects, and Operations to Shape Digital Transformation Related Activities

Empirical data at Siemens shows high level details. Siemens’ Digital Compass Trademark methodology involves using maturity maps and then value driven roadmaps, programs, and projects to guide business processes [190,246–251] at Siemens’ customers.

At PWC [221,222], change refers to the difference between the current gap in project, program, or operational activities between the operational performance, the starting position of digital transformation, and the target operating model, the target point of digital transformation. The roadmap is adjacent to predicted value, making it a value-driven roadmap.

PTC [238,239,252] has used the value-based roadmap to guide strategy, planning and decision making activities. The value-based roadmap is an interactive discussion guide that identifies the links between business strategies and the best practice capabilities required to make them real. The first question in the value-based roadmap is ”Why?”, that is the business value the roadmap will create: the fundamental premise is that value (e.g., total enterprise value, equity plus debt, market capitalization) is driven by earnings, which are directly influenced by growth, cost and risk. The roadmap gives a common understanding of what an organization is trying to do and why. It is used to trigger the process change required to unlock potential value. The roadmap identifies the connections between value drivers: growth, cost and risk strategies and the way to create and service products. In establishing the value based roadmap, there is a business discussion aligned to value and a technical discussion aligned to value [238,239]. The PTC Value Roadmap is a two-sided map to help organizations link these key business variables and technical variables, via: value drivers, current state, measures, processes, and best practices and technical variables [238,239]. Side A of the

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value roadmap links key business value drivers with the common current state challenges that limit organizations' ability to create value and the common measures used to evaluate success. Side B of the value roadmap links these same value drivers with the correlated processes across the organization and the technology-enabled best practices required to transform those processes and create value. The roadmap defines value drivers as strategies that enhance business value by increasing growth, reducing cost or reducing risk. These initiatives require a change in people, process, and/or technology to achieve. The current state describes the common challenges that limit the potential of an organization to pursue certain strategies. These are often the hurdles an organization must overcome to accomplish business goals. The measures are common means by which an organization determines if it is making progress towards achieving certain strategies. These measures drive focus and accountability, to help improve success. Processes are key sets of activities required to create and service products. These provide a comprehensive product lifecycle view; from concept through manufacturing, service and retirement. Best practices are technology-enabled capabilities required to create process transformation. These are the means by which an organization gains advantage creating and servicing products. At PTC, 1400 customer service employees helped customers implement solutions. The roadmap begins with the top-level value based strategy and ends with the processes and best practice capabilities required to realize them. The value-based roadmap is a business discussion aligned to value: current state, measures, value drivers and a technical discussion aligned to value: processes and best practices. The roadmap is a two sided map to help organizations link these business variables.

Business transformation by SAP [253–258] involves information technology grand design, transformation roadmap, transformation visioning, operation excellence. SAP turnkey process configuration and integration involves the following stages: prepare, explore, realize, deploy, run. This involves: project management, process management, requirements management, change control management, release management, test management. The architecture overview and integration model begins with process management, process and application landscapes, continues with requirements, work packages, work items, and finalizes with project management. SAP project management office support involves project management office roadmap, action plan. SAP change management entails change roadmap and action plan. The outcome success plan execution and ongoing change and communication involves alignment between enterprise strategy, program management and project execution. In another view, at SAP, the vision to value journey creates the transformation roadmap and defines the deployment plan as the third stage in the digital transformation journey. This is where the journey forward is planned for deployment. Execution readiness means answering the question: "What is your plan for deployment?". At SAP, the business evaluation involves answering the questions "Why?"; the technical evaluation involves answering the question "What?"; the transformation evaluation answers the question "How?". This stage represents SAP business transformation.

Management Instrument Used in the Predictable Business Environment: The Business Case, a Management Instrument to Compute Business Value out of Roadmaps

Siemens Product Lifecycle Management solution Teamcenter will allow the extended enterprise strategy that allows global organizations work as a single team to design, produce, support, and retire products while capturing best practices and lessons learned along the way. This brings the benefits of true concurrent engineering [202–208,259–261]. Siemens' Teamcenter software is used internally at Siemens and externally by customers to manage digital transformation projects holistically [259–261]. The technology also allows the collaboration of all disciplines involved in projects, of customers and of suppliers in product cost management [259–261]. Teamcenter allows integrated program planning and project execution predictively in all disciplines involved. Teamcenter includes an interdisciplinary approach to product costing before start of production. Teamcenter product costing manages need for innovation, market opportunity , quality, cost consciousness. Teamcenter allows the cost and value engineering approach, at an early stage of the development process by providing cost transparency for products and tools. This approach is consistent with early set requirements in

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system integration. This approach enables a quantifiable decision base for cost optimized products. Teamcenter has an integrated profitability calculation, which secures product investments by predicting future product costs and prices over the entire product lifecycle. Teamcenter involves decisions about product design, production planning and engineering, production ramp-up – projects which make decisions for future operations. All these stages exist in discrete industries, but product design is missing in process industries. The major decisions are the product design stage and bill of material. The next stage is production planning, which decides future operations, equipment and the production plant. Teamcenter allows profitability calculation across the entire lifecycle. The Teamcenter solution will enable the management of target product design costs, work plans or routings, optimal procurement prices, and profitable sales prices. These are decided during the research and development project. The Teamcenter solution for product costing provides an enterprise-wide platform for managing calculations. This provides the basis for standardized costing methods, models for fact-based calculations, and transparency into cost drivers. Product cost management provides a digital twin of customer product and tool costs which enables customers to accurately represent planned and simulated costs. Product cost management increases speed and accuracy of request for quote responses which helps companies to win more business. Product costing and systems engineering will work closely together so requirements are defined and the return on investment reaches the hurdle rate. Teamcenter is a software that enables value analysis and value engineering in the extended enterprise. Teamcenter allows in depth collaboration with suppliers. Teamcenter also uses target costing as a typical scenario . Target costing enables cost decisions at the early stage of the product life cycle, when the impact on cost is greatest. Target costing enables what if scenarios about product design, production planning and future manufacturing operations. Target costing is complemented by quotation costing. Teamcenter has integrated product design digital twin, production planning digital twin and production execution performance digital twin in a digital thread and closed loop manufacturing. Via the digital thread, closed loop manufacturing is ascertained to bring customers tremendous value, for instance in terms of innovation or facing disruptive innovation. Afterwards, return on investment is predicted, and a value driven phase solution deployment plan is devised. Teamcenter allows the prediction of future costs and prices over the entire lifecycle. The predictions are adaptable to a changing environment. Siemens Teamcenter allows for many variants of product configurations. In the current version of Teamcenter, product design and production planning are connected in a digital thread. All simulations are included in the digital thread. The initial maturity diagnostic will be followed by a roadmap, and investment calculation in the business case. The strategic roadmap consulting process culminates in a business case [190]. The logic model includes the virtual simulation of activities, inputs, outputs, outcomes, impact [190]. This is used in conjunction with the roadmap, by associating value drivers with project or operational activities. The roadmap schedules activities into programs, projects or operations. The Logic model associates each activity with inputs, outputs, outcomes or impacts. Every activity will have its inherent value drivers. The result will be used as data input to the business case. In addition, the world's leading business process mining solution, Celonis, has been integrated with Siemens' Mindsphere solution in order to improve customers' manufacturing processes from Celonis [260]. Siemens also boasts the Solutionlink application that helps with scenarios in return on investment, opportunity and risk assessment [190]. In Siemens' Digital Enterprise Consulting [262,264–271], the business case culminates in the investment case.

At PWC [221,222], the business case is the fourth stage in the digital transformation journey. The starting stage and the final stage will be connected by a business case for change. The business case helps stakeholders align their visions. Alignment is achieved by business case and mobilization. It is a catalyst session to align stakeholders with future vision. It is at this stage stakeholders plan the deployment schedule, design the target operating model, and conduct design by exception sprint.

At PTC [235–237,272–276], after linking the identified data to generate the digital thread use case, internal advocates must demonstrate short-term wins with measurable value and ROI. Validation of the digital thread use cases will be critical to establishing credibility for executive level buy-in, to build on these existing use cases, and implement new ones. At a high-level, executives have three

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levers to improve their companies' position in the marketplace: advance products for differentiation; optimize processes for efficiencies; empower people for productivity. There is very little data about business cases at PTC to support claims, but PTC argues the choice of use case depends on the value impact of all scenarios. PTC computes return on investment for customer offerings, for example product Creo. Smart Connected Products impact business processes and incur costs, benefits and key performance indicators or value drivers. The latter are used to compute return on investment in the customer business case. There is a procedure in place for this calculation. In another approach, the business case involves PTC collaborate with Forrester to compute the Total Economic Impact of products, services or solutions.The outcome based business model is preceded by a content delivery roadmap

At SAP [252–258], the business evaluation involves answering the questions "Why?"; the technical evaluation involves answering the question "What?"; the transformation evaluation answers the question "How?". Building the business case involves answering specific questions: "Where and how will we realize return on investment and deliver business value?"; "Which best practices assure success?". In a nutshell, this means SAP computes customer value in the business case and guarantees it to customers in the contract. PWC supports customers to achieve concrete outcomes for SAP. SAP writes about specific key performance indicators, return on customer investment, net present value of discounted cash flow incremental to the investment, internal rate of return, payback time. Using all these consulting tools, customer value is higher.

The Pay-per-Use Business Model, the Last Management Instrument Used in the Digital Transformation Management Consulting

One of Siemens' business models is pay-per-use [277]. Designed to enable the acquisition of a system or an item of technology or equipment, this will usually be some form of finance lease, operating lease, rental or hire purchase arrangement. Financiers with extensive knowledge of manufacturing will arrange the finance period and terms to align with the expected benefits the manufacturer will gain from the use of the technology. Often this type of financing will also cover associated costs of ownership, such as maintenance, via a bundled monthly payment. To enable easier ongoing acquisition decisions, a financier will often have some kind of master agreement with a manufacturer, streamlining the process of agreeing future finance. When use cases exist to shape solution architecture and make value predictable, the choice will be for the pay-per-use business models that tend to be employed [278]. Value comes as customer benefit and may be: "reduced costs, via reduced energy consumption, compressed R&D and product development; increased productivity, via automated processes, preemptive service, higher production capacity; international competitiveness, via reduced time-to-market, enhanced quality and reduced faults; customer choice, via more rapid setup agility, mass consumption". Siemens has computed the impact of the first steps to Industry 4.0, concretely as a productivity bonus between 6.3% and 9.8% [277]. The productivity bonus comes from increased manufacturing productivity; reduced energy consumption; reduced downtime and shorter setup and changeover times; improved quality; improved supply chain management, in the form of improved planning and forecasting, reduced inventory holding, reduced waste. Payment will be use or subscription based. In 2016, Siemens [277–279] identified three types of customer contracts: traditional contracts, performance based contracts, network platforms. One form of value-based contracts are performance contracts. Performance increase is predicted and guaranteed to the customer in this contract, which matches the pay-per-outcome later business model.

PWC for Oracle [221,222] offers integrated solutions, which leverage Oracle technologies, to drive end business outcomes and value realization. According to Oracle: "Each of our Integration Solutions is pre-designed and packaged in a playbook to include PwC's best in class digital assets, proprietary tools, industry insights, and intellectual IP focused on addressing the diverse challenges our clients face. This enables efficiency and scalability in the delivery of our Integrated Solutions.". Digital solutions solve complex challenges, are associated with proven assets, bring faster business outcomes, and generate digital innovation. Oracle's [282,283] contracts include the subscription basis

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as a pricing option. Oracle new 'as a service' models are driven by new ownership models - such as "pay as you go", "pay per use", and "pay per view" – or new business revenue models – such as those around the concept of "product as a service". There are specific challenges to be faced in a holistic way. It requires a "new operating model" for companies that come from more traditional business models.

PTC [284–288,290] writes about the use of as a service business models, particularly the pay per use business model. PTC uses several documents to close the deal with customers, and they are: quote, PTC cloud services and software as a service terms and conditions, PTC cloud and software as a service offering specific terms. PTC customer success services terms and conditions include success points are a flexible way of consuming success services. Customers can manage and redeem success points through PTC's Customer Success Management team. The Customer Success Management team works with the customer to facilitate customer's adoption of PTC software and solutions, including reviewing available usage metrics, sharing of best practice advice and guidance related to customer's adoption of PTC software and solutions, and helping to escalate technical issues as necessary. PTC architect mentoring services support the management consulting process. The pricing may be as a license or on subscription basis. Subscription is PTC's premier pricing model.

SAP uses several business models on a continuum of sophistication, where the least sophisticated are selling products and selling solutions on a pay-per-use basis [291–296].

An Alternative Stage of the Digital Transformation Journey if Pre-Architected Solutions Are Not Found: Customer Co-Creation

Siemens' value co-creation methodology is an additional methodology, suitable for innovative cases that do not match existing use cases [193,198,202,203,206,207,213–215,219,261,264,268,280,297–302]. The first step is the co-creation workshop. Co-creation design thinking process starts with combining customer's ambitions and Siemens domain and technology expertise to understand and ideate solutions (optimization opportunities) with the most significant impact on the business. Co-creation design thinking process starts with customer's value ambition, which is the way the customer reaches Siemens. In Siemens' co-creation framework, the customer ambition starts the process. The digitalization ambitions are: "Where to start?"; "How do I transform?"; "What is the timeline and budget of the digital transformation journey?". The discussions are attended by cross-functional teams comprising engineers with domain expertise, information technology experts, data scientists, sales and marketing professionals, user experience designers. The ambition will take two forms: an optimization opportunity or a pain point. Optimization opportunities are prioritized using the minimum viable product approach based on customer value or impact. This is the discover and define stage. Siemens and customers will understand and ideate solutions with the most significant impact on the business: idea, proof of concept, prototype. The Digitalization journey is then formalized into a roadmap, at this point a timeline. At the next stage of the co creation process, Siemens and customers will co-create the customer value proposition. This is the stage of value concept creation. It is the transition from proof of concept to measurable value). The third stage of the co-creation process defines the design value creation logic, and results in business model innovation. Value creation, capture and delivery is managed by workshops between Siemens and customers. In the fourth stage of the co-creation and value hacker process, Siemens and customers sign a value-based contract. This is based on joint targets between Siemens and customers. In what follows, a digital transformation project structure (roadmap, program, project) should oversee the digital transformation. Alternatively, in the fifth stage of the co-creation and value hacker process, minimum viable product will pilot and implement the concept, focusing on core features by collecting customer feedback along the stages of development; making increments available; iteratively learning what provides the most value to the customer. After this, agile product development will scale the concept. The roadmap set in the first stage of the co-creation process is used as a sprint goal, showing plans to achieve roadmap features and target milestones in the sprint. Customer involvement and input throughout the development is key to creating a "win-win" value proposition.

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In the fifth stage, PWC [221,222] provides strategic advice and systems integration for Oracle's preconfigured industry model systems to allow clients to introduce emerging technologies such as blockchain, Internet of Things, artificial intelligence, robotic process automation, robotic processes. PWC boasts the capability to predict the outcomes for the solutions. This includes the benefits of PWC's integrated solutions that solve complex challenges, prove assets, bring faster business outcomes, and digital innovation. PWC's process of researching, prototyping, testing, and building solutions around the essential eight emerging technologies help to extend the value of client's Oracle investments. The innovation stage comprises the following: build the target operating model; design, build, and test using iterative sprints; conduct systems integration testing; conduct usability testing; assess digital innovation. PwC's Emerging Tech Lab helps develop innovation use cases with emerging technologies on the Oracle platform which are incorporated into their Integrated Solutions. Their process of researching, prototyping, testing, and building solutions around the essential 8 emerging technologies help to extend the value of client's Oracle investments. Emerging technologies continue to develop and disrupt the marketplace. PwC recognizes the value digitalization and new technologies can offer clients. Committed to supporting clients, PwC invests in digitally upskilling its internal workforce to ultimately support the development of more innovative solutions. Through PwC's Automation Center of Excellence, they are focused on increasing the efficiency and the quality of their services through automation and technology. PWC delivers an innovation experience and drives bold solutions in a better, faster, more cost effective way. PwC's commitment to delivery excellence extends through collaborating with clients and empowering them to be able to embrace emerging technologies.

At SAP [291–296,303–307], enterprise architects shape solutions, in proportion to 80% before the deal and 20% when the deal with the customer is closed. The deal stipulates the customer outcome. The solution will be architected after the customer contract, where 20% is individualized to the customer situation and 80% pre-defined solution architecture. Use cases make up the pre-defined solution architecture. The solutions are based on business process management consulting and enterprise architecture. SAP employs 15 000 business consultants to devise these solutions. SAP also employs 7000 support engineers. SAP has in place its co-innovation strategy and co-innovation labs to innovate solutions with customers. SAP's co-innovation lab is, alongside SAP's product strategy and road map, a key pillar in strategy to enable organizations to become intelligent enterprises. Using the technical foundation provided by SAP Business Technology Platform (SAP BTP), SAP works together with partners to extend and integrate SAP applications to meet unique organizational needs and digitalize business processes. The procedure has been in place for 15 years and is implemented in 14 locations. SAP helps partners convert ideas for solutions for intelligent enterprises into working prototypes and from there to market-ready solutions. The procedure is in place for SAP Next-Generation Partnering initiative. One of the most prominent projects is the Hack2Build initiative to support rapid prototyping, use-case exploration, and technology adoption. The probability of coming up with a creative and innovative solution to a problem rises with the number and diversity of brains involved. Co-innovation benefits come from: understanding the customer; closing portfolio gaps; accelerating innovation; fostering a vibrant ecosystem; attracting amazing partners. Customer co-innovation usually takes place in the validation or prototyping phase and targets "jobs to be done" within a customer's cross-company business processes. The solution should address the needs of a particular customer by means of target-oriented innovation. By getting to know your customer's issues, you will gain a knowledge and understanding of your customer that will pay off well beyond a particular co-innovation project. That's why, throughout the IT industry, the concept of co-innovation – two or more organizations joining forces to solve a new and challenging problem – is on everybody's lips. Co-innovate with us for success in the digital economy: close alignment between line of business, industry, and Partner Innovation Lifecycle Services teams at SAP provides the expertise required to deliver certified and competitive partner solutions to the marketplace. The co-innovation process involves: use case assessment; expertise and guidance; quality assurance. The benefits are: differentiation and trust that drive sales: support when taking your product to market;

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yearly renewal. SAP has a series of co-innovation services, which are: use case review; architectural review; enablement and coaching; build support; assessment services; go-to-market support.

An Alternative Stage of the Digital Transformation Journey for Customer Co-Creation: The Outcome as a Service Business Model

Siemens moves business models from managed service to software as a service, availability as a service, insights as a service, outcome as a service. Siemens' documents to debate the outcome as a service business model have been initiated in 2015 [178,204,205,248,268], include their application on Internet of Trains [208], the calculation of value in business cases [202–204,207,214,215,264,277–281,297], and sustainability reports [184,219,261]. Business models are changed from transactional to outcome based partnerships. Siemens also writes about two service models: pay-per-use, a mature business model already described here, and pay-per-outcome business models. Pay-per-outcomes is about the expected outcomes the technology makes available. Savings or gains from access to the technology are used to, in effect, meet monthly payments, making the technology cost neutral for the manufacturer over time. In pay-per-outcome business models, payment is based on return on investment. This means that investment the customer makes will be matched with the target return on investment which Siemens commits to. At Siemens [192], solution architects assess, define and improve digital business process and solution architecture. They are in charge of: solution modeling and definition; proof of concept; gap mitigation; reference system topologies; plan network architecture; reference process alignment. Siemens supports customers by aligning, with technology openness, all solution components and constraints into a production viable architecture [192]. At Siemens [192], this is the stage when the solutions are implemented and the realization of predicted value is assessed.

At the end of this process, both at PWC-Oracle [221,222] and at Siemens [192], integrated pre-configured solutions will be offered to customers. At PWC-Oracle, integrated solutions are configuration and integration ready. They tackle large and complex challenges holistically. They involve repeatable playbooks or repeatable model systems. Each integrated solution ties back to a strategic roadmap that aligns business strategy and technology enablement with overall corporate objectives, ensuring clients end their journey with value realization. The end of the transformational journey is a business outcome, the realization of the predictable value. In the final stage of the predictable value approach, solutions will be adapted to customers via minimum viable product and agile development. At the release state, PWC conducts end-to-end testing; conducts operational simulation testing; stakeholder validation and training; transition to future state operating model; cutover. At the end of the solution integration process, PWC conducts the following stages: release and evolve. Release means: conduct end-to-end testing; conduct operational simulation testing; stakeholder validation and training; transition to future state operating model; cutover. The stage evolve means: conduct backlog releases; production support; adoption of future functionality releases; track key performance indicators and performance against business cases. Oracle guarantees the attainment of the targeted key performance indicators.

SAP [291–296,303–307] furthermore moves towards the outcomes based business model. Enterprise architects shape solutions, in proportion to 80% before the deal and 20% when the deal with the customer is closed. The solution will be architected after the customer contract, where 20% is individualized to the customer situation and 80% pre-defined solution architecture. Use cases make up the pre-defined solution architecture. The solutions are based on business process management consulting and enterprise architecture. SAP employs 15 000 business consultants to devise these solutions. SAP also employs 7000 support engineers.

At PTC [308,309], the process culminates in choosing the most suitable use case amongst several scenarios. The process prioritizes use cases based on their suitability with value expectations. The solution offered to customers is consistent with the use case. Use cases match a solution that overarches products, services, business processes impacted and the value created and delivered. Use cases are chosen based on the value expectations business customers have. Once this use case is adapted to the customer, value drivers and financial impact will be computed for the new business

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customer. The project sponsor works with leadership and group managers to prioritize use cases. PTC suggests creating a matrix of each use case's: level of value, solution type, level of cost, time to value, scalability. Then fill in the matrix with the information gathered so far and new insights from leadership, managers, and end users: are possible to address; present high potential value; can be attained with appropriate effort and cost. Together with leadership and managers, review the matrix, prioritize the list, and select the first use case. The use cases are selected based on their capability to create the greatest value for the customer company (business case). PTC offers several choices for its products, solutions and customer value. The entry page to the market player gives the list of products, services and solutions. PTC also offers guides about use cases and how they are shaped.

Discussion and Analysis

Table 1.

	Digital transformation management instruments	Multiple case study
1.	Management instrument: digital strategy	Siemens [184–186,188–197,200–220] PWC [221,222] for Oracle Consulting [222–228] SAP [229–234] PTC [235–241]
	- lean start-up innovation techniques	Siemens [186,211–213,280,297–302] PWC [221,222] SAP [291–296,303–307] Scientific literature review [314–320].
2.	Maturity index	Siemens [242,243] PWC [221,222] PTC [235–237,240,241] SAP [244,245]
3.	Roadmaps	Siemens [246–251] PWC [221,222] PTC [238,239,252] SAP [253–258]
	- ties between maturity index and roadmaps	Scientific literature review [313]
4.	Business case and capital allocation instruments	Siemens [202–208,259–262,264–271] PWC [221,222] PTC [235–237,272–276] SAP [252–258]
5.	As a service business model	
	- pay per use business model	Siemens [277–281]. PWC for Oracle [221,222] and Oracle [282,283] PTC [284–290] SAP [291–298]

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	- pay per outcome business model	Siemens [178,184,202–205,207,208,214,215,219,248,261,264,268,278–281,297] PWC-Oracle [221,222] SAP [291–296,303–307] PTC [308,309]

The objective of this article is to identify the management instruments and decisions that impact the digital transformation decision. In order to meet this objective, these management instruments are classified in terms of the W and H questions they answer: ”Where?”, ”Why?”, ”How?”, ”What?”, ”Who?”. The W and H question investigation is Kuhn’s paradigm approach [29]. The exploration of empirical data has revealed the following management instruments: corporate governance objective; market analysis; digital strategy; dual innovation strategy; as a service business models; maturity index; use case; roadmaps; programs; projects; operations; lifecycle costing; lean start-up; business case; capital allocation indicators and methods. Each of these management instruments is individually characterized, but the definitions are kept to a minimum due to the elaborate nature of this research. The management instruments have been identified in the text. They are to be matched with Wh questions according to the assertions from the four case subjects.

Empirical data analysis argues the first management instrument to be decided is the governance objective. This may take a vague form such as a mission statement or a highly concrete form such as outcomes agreed between parties. This makes it the first activity in the investment decision which buyers make when purchasing information technology or digital technology from vendors. The question ”Why?”debuts the decisional series and leads to the succession of value drivers in the form of input, output, outcome and impact which operations must meet. This is the first decisional activity in the transaction analyzed herein.

Market analysis is another instrument. It explains the choice of the Digital Sector vendors and Digitalized Sector customers which is the stance this case study is applicable in. Generally, investment decisions at buyers and indirect procurement decisions may be shaped like this beyond this relationship; however, direct procurement decisions cannot. Industry 4.0 is an evolutionary approach with maturity stages known in the digital transformation process until full digitalization. Beyond Industry 4.0 however, the stages of digital maturity become less certain and require progressive innovation. Market analysis is not mentioned in the text.

Another management instrument is the strategy, ambidextrous innovation, the major ”How?” in this process. This may be exploitative/ incremental or exploratory/ radical innovation. Ambidextrous innovation is referred to as the strategy for Industry 4.0 in scientific literature and empirical data analysis alike. Digital strategy is recognized as such in scientific literature review [310–312] and empirical data analysis.

As a service business models give two variables to be analyzed: customer offering (product-service, solution) and the value it creates, delivers and captures for the business customers. Three scenarios arise: the product-service is sold per se and the value is not known; both product-service and the value are known; the value is sold per se and the product-service is not known. The first scenario is the product business model, which is suitable for a certain business environment. The second scenario is the output as a service business model and is suitable for a predictable business environment. The third scenario is the outcome as a service business model, suitable for an uncertain business environment. There is no indication in scientific literature review about as a service business models and other management tools. Empirical data analysis however, matches the choice of as a service business model to the goal of the entire decisional process. The as a service business model is therefore a choice to be made at the end of the process, where the as a service business model is a dependent variable.

The capability maturity index is a management tool organized into known organizational dimensions and degrees of digital transformation maturity. The easiest representation of this tool is

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a radar chart with capability maturity stages on X axis and organizational dimensions of digital transformation on Y axis, as in Figure 3. Organizational dimensions impacted by digital transformation vary a lot. These indices are value based, which means that each stage of digital transformation capability maturity is expected to impact value and that as maturity levels increase so does the value expected to be created. They are suitable for a known environment. Empirical data analysis ties capability maturity indices to incremental innovation.

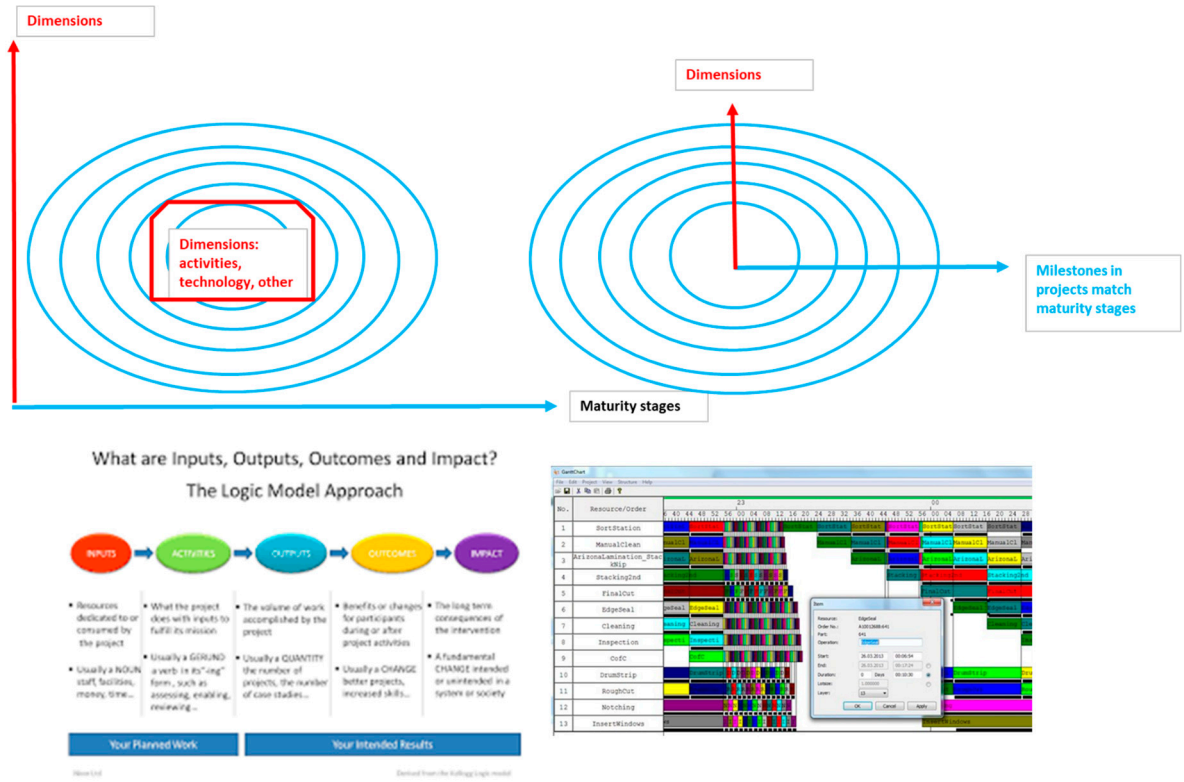

Figure 3. Capability maturity index, roadmap, program, projects, business case.

The use case is a similar management instrument, which may be defined as a technology solution encompassing several products and services combined, which shaped known business activities into a process, and has determinable business value calculated based on business activities. Use cases match known product-services.

Roadmaps are the overview project management tools. Roadmaps decide the milestones in one-off activities. They may overarch programs and projects, a one-off set of activities that decides future recurring activities or operations. The roadmap is applicable to a predictable environment. It gives other independent variables: the programs and projects, which have several options (call or put). Operations may be used for a fully predictable environment. This is management theory. Scarce theoretical resources take the axes in the capability maturity index and transform the radar chart into a timeline chart: maturity stages become milestones and organizational dimensions become the dependent variables and may be technology, activities, other [17,313].

The lean start-up method is used by organizations in search of a business model. It ends when the business model is found. The lean start-up is suitable for a highly uncertain environment [314–320].

Business activities are the management tool that mediates the relationship between the other variables. Business activities may be defined on a functional basis. In management theory, activity management tools are roadmaps, programs, projects, operations and the lean start-up.

Capital allocation is a management instrument which decides business value. This may be shareholder value, stakeholder value or other value. Capital allocation typically assigns equity or debt to the net present discounted value of the sum of operational, investment and financial value. This gives staple financial indicators net present value of discounted cash flow, internal rate of return

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and economic value added. Basic financial accounting refers to this method and may use the method of expenses by nature or functional activity, which are equivalent. Expenses by functional activity match the functional areas in the activity management theory. Options are a different type of capital which may be used complementary to equity and debt for valuation. Options may be put or call options. They are suitable for a high risk environment. In an uncertain environment, valuation uses venture capital. Scientific literature review and empirical data analysis tie programs and projects to options. They also indicate the lean start-up method is suitable for an uncertain environment and valued by venture capital.

The basic scenario is that the business environment is certain for a given timeframe. Technology and business activities are definable in capability maturity indices. They are derived to give roadmaps. Roadmaps overarch one-off activities like programs and projects and decide recurring activities like operations. They are organized on a functional basis. The Logic model assigns inputs, outputs, outcomes and impacts to activities in order to compute value indicators for equity and debt capital. These are the next present value of discounted cash flow, the internal rate of return and economic value added. When the environment becomes high risk and several strategic scenarios foreseeable, use cases replace maturity indices and the basic project path is added to call options or put options impacting valuation. This situation matches Figure 3. Here, the intangible asset to be invested in, the business activities as moderating variables and the value impact of all are known. It may also be value is chosen for several options of known solutions. This is the output as service business model, to be employed in a predictable environment and incremental innovation. It may happen that the environment is uncertain and valuation uses other capital, such as venture capital. This is used together with the lean strat-up and radical innovation, in scientific literature and empirical data analysis alike. Beyond certainty, radical innovation suits the lean start-up method and the outcome as a service business model. These are the independent variables for this as a service business model. The resulting overview matches Figures 4 and 5.

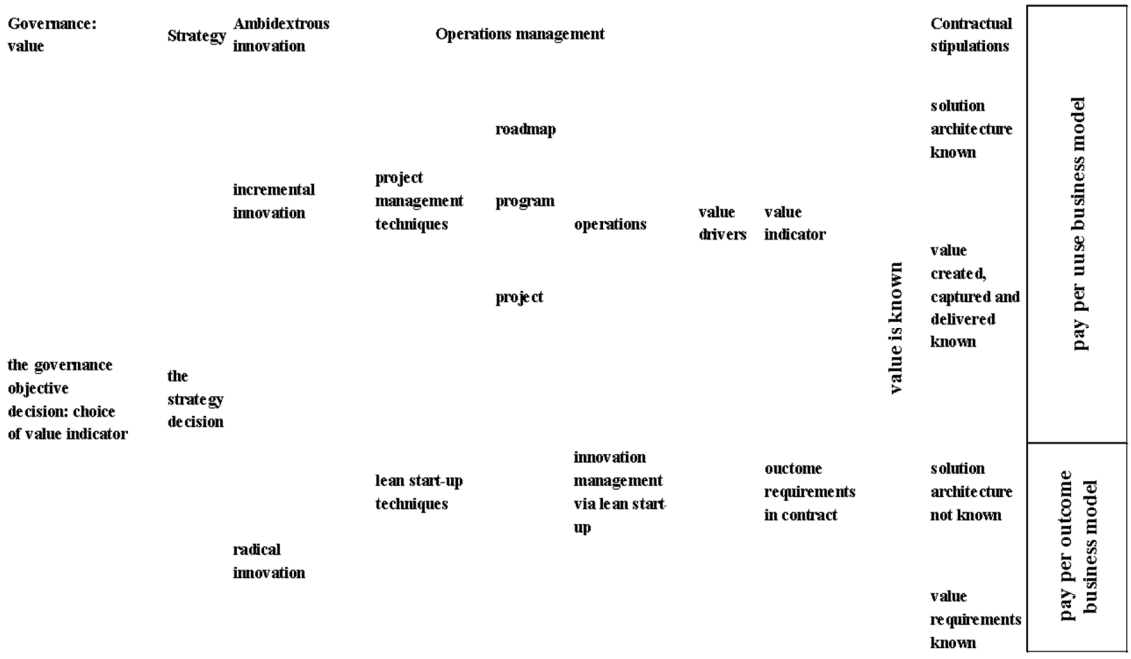

Figure 4. The sequence of the activities to decide value in as a service business models.

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Digital transformation customers (the digitalized economy)														
Where digitally invest?	Digital transformation markets	automation	cloud	analytics	digital twin	artificial intelligence	cyber-physical systems	distributed systems of CPS	generative engineering	manufacturing additive	blockchain	other emerging technologies	quantum computing	
		Industry 4.0 scenario							Beyond Industry 4.0					
Why digitally transform?	Environment uncertainty	predictible work environment			several predictible scenarios				uncertain environment					
	Governance objective	value indicators or value drivers			value indicators or value drivers				value indicators or value drivers					
	Innovation	incremental innovation			product innovation + business model innovation				disruptive innovation					
What to digitally transform?	Maturity indices	stage 1	stage 2	stage 3	stage 4	stage 5	stage 6	stage 8	stage 9	stage 10	stage 11	stage 12	stage 13	
How to digitally transform?	Strategy	optimize the core			dual innovation strategy (optimize the core and create the new)				dual innovation strategy (optimize the core and create the new)					
	Innovation	incremental innovation			from adaptive to product innovation + business model innovation				disruptive innovation					
	Business model innovation	pipeline business models			the evolution from automation hierarchy to flexible value networks				platform business model					
		output as a service based business model							outcome as a service based business model					
	Roadmap create the new				innovation in software and embedded computers for smart connected products: autonomous, robotic				innovation in configured products (new shapes, new materials)					
					innovation in customer experience for smart connected products				innovation in customer experience for configured products					
					smart factories				the intelligent enterprise					
					lean start-up, agile development				lean start-up, agile development					
	Roadmap adapt the existing				enhance existing products with smart and connected attributes				configure existing products to the customer					
					adapt existing operations to Industry				adapt existing operations to the intelligent enterprise					
					programs, projects, use cases				programs, projects, use cases					
To digitally transform yes or no?	Business case	discounted cash flow, economic value added			discounted cash flow, economic value added, total economic impact, real options theory, integrated reporting				outcomes, business models, venture capital, integrated reporting					

Figure 5. The digital transformation of traditional industries to the digitalized economy paradigm.

Exploitative innovation will lead to a known solution, matching a predictable environment. Exploitative innovation means solutions offered to customers are known and already architected. The impact this solution has remains to be determined via the business activities it shapes and the value it thereby creates, captures and delivers for the business customers – which is stipulated in the

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customer contract too. With radical innovation, the customer deliverable is not yet known in terms of technology and matches value requirements called outcomes. Outcomes are decided first and the solution is decided at the end of the innovation process.

The degree of innovation leads to the choice of a service business model. With the output as a service business model, contractual stipulations are the solution, known and pre-architected, and the customer business value, calculated for this known solution. This is incremental innovation. With the outcome as a service business model, contractual stipulations include only value requirements; after the contract is closed, once it is executed, the solution will be architected to meet these value requirements in a radical innovation process.

One set of questions is the ”Why?”: “Why digitally transform?”. This unveils the rationale of digital transformation and spurs objectives about corporate governance, which may be shareholder value, stakeholder value or other type of value. The same question is answered by the business case or capital allocation methods, which decide shareholder value or stakeholder value. This question is explicitly tied to the corporate governance objective and business case in the text. The management instruments that decide shareholder or stakeholder value are the corporate governance objective and the business case , as evidenced in the empirical data analysis section.

Another set of questions is the market analysis: ”Where to play?” for sellers and ”Where to buy for investors?”. This explains the choice of market platforms as a service, in the methodology section. The finale of digital transformation, architecting the solution, also answers the question where. The question “Where to play in digital transformation?” opens several questions: “Which are the markets of digital transformation technologies?”; “Which are the existing and emerging technology markets?”; “Where to play in terms of geography?”; “Where to play in terms of product, product-service system, solution or outcome?”; “What are the use cases marketed between sellers and buyers?”; “What are the customer markets of digital transformation?” match the management instruments identified previously.

The next management instrument is digital strategy, where this article considers one type of digital strategy: the dual innovation strategy. The questions “How to digitally transform?”, “How to win in digital transformation?”, ”How to innovate in digital transformation?”, ”How to organize the transaction or relationship between digital transformation market players?” are answered by digital strategy, competitive advantage, dual innovation, business model innovation, and roadmap. The Objective is to describe these management tools well. Digital strategy guides the digital transformation journey. The former three questions have the same answer: the dual innovation strategy is the strategy for digital transformation, for competitive advantage, for innovation. On the digital transformation market, the transaction or relationship between market players is settled via as a service business models. Depending on the business model, digital transformation may be decided together by buyers and sellers and value computed after all these decisions. In another business model, value is decided at the beginning as outcome, and the responsibility for the solution rests on the seller.

The ”When?” question is also decided by the timeline chart which the roadmap is.

The following management instrument considered is the general review of the maturity index. Maturity indices answer the question ”What?”. Digital transformation capability maturity indices answer the question ”What?”, “What to digitally transform?” highlights the overview tool in digital transformation, the digital capability maturity index and its constituents - the organizational dimensions impacted by digital transformation and the stages of digital transformation, while allowing the mapping of the complex relationships that shape maturity indices as a diagnosis tool. The objective is to highlight the digital capabilities, and their determinants, organizational dimensions at their scale of maturity. There are commonalities amongst digital transformation capability maturity indices.

Questions ”Who?” and ”Which?” refer to the specifics of this case, the four data subjects, and are covered by the market players in market analyses.

When innovation is incremental, capability maturity indices and use cases are used, in accordance with Figure 3. Capability maturity indices are represented as a radar chart, with capability

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maturity stages on X axis and organizational dimensions of digital transformation on Y axis, as in Figure 3. When solutions are numerous, use cases replace capability maturity indices. Roadmaps take capability maturity indices and match every capability maturity stage with a project or program milestone on the X axis of a timeline chart. The Y axis or axes will be the organizational dimensions digitally transformed, such as business activities or other. Programs and projects will be decided via Gantt charts, as in Figure 3. In manufacturing, programs match product design and production planning. This matches disciplines research and development, business development, strategic supply chain management, and others. Explicit statements exist that maturity indices are followed by roadmaps and that roadmaps shape programs, projects and operations. These match empirical data statements as well as theoretical research scouted to see if the empirical data analysis has theoretical underpinning. The fundamental question is: "Is strategy incremental innovation or radical innovation?": if yes, then the capability maturity index or use case shapes the pre architected solution; activity management uses roadmaps, programs, projects and operations; the business case valued equity debt and options as the net present value of discounted cash flow, internal rate or return, economic value added, call or put options, as in Figure 3; end of this process both solution and value are stipulated in the pay per use business model; if no, activity management used the lean start-up and values using venture capital; the output relationship is in Figure 5.

Conclusions

The article addresses a topic that is little tackled in scientific literature review, as service business models. It does so to explain the component of as a service business contracts that creates the shift from as a product business models to as a service business models, that is customer value stipulations. The article sheds light on the decisional process about customer value on business to business markers, where the decisional process comprises several activities both at vendor and customer. The decisional process is inferred based on empirical data analysis. The article treats digital transformation as a market within the information technology global market, valued as such by market analysts. Therefore, empirical data has a theory building impact. The case is educational to digital transformation sellers who may proceed equally and to digital transformation buyer organizations, who may be interested in business value besides the technical solution. It forms a bridge between business to a holistic organizational approach. It thereby looks at a service business model not as singularity but as a compound phenomenon whose constituents are constructed therein.

The finding matches scientific literature review in terms of variables and creates an unprecedented link amongst them. This is the main contribution of the article. This has value from a theoretical point of view, as the topic has not been addressed by research yet. It is of value to practitioners who need an accredited methodology to compute business value, not yet theorized and yet shared by staple digital transformation solution providers.

This has implications for sustainability in that business customer value may be shareholder value or stakeholder value. Both types of value are possible in this approach. The more business customers become prone to adopting stakeholder value, the more their business processes will be sustainable for shareholders, customers, employees, environment and other stakeholders. This article will support the decision to adopt sustainable value by providing insight into the paradigm to calculate and otherwise decide this value in a specific case. Using the logic of abduction, this case may be generalized. Using statistical data analysis, the case may be used as basis for quantitative analyses that prove its verdicity or not. The research is thereby pioneering.

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