

Online Appendix : A literature review on the effectiveness and efficiency of business modeling

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Abstract

For brevity and publishing reasons, this document is stored online and contains all Appendixes as supplementary information to the e-Informatica Software Engineering Journal, Manuscript ID EISEJ-2018-0010 entitled "*A literature review on the effectiveness and efficiency of business modeling*". Parts of this Appendix may also be published in other Journal papers.

A. Selected articles

Table 1 lists all the articles selected through the snowballing methodology. It contains Paper ID, author/bibliographic reference, plus extracted data for rigor and relevance factors (EP3), paper content (EP4), and the number of topics (RQ1+RQ2+IC2+IC3)¹ addressed by the paper. A detailed description of EP3 (including calculation of scores) and EP4 are found in the online² Appendix C while details of IC1-IC3 are found in Appendix B.

In the main article we use the notation [Paper ID, ...] to indicate a reference to one or more of the study's selected papers when we specifically talk about a result or an synthesis thereof. Please note that the start set consists of P1-P10.

Paper ID	Authors/Ref	Year	Rigor (EP3)			Relevance (EP3)				Content	No. of
			C	SD	V	C	Sc	Su	RM	EP4	RQ+IC
P1	Woodard et al. [54]	2013	1	1	1	1	1	1	1	2	4
P2	Rohrbeck et al. [46]	2013	0.5	1	0	1	0	1	1	1	3
P3	Reim et al. [43]	2013	0.5	0.5	0	0	0	0	0	2	3
P4	Hackney et al. [28]	2004	0.5	0	0	1	1	0	0	3	2
P5	Chew [13]	2014	1	0	0	1	0	0	0	2	4
P6	Ballon [6]	2007	0	0	0	1	0	0	0	1	3
P7	Loss & Crave [35]	2011	0	0	0	1	0	0	0	2	3
P8	Romero & Molina [47]	2011	0	0	0	0	0	0	0	3	3
P9	Höflinger [29]	2014	0.5	1	0	0	0	0	0	2	3
P10	Goel et al. [25]	2009	0.5	0	0.5	0	0	0	0	3	3
P12	Casadesus-Masanell & Ricart [11]	2010	0	0	0	1	0	1	0	3	3
P13	Chesbrough [12]	2010	0	0	0	1	0	0	0	2	3
P14	Demil & Lecocq [15]	2010	1	0	0.5	0	0	1	0	2	2
P15	Doz & Kosonen [18]	2010	0	0	0	0	0	0	0	1	2
P16	Dubosson-Torbay et al. [19]	2002	0	0	0	0	0	0	0	2	2
P17	Hacklin & Wallnöfer [27]	2012	1	0.5	0	1	1	1	1	1	3
P18	McGrath [38]	2010	0	0	0	0	0	0	0	1	3
P19	Richardson [44]	2008	0	0	0	0	0	0	0	2	3
P20	Storbacka & Nenonen [53]	2011	1	1	1	1	1	1	1	2	2
P21	Zott & Amit [56]	2010	0	0	0	1	0	0	0	2	2
P22	Baden-Fuller & Morgan [5]	2010	0	0	0	0	0	0	0	2	3
P23	Gao et al. [21]	2011	0	0	0	1	0	1	0	3	2
P24	Kindström [32]	2010	1	1	0.5	1	1	1	1	2	4
P25	Meier & Massberg [40]	2004	0	0	0	0	0	0	0	3	2
P26	Meier et al. [39]	2010	0	0	0	1	0	1	0	3	3
P27	Richter et al. [45]	2010	0	0	0	0	0	0	0	2	2
P28	Schuh et al. [51]	2009	0	0	0	0	0	0	0	3	1
P29	Zott et al. [57]	2011	0.5	1	1	0	0	0	0	2	4
P30	Amit & Zott [2]	2001	1	1	1	1	1	1	1	3	2
P31	Baden-Fuller & Haefliger [4]	2013	0.5	0	0	0	0	0	0	3	3
P32	Osterwalder et al. [42]	2005	0	0	0	0	0	0	0	2	3
P33	Al-Debei [1]	2010	0.5	0	0	1	1	1	1	2	3
P34	Bouwman [8]	2006	0	0	0	0	0	1	0	3	3
P35	Buder & Felden [9]	2012	1	1	1	0	1	0	0	1	4
P36	Cortimiglia et al. [14]	2015	1	1	1	1	1	1	1	1	2
P37	Ghezzi [23]	2013	0.5	0.5	0.5	1	1	1	1	1	4
P38	Ghezzi [22]	2012	0.5	0	0	1	1	1	1	3	2
P39	Haaker et al. [26]	2004	0.5	0	1	1	1	1	1	2	2
P40	Krumeich et al. [33]	2012	0	0.5	0.5	0	0	0	0	2	2

¹ IC1-IC3 are topic-oriented while IC4 and IC5 are related to rigor and relevance

² Online Appendix: A literature review on the effectiveness and efficiency of business modeling, see https://www.bth.se/wp-content/uploads/2018/05/SLR_BM_Main_2018-0010_Appendix.pdf

Paper ID	Authors/Ref	Year	Rigor (EP3)			Relevance (EP3)				Content	No. of
			C	SD	V	C	Sc	Su	RM	EP4	RQ+IC
P41	Zolnowski & Böhmman [55]	2011	0.5	0.5	0	0	0	0	0	1	2
P42	Andries & Debackere [3]	2007	1	1	0.5	1	1	1	1	3	2
P43	Björkdahl [7]	2009	0.5	0.5	0.5	1	1	1	1	3	2
P44	Casadesus-Masanell & Llanes [10]	2011	1	0	0	0	0	0	0	3	2
P45	Doganova & Eyquem-Renault [17]	2009	0.5	0.5	0	1	1	1	1	2	4
P46	Mason & Leek [37]	2008	0.5	0.5	0	1	1	1	1	3	2
P48	Lindström [34]	2014	0.5	0.5	1	1	1	1	1	3	2
P49	Eurich et al. [20]	2014	0.5	0.5	0	1	1	1	1	1	3
P50	Ning et al. [41]	2011	0.5	0.5	0	1	1	0	0	3	0
P51	Dmitriev et al. [16]	2014	1	1	1	1	1	1	1	1	2
P52	Schneider & Spieth [50]	2014	0.5	0.5	0.5	1	0	0	1	1	3
P53	Short et al. [52]	2013	0	0	0	1	1	0	1	1	2
P54	Meier & Boßlau [39]	2013	0.5	0	0	1	1	1	1	1	4
P55	Giessmann et al. [24]	2013	0.5	0	0.5	1	0	0	0	3	3
P56	Salgado et al. [49]	2014	0.5	0	0	1	1	1	1	1	3
P57	Kim et al. [31]	2008	1	0	0	0	0	0	0	3	2
P58	Mason & Mouzas [36]	2012	1	1	1	1	1	1	1	3	2
P59	Salgado et al. [48]	2014	0	0	0	0	0	0	1	3	2

Table 1: Selected papers including extracted properties.

B. Inclusion and exclusion criteria

To identify literature related to our research questions, we developed the Inclusion criteria (IC) and Exclusion criteria (EC) listed in Table 2. These criteria allow us to explore why BM is used, how it is applied, and what solutions currently exist. Since our research topic covers multiple research disciplines, we decided to address the RQs by designing the IC as wide as possible, to give us a large variety of articles discussing BM (IC1) in any relationship to effectiveness and efficiency. To evaluate BM efficiency, it is important to connect the business strategy via the business model to the execution of the business model with a traceability to daily operations and results. So to understand if business modeling enables effectiveness and efficiency, we want to know how a business model can be operationalized by developing the right type of flexibility (variability in the realization, IC3) matching all desired strategical and tactical choices (business flexibility, IC2).

Table 2. Inclusion and Exclusion criteria.

Criteria	Evaluate(= Yes)	Reasoning
EC1	Exclude if Not written in English	Must be able to read and understand to evaluate
EC2	Exclude if Not peer-reviewed	Basic Quality assurance of paper
EC3	Exclude if duplicated	Snowballing will give many duplicates
IC1	Does the abstract, introduction, conclusions (or full text if needed) mention purposes, benefits or challenges (PBC) for business modeling?	Papers must identify real problems and issues related to business model, business modeling or business model innovation.
IC2	Does the text mention aspects of business flexibility (BF)?	BM is becoming increasingly complex due to growing business ecosystems and the digitalization of the value delivery, which both introduce a need for variability in the offering. Offering services on top of products are one example to address BF.
IC3	Does the text mention aspects of variability in the realization (VR)?	Planning a business model is not enough. It needs to be efficiently realized as well, so the business flexibility needs to be matched with a variability in the realization of the business model. Offering Software Product lines (SPL) or Product Service Systems (PSS) are examples of addressing VR.
IC4	Is it an empirical study?	We want to investigate how business models are used in practice, and not only in theory. Empirical is done in an industrial context, no student work, no proof of concept, no examples even if they are 'based on real data'
IC5	Is it referring to a SIPD context?	The realization of business models is highly dependent on software due to the digitalization of the value delivery. This opens up new opportunities for value capture (and value creation) in the business ecosystems.

Business modeling allows an organization to identify and prioritize changes to current business operations (content, activities, and governance). This change is continuously translated into a realization of the business model, through experimentation or otherwise, by understanding how the desired flexibility can be operationalized using modularity in design and software-based systems to support content, activities (all stakeholders, e.g., internal organization, partners, suppliers, and customers) and governance.

Effectiveness and efficiency should be evaluated from the gap between all strategic and tactical choices, in combination with how the organization (and supporting software) utilize the remaining flexibility to create satisfied customers in everyday transactions. The dilemma of not only implementing the right flexibility (supporting the needed business options) but also implementing it efficiently, is key to success, i.e., the right level of variability in the realization combined with the

appropriate changeability in the realization to facilitate experimentation with the operationalized business model.

The selection criteria was based on IC1 AND (IC2 OR IC3 OR IC4 OR IC5) to achieve a broad selection of papers as possible. If only the term Business model were used (and not specifically Business modeling), the paper could still be a candidate if it referred to activities related to creating, maintaining, or otherwise using a business model.

C. Data Extraction properties

Table 3 lists the data extraction properties used for this study and maps their relevance to each RQ. Properties EP1-EP4 are evaluated per paper and used to analyze the relevance to industry for each paper’s contribution. Properties EP5-EP9 use open coding and the extracted data was thematically and narratively analyzed.

Table 3. Data Extraction properties.

Id	Evaluate	How	RQ mapping
EP1	Research Methods	Action research, Case study, Conceptual analysis, Design Science research, Experiment, Interview, Literature review, Not stated, Other	Relevance of paper
EP2	Paper Context	SW intensive, Industry, General (e.g. Literature review), Non-industry (in priority order)	RQ1 and relevance
EP3	Rigor & Relevance of the paper	Detailed rubric definitions per aspect [30] Rigor: Context is described Rigor: Study Design is described Rigor: Validity is discussed Each Rigor aspect measurement: Strong description (1), Medium description (0.5), and weak description (0) Relevance: Context (weight=8), i.e. in industrial setting Relevance: Scale (weight=4), i.e. realistic size and industrial scale Relevance: Subjects (weight=2), i.e. industry professionals Relevance: Research Method (weight=1) Each Relevance aspect measurement: Contribute to relevance (1), Do not contribute to relevance (0)	Overview and relevance
EP4	The relevance of the paper content in respect to Business modeling.	Coded 1-3: (1) Business modeling. The paper discuss specifically the process of modeling your business (2) Business model. The paper mainly focus on the Business model and discuss how different aspects of the Business model constructs are developed (3) Other. It only refers to a specific business model(s), or discuss specific instances thereof, or a topic related to business model (e.g. flexibility). Therefore of minimal significance to our study.	RQ1
EP5	IC1-IC3	Use ATLAS TI to extract related quotes for each RQ.	RQ1, RQ2
EP6	Business Element context	Use ATLAS TI to extract related quotes referring to a part of the business model construct, what it is, why it is important and how it is used and relates to other parts.	RQ1
EP7	Practice/Technique	Use ATLAS TI to extract quotes referring to a practice or technique presented, described or used.	RQ1, RQ2
EP8	Measurement perspective	Use ATLAS TI to extract quotes related to - Product view (how well is the value created) - Process view (how efficient have you organized the value flow) - Resource view (how well is the resource utilized and adapted for the needed task) - Project view (how efficient is the goal fulfilment) - Relationship view (how effective is the communication)	RQ2
EP9	Success indicator and metric	Use ATLAS TI to extract related quotes.	RQ2

Property EP1 and EP2 are subset of property EP3 (Rigor & Relevance) where property EP2 categories the paper’s context. We extend the definition of Context (EP3 [30]), by adding (large-scale) Software intensive industry. The relevance parameter (EP3), we coded with binary weights (originally proposed as plain sum of 0 or 1), allowing us to visualize the impact of different relevance aspects. The weights were guided by RQ1, hence setting our priority: Industry (8), Scale (4), Subjects (2) and Research method (1), e.g. a value of 9 or higher would represent anything in “industry” with at least one additional relevance aspect met. Originally the Relevance element of property EP3 focus on the paper’s context in relation to industry so we added property EP4 (Paper content) to map the relevance of each paper’s content related to answering the RQs.

EP5 corresponds to our inclusion criteria (IC). EP6 was used to look for patterns on the business model construct as to describe what it is, why it is important and how it is used. This is important since the topic of BM is wide and lacks a clear definition. EP7-EP9 was used to understand the context for effectiveness and efficiency as related to business modeling.

D. Quotes of purpose, benefit and challenges

Table 4 lists the quotes of purposes, benefits, and challenges for business models and business modeling, extracted from the selected studies (see Appendix A for paper references). All quotes have been categorized into common areas (first column), and then listed under respective primary context they are found in. We use prefix notation (+) for benefit, (-) for challenge, and [Pid] for the paper reference.

Common areas	Strategy & Planning (Define)	Daily operations (Execute)	Governance & communication
Value creation, value capture	<p>Conceptual discussion and visualization of value creation/capture [P2]</p> <p>Articulate Value proposition [P7], [P13],[P35]</p> <p>Identify a market segment and value chain [P7], [P13],[P20]</p> <p>Appropriate value from technology [P36]</p> <p>(+) depicts the logic for value creation/capture [P17]</p> <p>(+) fosters innovation and increases readiness for future [P32]</p> <p>(+) rigorously describes and analyses business with system dynamics [P36]</p> <p>(-) hard managing tension between value creation and value capture (trade-offs monetization) [P5]</p> <p>(-) hard managing service flexibility (segmentation, QoS) [P5], [P24]</p> <p>(-) ensure consistent service experience (multi-channels) [P5]</p> <p>(-) a total value need consideration (not only financial) [P53]</p>	<p>Reconfiguration of roles and relationships [P8], [P20]</p> <p>Determining the logic for value [P30]</p> <p>(+) captures how resources transforms into customerswillingness to pay for value [P18]</p> <p>(-) Service vs. Product centric create conflicts, balancing is difficult [P1][P24]</p> <p>(-) low effectiveness (customer experience) of value co-creation (organization/customer) [P5]</p> <p>(-) it is difficult to incorporate closer customer interaction [P24]</p> <p>(-) how to acquire resources in value chain not previously available in-house [P24]</p>	<p>Describe and classify businesses [P32],[P22]</p> <p>Meeting customer's needs [P58]</p> <p>Compare value creation approaches [P32]</p> <p>(+) facilitates strategic discussion and finding creative solutions [P2]</p> <p>(+) it is a structural template for mapping existing value logic [P17]</p> <p>(+) reduces imitability, create sustainable advantage [P24]</p> <p>(+) creates novel approach for using services in value creation [P41]</p> <p>(+) it is explicative and predictive power to value creation [P45]</p> <p>(+) helps calculate technology value to investors, customers, partners [P45]</p> <p>(-) complex coordination for ecosystem collaboration [P2]</p> <p>(-) negatively influences optimal value co-creation in aligned processes [P5]</p> <p>(-) new value (co-)creation focus on relationship-centric aspects [P7]</p> <p>(-) difficulty in identifying market opportunities due to changing customer needs [P9]</p> <p>(-) difficulty to effectively communicate (articulate, visualize) emerging value proposition [P24]</p> <p>(-) hard to analyse business process vs. value activities [P35]</p> <p>(-) many frameworks has many deficits concerning consistency and value activities [P35]</p> <p>(-) lacks a quantitative way to convey value and no sales model for perceived value [P48]</p> <p>(-) difficult to visualize value for integrated offers [P48]</p> <p>(-) BM has a dual nature conceptualizing value and organizing for that value (in different life cycles) [P51]</p>

Common areas	Strategy & Planning (Define)	Daily operations (Execute)	Governance & communication
<p>Cost, revenue, profit</p>	<p>Estimate cost/revenue potential [P7] (+) depicts actual structures for a company to profit from business [P9] (+) experiment with cost before investing [P18] (-) “black-hole” investment [P18] (-) incorporate requirements for lean consumption and achieve the objectives of service profit chain [P5] (-) develop technology innovations in an adaptive process (trial-and-error) with cost as main cause for readjustments [P51]</p>	<p>(-) adaptation to environment by trial-and-error [P51] (-) amount of human resources needed for modeling [P56] (-) new revenue streams driven primarily by customer perceived value instead of internal cost [P24]</p>	<p>Incentives to engage in and control operations [P20] (-) maintain accurate definition of ownership conditions in a collaborative business model, and revenue model considering risk distribution [P54] (-) maintain a new value chain reward system [P24]</p>

Common areas	Strategy & Planning (Define)	Daily operations (Execute)	Governance & communication
Mind-set, Knowledge	<p>Experimenting [P2], [P22], [P49]</p> <p>Shift company's boundaries [29]</p> <p>Exploit business opportunity [P22], [P29]</p> <p>Foster Innovation [P32]</p> <p>Increase knowledge [P29]</p> <p>(+) focus beyond company-centric focus [P17]</p> <p>(+) shifts focus from WHAT resources to HOW to use them [P18]</p> <p>(+) BMI enables strategic renewal [P36]</p> <p>(-) turns shared meaning into identity lock-ins [P17]</p> <p>(-) resistance to change [P17]</p> <p>(-) plan for "experimentation and learning" in established companies [P18]</p> <p>(-) systematic servitization (product to service shift) [P24]</p> <p>(-) hard to define business requirements (lack of information and specific details) [P56]</p>	<p>Enhance creativity, unlock barriers of innovation [P2]</p> <p>Build trust [P2]</p> <p>Increase readiness via portfolios and simulation [P9], [P32]</p> <p>Build knowledge [P22]</p> <p>(+) uses of mixed techniques between Business and IT improved communication and IT development [P56]</p> <p>(-) how to achieve organizational and customer learning's incorporated into iterative design [P5]</p>	<p>Mediating, facilitating and sharing strategic discourse [P17], [P36]</p> <p>Address lack of knowledge [P45], [P22]</p> <p>(+) unlocks barriers of innovation + building trust [P2]</p> <p>(+) breaks cognitive structures and act as communicative, mediating device for shared meaning and commitments [P17], [P32]</p> <p>(+) improves understanding, language and legitimacy [P17], [P32]</p> <p>(+) formalization forces implicit understanding becoming explicit (move strategy into execution) [P17]</p> <p>(-) lack of formality and analyst dependency with high skills [P56]</p> <p>(+) promotes outside in view on customer value [P18]</p> <p>(+) provides early warning for threatened BM via analysing dynamism of competitive advantage [P18]</p> <p>(+) highlights consistency strategy and BM building blocks [P24]</p> <p>(+) provides new insights (externalize, map and store knowledge) [P32]</p> <p>(+) fosters systematic BMI [P32]</p> <p>(+) unambiguously defines dimensions, properties and semantics [P33]</p> <p>(+) visualization improves understanding [P32], [P56]</p> <p>(+) helps define goals [P32]</p> <p>(+) educates decision-makers for informed decisions, goals and requirement engineering [P32]</p>

Common areas	Strategy & Planning (Define)	Daily operations (Execute)	Governance & communication
Means	<p>Innovation and technology management [P29] Plan and design business logic [P32] Understand complex inter-play [P31] Adopt servitization to further enhance global competitiveness [P54] (+) Prepares implementation (identifying joint activities with priority and validating the business model) [P2] (+) Helps to build better strategies (e-business) [P32] (-) Business model design requires better integration with strategy analysis [P37] (-) Difficult to be systematic (too slow, too detailed, iterative) [P17] (-) limited empirical validation [P17] (-) provides good insights but lacks support where to start investing to reach future business [P18] (-) capture customer's reaction to new technology [P5] (-) hard to effectively balancing (conflicting) requirements (user and design) and strategic interests (of partners) [P39] (-) tools conceptual, complicated and too time consuming (for network centric BM) [P53] (-) paradigm shift business activities and consumption patterns must be aligned with environmental and social objectives [P53]</p>	<p>Change and implement business logic (and business process execution) [P17], [P32] Realize strategic tasks [P9] Support resource fluidity [P15] Commercialize ideas & technology [P29] (+) better requirement engineering [P32] (+) facilitates and improves choices in IS/IT [P32] (-) difficult to mobilize and align available resources (not only internal but also extending external base) in time [P9], [P15], [P24] (-) integration, agility and change [P10] (-) barriers to change business model are real processes and tools are not good enough [P13] (-) a structured service development process connected to the business model [P24]</p>	<p>Alignment of strategy, business organization and technology [P32] Manage flexibility and increase change capability [P58] (+) improves measuring, observing and comparing business logic [P32] (+) improves design of sustainable business models [P32] (+) improves alignment of strategy, organization and technology and integration business IS/IT domains [P32] (+) BM may enable strategy execution and how operational choices affect company's performance [P37] (+) helps to react to environment change due to strategic flexibility and dynamic capabilities [P52] (-) hard to reach and maintain alignment of business model and information system model [P59] (-) value co-creation is a hard cooperative process (speed, coordination, compromise) [P8] (-) how to industrialize large-scale service offerings [P24] (-) how to avoid isolated change (relationships, value, dynamic portfolio) [P24] (-) hard to visualize, document and share basic elements due to relationships and speed of change [P26], [P32] (-) hard to achieve consistency between BM and BPM and achieve real improvements with BPM [P35] (-) lack of appropriate methods and tooling for BM integrated with BPM [P35] (-) BM design requires better integration with strategy analysis models [P37] (-) discovery of goals and rules no common process for elicitation [P56]</p>
Ends	<p>Describe position of company in value network [P7], [P13], [P29] Formulate competitive strategy with goals and objectives [P19] [P37] Act as receipt for the business [P22]</p>	<p>Operationalize strategy [P36], [P37]</p>	<p>Alignment of strategy, business organization and technology [P32] Act as a scale model and role model for characterization of similarities and definition of difference [P22]. (+) facilitates and improves choices in IS role and structure [P32]</p>

Common areas	Strategy & Planning (Define)	Daily operations (Execute)	Governance & communication
Assessment	<p>Deal with uncertainty [P2] [P52][P54]</p> <p>Holistic picture of future state [P2][P32]</p> <p>Explain strategic issues (value creation, competitive advantage, company performance etc.) [P36],[P29]</p> <p>Support Leadership unity [P15]</p> <p>Explore and design promising business concepts/ideas [P32], [P36], [P41]</p> <p>Strategy and business model innovation [P17] [P36], [P52], [P53]</p> <p>(+) facilitates strategic discussion with shared insights to barriers/drivers (visual + levels of details) [P2]</p> <p>(+) facilitates interaction to create strategic options and share mediate strategic discourse [P17]</p> <p>(+) help to better understand the business and its important parts [P24]</p> <p>(+) helps to improve planning, change and implementation (with knowledge and facilitate choice of indicators) [P32]</p> <p>(-) difficult managing dynamics (agility, adaptability, planning, decision) for alignment to environment and other organizations [P2], [P5], [P7], [P9], [P36]</p> <p>(-) different methods or patterns not aligned, no guidance how to obtain final design [P49]</p> <p>(-) neglects the relevance for environment - focus on model-internal consistency [P49]</p>	<p>Alignment of control and value parameters [P6]</p> <p>Mapping of business roles or interactions onto technical modules, interfaces, etc. [P6]</p> <p>Analyse functioning of an organization [P32]</p> <p>Describe use of information technology [P32]</p> <p>Improve the Business-IS/IT dialogue [P32],[P56]</p> <p>(+) managing a business model portfolio can lead to flexibility in re-organizing resources [P9]</p> <p>(+) low-risk experiments via simulation [P32]</p> <p>(-) balancing act between customer, revenue, cost, functionality (e.g. local adaptation vs. sw platform) [P1]</p> <p>(-) mutual alignment between steps/organizations/customers when performed iteratively and holistically [P5]</p> <p>(-) how to match consequences of environmental changes onto company with best fit [P9]</p> <p>(-) a continuously learning business model experimentation [P13]</p> <p>(-) business model change (hard decision, risky organizational adjustments, and collective commitment) [P15]</p> <p>(-) efficient management of information (explore vs. create collective understanding) is difficult [P45]</p>	<p>Force decisions [P2]</p> <p>Analyse Business model fit [P49]</p> <p>Bridge static view for change and performance over time [P14]</p> <p>Computerize DDS for better design, critique and simulation of new BMs [P32]</p> <p>Understand how technology is converted into market outcome [P29] [P31]</p> <p>Provide contextual information [P35]</p> <p>Identification of critical success factors and investigate performance [P41]</p> <p>Proof, persuasion, comparison and benchmarking [P45], [P55]</p> <p>(+) creates common language, shared priority and forces decisions [P2]</p> <p>(+) improves dealing with uncertainty (reduction by sharing, turn into advantage, enhance understanding of barriers) [P2]</p> <p>(-) difficult to deal with uncertainty, complexity and dynamism [P54]</p> <p>(+) facilitates brainstorming (today and future) and integrative (no theory bias) [P17]</p> <p>(+) helps reducing complexity (visual) [P32]</p> <p>(+) improves mutual understanding Business and IT domains [P32]</p> <p>(+) facilitates identification of key indicators to follow execution of plan [P32]</p> <p>(-) difficulty in reliable monitoring of key indicators [P54]</p> <p>(+) BM as "scale model" demonstrates feasibility and worth to partners [P45]</p> <p>(-) achieve joint strategy when decisions create cross-functional/divisional conflicts [P5]</p> <p>(-) align social, organization, and technology (due to richness and change of knowledge economy) [P7]</p> <p>(-) difficult to choose from massive results regarding BM design experimentation [P18]</p> <p>(-) hard to identify threats to BM in time [P18]</p> <p>(-) managed different abstraction levels and get the details right in execution [P19], [P21]</p> <p>(-) requires decision-making on multiple parameters of activity systems [P21]</p> <p>(-) BM has a dual nature (instance vs. classification) [P22]</p> <p>(-) hard to overcome resistance to and awareness of need to change [P52]</p> <p>(-) over-estimate/false impression of your ability to change, [P52]</p>

Common areas	Strategy & Planning (Define)	Daily operations (Execute)	Governance & communication
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Table 4: Quotes on purpose, benefits and challenges for BM.

References

- [1] M. M. Al-Debei and G. Fitzgerald. The Design and Engineering of Mobile Data Services: Developing an Ontology Based on Business Model Thinking. In *IFIP Advances in Information and Communication Technology*, volume 318, pages 28–51, 2010.
- [2] R. Amit and C. Zott. Value creation in e-business. *Strategic Management Journal*, 22(6-7):493–520, 2001.
- [3] P. Andries and K. Debackere. Adaptation and Performance in New Businesses: Understanding the Moderating Effects of Independence and Industry. *Small Business Economics*, 29(1-2):81–99, 2007.
- [4] C. Baden-Fuller and S. Haefliger. Business Models and Technological Innovation. *Long Range Planning*, 46(6):419–426, 2013.
- [5] C. Baden-Fuller and M. S. Morgan. Business Models as Models. *Long Range Planning*, 43(2-3):156–171, 2010.
- [6] P. Ballon. Business modelling revisited: the configuration of control and value. *Info*, 9(5):6–19, 2007.
- [7] J. Björkdahl. Technology cross-fertilization and the business model: The case of integrating ICTs in mechanical engineering products. *Research Policy*, 38(9):1468–1477, 2009.
- [8] H. Bouwman and I. MacInnes. Dynamic business model framework for value webs. In *Proceedings of the 39th Annual Hawaii International Conference on System Sciences (HICSS '06)*, 2006.
- [9] J. Buder and C. Felden. Evaluating business models: Evidence on user understanding and impact to BPM correspondence. *Proceedings of the Annual Hawaii International Conference on System Sciences*, pages 4336–4345, 2012.
- [10] R. Casadesus-Masanell and G. Llanes. Mixed Source. *Management Science*, 57(7):1212–1230, 2011.
- [11] R. Casadesus-Masanell and J. E. Ricart. From Strategy to Business Models and onto Tactics. *Long Range Planning*, 43(2-3):195–215, 2010.
- [12] H. Chesbrough. Business Model Innovation: Opportunities and Barriers. *Long Range Planning*, 43(2-3):354–363, 2010.
- [13] E. K. Chew. Linking a Service Innovation-Based Framework to Business Model Design. In *2014 IEEE 16th Conference on Business Informatics*, volume 1, pages 191–198. IEEE, 2014.
- [14] M. N. Cortimiglia, A. Ghezzi, and A. G. Frank. Business model innovation and strategy making nexus: evidence from a cross-industry mixed-methods study. *R&D Management*, 46(3):414–432, 2016.
- [15] B. Demil and X. Lecocq. Business Model Evolution: In Search of Dynamic Consistency. *Long Range Planning*, 43(2-3):227–246, 2010.
- [16] V. Dmitriev, G. Simmons, Y. Truong, M. Palmer, and D. Schneckenberg. An exploration of business model development in the commercialization of technology innovations. *R&D Management*, 44(3):306–321, 2014.
- [17] L. Doganova and M. Eyquem-Renault. What do business models do? Innovation devices in technology entrepreneurship. *Research Policy*, 38(10):1559–1570, 2009.
- [18] Y. L. Doz and M. Kosonen. Embedding strategic agility: A leadership agenda for accelerating business model renewal. *Long Range Planning*, 43(2-3):370–382, 2010.
- [19] M. Dubosson-Torbay, A. Osterwalder, Y. Pigneur, M. D.-t. Alexander, and O. Yves. E-business model design, classification, and measurements. *Thunderbird International Business Review*, 44(1):5–23, 2002.

- [20] M. Eurich, T. Weiblen, and P. Breitenmoser. A six-step approach to business model innovation. *International Journal of Entrepreneurship and Innovation Management*, 18(4):330–348, 2014.
- [21] J. Gao, Y. Yao, V. C. Y. Zhu, L. Sun, and L. Lin. Service-oriented manufacturing: a new product pattern and manufacturing paradigm. *Journal of Intelligent Manufacturing*, 22(3):435–446, 2009.
- [22] A. Ghezzi. Emerging business models and strategies for mobile platform providers: a reference framework. *Info*, 14(5):36–56, 2012.
- [23] A. Ghezzi. Revisiting business strategy under discontinuity. *Management Decision*, 51(7):1326–1358, 2013.
- [24] A. Giessmann, A. Fritz, S. Caton, and C. Legner. A Method For Simulating Cloud Business Models: A Case Study On Platform As A Service. *ECIS 2013 Completed Research. Paper 42.*, pages 1–12, 2013.
- [25] A. Goel, H. Schmidt, and D. Gilbert. Towards formalizing Virtual Enterprise Architecture. *13th IEEE International Enterprise Distributed Object Computing Conference Workshops (EDOCW)*, pages 238–242, 2009.
- [26] T. Haaker, H. Bouwman, and E. Faber. Customer and Network Value of Mobile Services: Balancing Requirements and Strategic Interests. In *ICIS 2004 Proceedings. Paper 1*, 2004.
- [27] F. Hacklin and M. Wallnöfer. The business model in the practice of strategic decision making: insights from a case study. *Management Decision*, 50(2):166–188, 2012.
- [28] R. Hackney, J. Burn, and A. Salazar. Strategies for value creation in electronic markets: towards a framework for managing evolutionary change. *The Journal of Strategic Information Systems*, 13(2):91–103, 2004.
- [29] N. F. Höflinger. The business model concept and its antecedents and consequences - towards a common understanding. *Academy of Management Proceedings: Organization Development & Change*, 2014:1, 2014.
- [30] M. Ivarsson and T. Gorschek. A method for evaluating rigor and industrial relevance of technology evaluations. *Empirical Software Engineering*, 16:365–395, 2011.
- [31] Y. Kim, Y. Lee, G. Kong, H. Yun, and S. Chang. A new framework for designing business models in digital ecosystem. In *2008 2nd IEEE International Conference on Digital Ecosystems and Technologies, IEEE-DEST 2008*, pages 281–287, 2008.
- [32] D. Kindström. Towards a service-based business model - Key aspects for future competitive advantage. *European Management Journal*, 28(6):479–490, 2010.
- [33] J. Krumeich, D. Werth, T. Burkhart, and P. Loos. Towards a component-based description of business models: A state-of-the-art analysis. In *18th Americas Conference on Information Systems 2012, AMCIS 2012*, volume 1, pages 266–277, 2012.
- [34] J. Lindström. A Model for Value-Based Selling: Enabling Corporations to Transition from Products and Services Towards Further Complex Business Models. *Journal of Multi Business Model Innovation and Technology*, 1:67–98, 2014.
- [35] L. Loss and S. Crave. Agile Business Models: an approach to support collaborative networks. *Production Planning & Control*, 22(February 2015):571–580, 2011.
- [36] K. Mason and S. Mouzas. Flexible business models. *European Journal of Marketing*, 46(10):1340–1367, 2012.
- [37] K. J. K. Mason and S. Leek. Learning to Build a Supply Network: An Exploration of Dynamic Business Models. *Journal of Management Studies*, 45(4):774–799, 2008.
- [38] R. G. McGrath. Business Models: A Discovery Driven Approach. *Long Range Planning*, 43(2-3):247–261, apr 2010.
- [39] H. Meier and M. Bofklau. Design and Engineering of Dynamic Business Models for Industrial Product-Service Systems. In *CIRP IPS2 Conference*, 2012.

- [40] H. Meier and W. Massberg. Life Cycle-based Service Design for Innovative Business Models. *CIRP Annals - Manufacturing Technology*, 53(1):393–396, 2004.
- [41] Y.-c. Ning, H. Fu, and W.-f. Zheng. Business model dynamics: A case study of Apple Inc. In *2011 IEEE 18th International Conference on Industrial Engineering and Engineering Management*, volume Part 1, pages 77–80, 2011.
- [42] A. Osterwalder, Y. Pigneur, and C. L. C. C. L. Tucci. Clarifying business models: Origins, present, and future of the Concept. *Communications of the Association for Information Systems*, 15(1):1–25, 2005.
- [43] W. Reim, V. Parida, and D. Örtqvist. Strategy, business models or tactics -what is product-service systems (PSS) literature talking about? In *Proceedings of the International Conference on Engineering Design, ICED*, volume 4 DS75-04, pages 309–318, 2013.
- [44] J. Richardson. The business model: an integrative framework for strategy execution. *Strategic Change*, 17(5-6):133–144, 2008.
- [45] A. Richter, T. Sadek, and M. Steven. Flexibility in industrial product-service systems and use-oriented business models. *CIRP Journal of Manufacturing Science and Technology*, 3(2):128–134, 2010.
- [46] R. Rohrbeck, L. Konnertz, and S. Knab. Collaborative business modelling for systemic and sustainability innovations. *International Journal of Technology Management*, 63(1/2):4, 2013.
- [47] D. Romero and A. Molina. Collaborative networked organisations and customer communities: value co-creation and co-innovation in the networking era. *Production Planning & Control: The Management of Operations*, 22(5-6):447–472, 2011.
- [48] C. E. Salgado, R. J. Machado, and R. S. Maciel. An OMG-based meta-framework for alignment of IS/IT Architecture with Business Models. In *2014 9th International Conference on the Quality of Information and Communications Technology*, 2014.
- [49] C. E. Salgado, J. Teixeira, R. J. Machado, and R. S. P. Maciel. Generating a Business Model Canvas through Elicitation of Business Goals and Rules from Process-level Use Cases. In *Proceedings of the 13th International Conference on Business Informatics Research*, pages 1–15, 2014.
- [50] S. Schneider and P. A. T. Spieth. Business model innovation and strategic flexibility: insights from an experimental research design. *International Journal of Innovation Management*, 18(6):1–22, 2014.
- [51] G. Schuh, W. Boos, and S. Kozielski. Life cycle cost-orientated service models for tool and die companies. In *Proceedings of the 1st CIRP Industrial Product-Service Systems (IPS2) Conference*, pages 249–254, 2009.
- [52] S. W. Short, P. Rana, N. M. P. Bocken, and S. Evans. Embedding sustainability in business modelling through multi-stakeholder value innovation. *IFIP Advances in Information and Communication Technology*, 397(PART 1):175–183, 2013.
- [53] K. Storbacka and S. Nenonen. Scripting markets: From value propositions to market propositions. *Industrial Marketing Management*, 40(2):255–266, 2011.
- [54] C. J. Woodard, N. Ramasubbu, F. T. Tschang, and V. Sambamurthy. Design capital and design moves: The logic of digital business strategy. *MIS Quarterly: Management Information Systems*, 37(2):537–564, 2013.
- [55] A. Zolnowski and T. Böhmman. Business modeling for services: Current state and research perspectives. In *AMCIS 2011 Proceedings - All Submissions. Paper 394.*, pages 1–8, 2011.
- [56] C. Zott and R. Amit. Business Model Design: An activity system perspective. *Long Range Planning*, 43(2-3):216–226, 2010.
- [57] C. Zott, R. Amit, and L. Massa. The Business Model: Recent Developments and Future Research. *Journal of Management*, 37(4):1019–1042, 2011.