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OM Forum

Business Model Innovation for Sustainability

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A systematic approach to innovating business models can help identify new business models that encourage sustainable use of products and services, or facilitate wider adoption of new environmentally friendly technologies. This paper provides a brief summary of a conceptual framework that we have developed to systematize the study and identification of new business models. Our approach advocates that the key to identifying new business models is understanding the context of decision making in existing models and the associated inefficiencies. We propose a three-step approach: First, existing business models must be audited for identifying information and incentive misalignment inefficiencies that destroy value. Next, new business models can be identified by changing the context of the decision associated with the most consequential of these inefficiencies. We conjecture that four elements of the decision context are most significant: WHAT decisions are made, WHEN they are made, WHO makes them, and WHY they are made. We provide a set of idea triggers to stimulate brainstorming of new business models by changing one of these four Ws. Finally, we advise that generated business models should be analyzed and experimented with to identify the most promising ones. We close the paper by describing the design of a pedagogical program based on this framework.

Key words: business models; sustainability; innovation; entrepreneurship; business model innovation; risk

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1. Introduction

Plambeck (2013) describes five “cleantech” firms (ZETA, First Solar, Better Place, Amyris, and Calera) and calls for guidelines on how the operations management community can stimulate invention of new business models that promote environmental sustainability. The need to systematize the study of business model innovation is central to the creation of sustainable businesses. A new business model can often make the ownership and use of existing products/technology more environmentally and socially favorable. For instance, business models that align incentives of users with the environmental impact of their use can make existing products and technologies more sustainable. Further, just as with earlier disruptive technological advances like the Internet, the advancement of sustainable technology has often exceeded the development of business models needed to capture value from it (Teece 2010). Specifically, the innovative technology offerings of some cleantech firms often come with economic characteristics (scale-cost functions, risk profiles, cash flow profiles, etc.) that are drastically different from the traditional technologies that they substitute. Thus, these firms must pair their innovative technology offerings

with business models that facilitate commercialization, adoption, and scaling of these innovative technologies. This paper provides a brief summary of a conceptual framework that we have developed to study and cultivate new business models, as applied to understanding and developing business models for sustainable firms. The ideas presented in this paper are elaborated in our forthcoming book (Girotra and Netessine 2014); the interested reader can find details of the illustrative examples in the associated references.

2. Innovating Business Models

What is a business model? There is no general agreement on the answer to this seemingly simple question; Teece (2010, p. 174) states directly that “...the concept of a business model has no established theoretical grounding in economics or in business studies.” Academics have tried to further break down business models of firms into pieces such as the profit formula, processes, the value proposition, and resources (Johnson et al. 2008); activities (Amit and Zott 2012); and the business model canvas, which proposes a nine-part analysis covering organizational activities, partners, value proposition,

channels, resources, etc. (Osterwalder and Pigneur 2010). Each of these definitions is intimately related to the way the organization produces and delivers value to customers, a central focus of the operations management community. In fact, one way to define a business model would be the operating model of a company or as the product/service delivery system. Despite the centrality of operations to the design and analysis of business models, the topic of business model innovation is largely absent from discourse in the operations management community, with perhaps the exception of the work on operational innovation by Hammer (2004), which describes the role of process reengineering in achieving breakthrough cost-reduction or process-efficiency improvements. Missing from these perspectives on business models is the role of decisions, risks, uncertainty, and incentives—all central topics in recent operations management research—in driving (or holding back) business model performance.

Consider three celebrated examples of business model innovation: Dell's production-to-order system, Zara's supply chain for fast fashion, and the Toyota production system. In each of these examples, the firms disrupted the traditional way of doing business not through introduction of new technology, creation of new products, or finding new market niches, but by identifying novel ways of delivering existing products based on existing technology to existing markets (Girotra and Netessine 2011). These examples did not involve any new technology; however, there are other business model innovations that are enabled by technological advances, such as Amazon's efficient retailing model, which was enabled by advances in information technology.

A key difference between business model innovation and, say, technological or product innovation is that, unlike the latter, which usually relies on market or technical knowledge specific to the industry, business model innovation is deeply rooted in the laws of economics and operations management that are universally applicable to a wide variety of industries. This feature allows for the systematization of the process of identifying, selecting, and refining such innovations and provides a promising opportunity for operations management scholars to contribute to the study of business model innovation, a topic that is increasingly on the mind of leaders in industry and government.

The need to advance the study of business model innovation is particularly evident when it comes to sustainability. Often the lasting impact of many common human and business activities can be reduced by employing innovative business models that facilitate a more sustainable use of traditional technologies. For instance, IBM Global Financing Division's

new business model that combines lease financing and asset recovery programs provides customers with new equipment and ensures high resale value, creating complementarities that change the usage costs for consumers, enabling more sustainable use of existing products. Similarly, switching station-based electric vehicle models, as pioneered by the now-bankrupt start-up Better Place (Girotra et al. 2011) and advanced by Tesla Motors, can increase adoption of existing electric vehicle technology. Essentially, these models separate the ownership of the electric battery and the electric vehicle: the provider firm owns batteries and maintains a network of switching stations, which allows for fast replacement of a discharged battery with a fully charged one, while customers only pay for the miles driven. The business model innovation at ZETA (Plambeck 2013) is in building an integrated organization that designs and manufactures customized, green, and inexpensive buildings in a factory that employs people with expertise in manufacturing, architecture, green material procurement, and all the functional specialties of the construction industry. This unique organizational structure enables the design and manufacture of entire buildings based on sustainable green technology in a responsive build-to-order fashion.

These examples represent business model innovation in its purest form: these firms did not invent novel technologies, but instead they developed new product/service delivery systems that enabled higher adoption and/or better use of existing technologies. Interestingly, ZETA's build-to-order model is similar to Dell's model; the approach of Better Place of converting sales of products (electrical cars) into sales of services (miles driven) is a known solution to many other environmental problems (Mont 2002); and IBM's joint program exploits widely understood economies of scope. These similarities highlight that, to create new business models that promote sustainability, we can often repurpose innovations from other industries. What is often missing is a unifying approach that allows one to see this commonality and enable this translation process.

The need for developing new business models extends beyond facilitating more sustainable use and adoption of existing technologies. Organizations that develop innovative new sustainable technologies must often identify new business models to facilitate the commercialization and consumer acceptance of their newly developed technology. For instance, Amyris, First Solar, and Calera (Plambeck 2013) all pioneered innovative new technologies, but only when these organizations paired the new technologies with appropriate business models were they able to achieve commercial viability. Amyris's traditional business model of dealing with suppliers through

take-or-pay contracts failed, which led to significant write-offs; the organization faces bankruptcy unless it develops a business model that allows it to address these issues and dramatically increases productivity in its Brazilian facility. On the other hand, First Solar pairs its innovative lower-cost photovoltaic panels with a new business model. Rather than following the traditional approach of selling these panels, First Solar offers integrated design, construction, operation, and maintenance of solar installations. This new business model eliminates key roadblocks to adoption and stimulates demand for the panels. This has helped First Solar survive where numerous other competitors have failed. Finally, although Calera has the technological solution to produce sustainable cement, it faces many business model issues around sourcing of inputs from suppliers and gaining buyer adoption of its product.

3. Searching for New Business Models

How can we, operations management researchers, better understand business model innovations and, more importantly, proactively help design them? Examples of business model innovations are often hiding in plain sight in operations management textbooks and course materials (cf. Dell, Zara, Timbuk2, Toyota, Barilla, and Amazon.com), but they are rarely recognized as disruptive innovations based on operations thinking that transformed industries. In the absence of a unifying framework that identifies and categorizes the common patterns among these innovations and ties them with operations and economics principles, they often appear to be idiosyncratic operational improvements. We next outline a unifying framework for business model innovation; we use this framework to propose a design-thinking inspired, systematic approach to generating new business model innovation opportunities, selecting among them and refining them through quick prototyping.

Our approach is inspired by the search view of product innovation that conceptualizes innovation as a search among different combinations of design attributes (color, size, material, etc.) to find a combination that provides the highest level of performance (ergonomics, reliability, etc.). We identify widely applicable performance metrics and design attributes for business models that facilitate thinking of business model innovation as search among different business models to identify models with the highest performance.

4. Performance Metrics for Sustainable Business Models

The sustainability of a system can be measured as its lasting impact on the social, cultural, and natural

environment. For-profit, sustainable business models allow organizations to earn profits in the face of uncertainty and rational utility-maximizing behavior by actors in the model, while having minimal long-lasting impact. In an entrepreneurial context, the odds of business survival and the rate of growth may be more pertinent rather than profit. Interestingly, in the most desirable of sustainable business models, in for-profit organizations, the lasting impact of the business model often contributes to the organization's profits, growth, and survival, instead of detracting from commercial concerns. In the case of nonprofit organizations, these may be the actual objectives of the organization.

We argue that, consistent with Teece (2010, p. 191), "a business model cannot be assessed in the abstract; its suitability can only be determined against a particular business environment and context." Thus, from the point of view of identifying new sustainable business models, we conjecture that it is often most useful to examine business models' performance with respect to two key contributors to the actual performance function (however it is defined—profits, growth, or sustainability), rather than the performance directly. The performance of most business models is held back by two types of inefficiencies (which can arise at different stages of the entire value chain):

- *Information inefficiencies:* Decisions in business models are often made without complete or correct information about their consequences, often long before the full information needed to make the decisions becomes available. In the sustainability context, development and adoption of sustainable technology often requires organizations to make risky investments with incomplete information on technology performance, scalability, and future technology advances while facing highly uncertain government incentives and regulations. For instance, although energy-efficient light bulbs are more cost-efficient in the long term, customer disbelief in manufacturer claims on energy performance, incomplete information on their lighting performance and on the potential availability of even better technology in the future, preclude their wide adoption, holding back both the provider's profits and wider adoption of sustainable lighting solutions.

- *Alignment inefficiencies:* Most decisions are made by individuals or organizations whose objectives are not in line with each other or whose objectives are not in line with objectives of the entire value chain. For instance, a provider selling commercial equipment and after-sales repair and maintenance services has limited incentives to design products that limit breakdowns. On the other hand, the user and the system as a whole are better off if incentives of the equipment maker are aligned with their incentives and

products designed to be more reliable. In the context of sustainability, there are often alignment inefficiencies as a result of multiple externalities imposed by sustainability-directed actions. For instance, product manufacturers may not want to participate in collection and recycling networks if their share of the cost of running such a network is not aligned with benefits they get from it (Gui et al. 2012). This limits the environmental benefits of the green initiative. These inefficiencies are studied in the field of information economics and, more recently, in operations management.

These two inefficiencies are directly related to the sustainability performance of business models. We have found that rather than focusing on the performance itself, focusing on these two contributory inefficiencies is often more useful to understand failings and sustainability pain points of existing models, to help identify more sustainable business models, and to allow for translating such identified innovations to different contexts.

For example, Dell dramatically reduced information inefficiency by producing computers only after demand information became available. Blockbuster aligned its incentives with incentives of studios through revenue sharing. Likewise, organizations that want to bring a sustainable solution to the market can reduce business model inefficiencies if they follow a simple observation that, like products, business models have certain attributes that can be altered to improve performance. More often than not, in sustainability examples, these inefficiencies arise as a result of interactions of multiple players in the value chain and their failure to recognize externalities that they impose on each other, and as a result of the lack of proper information to make environmentally friendly decisions.

5. Design Attributes in Business Models

To develop novel business models that have lower inefficiencies than traditional models, we must alter associated design attributes and search for new models. We find it convenient to decompose business models into key decisions made by organizations and to further decompose each decision into four key attributes: WHAT key decisions are made, WHEN they are made, WHO makes them, and WHY they are made. Together, the decisions and their four attributes (or 4Ws for short) are the key design parameters in a business model, akin to the size, material color, etc. in a physical product. Altering these design attributes can help arrive at superior business models as follows.

WHAT. Every key business model decision is predicated on choices the organization has made earlier. In other words, it has chosen to offer a set of products or services, and those choices drive WHAT substantive matters the business model must address. Changing the scope of activities of an organization or changing what decisions must be made can help arrive at innovative and more sustainable business models. For instance, an organization that changes its scope of activities or what it does to include managing the secondary market (Oraiopoulos et al. 2012), or to utilize byproducts of the main manufacturing process (see Lee 2012), may derive benefits out of the complementarities and diversification benefits from joint decision making that reduce risk, inefficiencies, and environmental impact, compared with a traditional business model with a more limited scope. In principle, these organizations increased the number of decisions to include diversifying or complementary decisions. Alternately, the organization may choose to do something different: rather than sell products, the organization may sell a service—the service of the use of the product (Guajardo et al. 2012).

WHEN. Every decision is made at a point in time relative to the availability of the best information needed to make it. Changing the timing or even the sequence of decisions in a business model can often lead to innovative business models. For instance, the use of contests to identify the most promising green technology (rather than invest into one or more technologies right away) can substantially reduce the risk associated with green investments. Notable examples include the Wendy Schmidt Oil Cleanup Challenge¹ and the Progressive Automotive X-Prize.² By reversing the sequence in which information is gathered on technology performance and investments are made in a favored technology, contests help reduce the often paralyzing information risks associated with green investments. The changes in sequence allow investments to be delayed till better information is available. As another example, Patagonia's Common Threads Initiative changed the time when the company takes responsibility for the product to "from birth to death and then beyond death, back to rebirth" (Reinhardt et al. 2010, p. 8). A full ownership of the product life cycle reduces the incentive conflicts inherent in a business model where different entities are responsible for the different parts of the life cycle. With a full horizon view of the product life cycle, products are designed, manufactured, and sold with their rebirth in mind. Resequencing, delaying, and splitting decisions are typical strategies to achieve such improvements.

¹ <http://www.iprizecleanoceans.org> (accessed July 18, 2013).

² <http://www.progressiveautoxprize.org> (accessed July 18, 2013).

Figure 1 Idea Triggers for Business Model Innovation

WHAT	WHEN	WHO	WHY
Select focused versus flexible business model	Delay decisions as much as possible	Transfer decisions to best-informed players	Change the profit/revenue streams to align incentives
Change the scope of decisions	Change the sequence of decisions	Transfer decision rights to the party for which consequences are the least	Replace short-term relationships with long-term relationships
Hedge/complement decisions with each other	Split decisions to obtain partial information before decision is completed	Move the consequences (costs) of the decision to the party that benefits the most	Integrate misaligned parts of the value chain

WHO. Every decision induced by a business model design is made by a particular person (or persons): an employee, a government regulator, a committee, or other organizational structure. Changing the decision maker can often lead to higher efficiencies. For instance, TerraPass (Ulrich 2008), a carbon offset retailer that was cofounded by one of the authors of this paper, changes the person who decides to reduce carbon emissions. Instead of individuals directly reducing their carbon emissions by investments in new technologies, TerraPass uses its superior information and scale to target investments to the most efficient of carbon reduction opportunities. Interestingly, this can bring the costs of remediating a typical family's carbon footprint by an order of magnitude or more, as compared with uninformed, disaggregated investments made by individuals. Agrawal et al. (2012) show that a business model that empowers a product supplier (e.g., a carpet manufacturer such as Interface Inc.; Oliva and Quinn 2003) to retain ownership of the product, and make maintenance and disposal decisions in addition to sales and installation decisions, can provide both superior product performance and environmental benefits. Energy-efficiency service companies take over installation of energy-efficient equipment and share the gains with the focal firm (Aflaki et al. 2013), as does Netafim, a provider of sustainable drip irrigation technology (Lee and Michlin 2006).

WHY. The design of a business model typically imposes certain goals and incentives on decision makers. Because decision makers are generally rational actors, these factors can powerfully influence the decisions they make. For instance, Recyclebank (<https://www.recyclebank.com/>) changes the incentives of consumers to recycle by giving them reward points that can be redeemed at participating recyclers while municipalities pay some money for diversion of products from landfills. Aflaki and Netessine (2012) demonstrate that, using long-term contracts fixing electricity prices (so-called feed-in tariffs), governments can increase investment into renewable energy sources. Long-term partnerships with suppliers, as pioneered by Toyota and further developed by

Li & Fung (Belavina and Girotra 2012), align the incentive horizon of suppliers and buyers, facilitating risky long-term investments (such as in electric-battery production in the late 1990s), and ensure better across-value-chain accountability and compliance with labor standards and environmental norms.

Thinking of business models as a collection of these design attributes structures the landscape of business model innovation opportunities and allows for an organized search of this landscape. It also offers a second advantage: this choice of design attributes frames the business model design as a classic decision-making problem to which we can apply insights from operations and economics to advise on the most promising directions for altering design attributes. In short, the four Ws of a business model should be altered such that *the newly proposed business model empowers the right decision makers with the best available information and value-creating incentives to make the right decisions with measurable consequences*. Using principles of operations and economics, this generic principle can be translated to 12 specific idea triggers to alter the four design attributes of every decision (Figure 1). These 12 approaches cover the sustainability examples described above and the vast majority of the hundreds of business model innovations we have documented over the years, spanning examples in supply chain management, service operations, healthcare, manufacturing, nonprofits, and even government services. Their scope includes innovations within established organizations (such as Netafim and Toyota) to start-up-driven innovations (such as TerraPass and Better Place) (see Girotra and Netessine 2014). Using these triggers, an innovator can start asking questions such as, “What would my business model look like if I take the current model of the industry/company and apply technique in cell X?”

However, one must remember that idea triggers are not generically applicable rules: A business model developed by applying the idea triggers is not guaranteed to be feasible or commercially or environmentally superior to existing business models. The opportunities generated from applying these triggers should be evaluated on a case-by-case basis for their

efficacy in reducing inefficiencies using both analytical and experimental approaches. Further, the goal of these triggers is not to provide an exclusive taxonomy of all innovations—an innovation may be classified in multiple ways, but for the purpose of systematizing idea generation, we have found these triggers to be a comprehensive and effective set of brainstorming stimuli.

Taken together, the process of business model innovation can be thought of as an optimization problem, where the reduction of inefficiencies is the objective function, the four Ws of the decisions implied by the model are the decision variables, and the utility-maximizing behavior of involved actors contributes to the constraints. While more detailed and precise relationships between the decision variables (4Ws) and the performance (inefficiencies) may be outlined in specific contexts, the principles outlined in Figure 1 provide generic idea triggers that relate the decision variables to the performance function.

6. A Pedagogical Approach for Business Model Innovation

The design-thinking-enabled view of business model innovation can be used to analyze novel business models around sustainability (e.g., see Avci et al. 2013 for a rigorous analysis of Better Place) as well as to catalogue new sustainable business models in case studies. But the most important benefit comes from proactively developing new business models. Teaching innovation is hard, and teaching innovation in sustainability is even harder. A vast majority of approaches that we have seen rely on the theoretical analysis of existing business models, e.g., using the business model canvas of Osterwalder and Pigneur (2010). We, in contrast, advocate a more hands-on, experiential learning approach that works not only in the specific context of sustainability but also in the generation of new business models for multiple contexts. We have experimented with this approach in numerous executive education programs as well and for an MBA/EMBA elective on identifying new business opportunities (for details, see <http://www.inboinsead.com>). At the heart of these engagements lies the process of generating new business models using the 12 idea triggers from Figure 1, selecting from these potential innovation opportunities and refining them through the use of cheap prototypes. Note that these idea triggers are specific to business model generation rather than product/technology-generation techniques typically used in entrepreneurship courses. When combined with discussion of recent trends (such as sustainopreneurship), it inevitably leads to numerous sustainability-inspired ideas. Together, we propose a

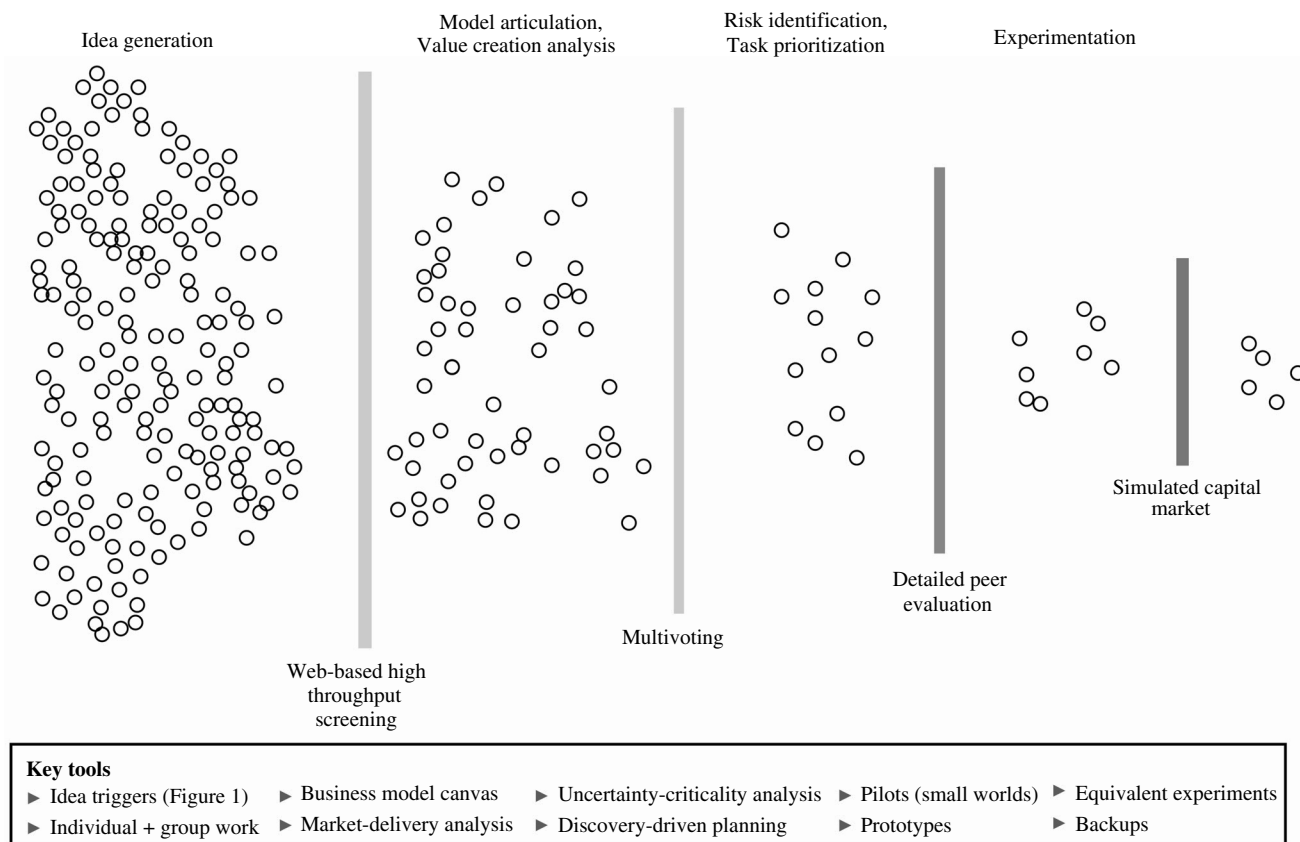
systematic, stage-gate process of generating, selecting, and refining potential innovation opportunities (Figure 2). This methodology has three key features.

First, the methodology advocates generation of a large number of potential business model innovation opportunities. Girotra et al. (2010) demonstrate that a key driver of idea quality is the number of opportunities from which the idea is selected. Generating ideas is, by its very nature, a serendipitous task, yet in our experience, the availability of a systematic idea triggers to generate opportunities, such as in Figure 1, greatly increases the ability of managers and students to generate many innovation opportunities. In effect, this framework transforms a creative task into an analytical task, a task that most practicing managers are far more adept at than open-ended venture idea-generation tasks. Idea generation works best when participants work individually to generate ideas followed by some group discussion of ideas, a hybrid brainstorming process (Girotra et al. 2010). Individual work leverages the parallel search of a large number of opportunities, whereas group work allows individuals to build on ideas developed by others.

Second, the approach prescribes that the generation stage be followed by a series of iterative elimination rounds (an innovation tournament, as described in Terwiesch and Ulrich 2009). Girotra et al. (2010) demonstrate that the use of independent, unbiased judgments outperforms the use of experts and group judgments in identifying new business opportunities. Ideas may be evaluated on their potential to decrease the inefficiencies identified in existing business models and by the sustainability of the practices they engender. Early rounds of elimination must favor a fast and efficient mechanism to screen a large number of ideas, whereas later rounds can focus on more precise and careful evaluation of a fewer surviving set of ideas. Moreover, unlike tournaments for new products, which emphasize the need that a new product satisfies, tournaments for new business models should focus on the analysis of inefficiencies that the business model reduces.

Third, although the framework in Figure 2 provides guidelines for generating and selecting between novel business models, as with all innovations, there is substantial venture risk on the extent and viability of the improved business model. Sequencing activities in the development of new ideas to reduce risks with minimum resource investment is the key to limiting venture risks. We advocate a two-step approach to this stage: First, the key contributors to risks of new venture success must be identified by using rigorous operations analysis to highlight the key determinants and drivers of the improved business model performance. Second, cheap “business model prototypes” must be designed and used to empirically validate the improvements in performance (see also

Figure 2 A Sample Design for a Systematic, Stage-Gate Process of Generating, Selecting, and Refining Potential Innovation Opportunities



Chesbrough 2010 for discussion of ex ante foresight versus ex post adaptation in business models). Just as product design theory advocates the use of rapid product prototypes that offer only minimal functionality that must be tested, cheap experiments can be used to test only the key determinants of business model success. These experiments can combine primary data collection, small-scale pilots, bare-bones business prototypes, and experiments. For instance, before launching full-scale revenue-sharing contracts, Blockbuster experimented with them in Pittsburgh area stores. TerraPass was initially launched and marketed in a very limited fashion to identify the most potent of product concepts. These two approaches require analysis and experimentation skills that are central to the practice and study of operations management. The use of these techniques leads to the refinement of business model opportunities in a fashion such that less attractive innovation opportunities can be eliminated quickly and cheaply, effectively using operations thinking to bring the “fail fast and fail cheap” maxim to business model innovation.

7. Conclusion

Identifying sustainable paths to growth is more central to policy makers and corporate agendas today

than at any other time in the past. This focus on sustainability almost always translates into the search for new products and technologies. In the absence of rigorous frameworks and a community of scholars, the search for new business models that complement or substitute these technology advances is often ignored. As a result, in many domains of environmental sustainability, we see that opportunities to make the ownership and use of products sustainable by pairing them with new business models are overlooked. Further, even when new technologies are developed, the lack of business models that make these technologies acceptable to the customer, viable, and scalable restricts their benefits. In this paper, we have provided a brief outline of a new conceptual framework that highlights how the operations management community can leverage its deep understanding of risks in business models to facilitate the search for new business models that enable the adoption of sustainable practices. We hope that the proposed framework will be embraced by the operations management community to understand, generate, and refine business model innovation opportunities. Our experiences with this approach in a variety of educational programs indicate that it often inspires many fascinating new sustainable business models, including such

examples as TerraPass (the outcome of the Innovation Tournaments class at the Wharton School), parkBnB (parking spot sharing), Utoypia (used toy sharing), a chain of biorestaurants in China, a chain of Zero Carbon hotels and resorts, an integrated service provider for energy-efficient electric windows, a gadget-sharing website, fractional ownership of vehicles for use in emerging markets (all examples are from classes at INSEAD), ecoreports based on credit card bills, MiClothes (ecolabels for clothing), a long-term information-sharing platform connecting donors with charities (examples from a class following this approach at Georgia Tech), and numerous others.

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