



The role of costs in business model design for early-stage technology startups

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ABSTRACT

Beginning in their early stages, technology start-ups (TSUs) develop several business models. Costs are often perceived as a constraint to business model innovation. Challenging this assumption, we question the role that costs play in business model design. We analyzed twelve TSU case studies from Switzerland, France, and the USA. The results indicate that TSUs develop three types of business models that are technology-driven, market-driven, and exit-driven. Costs act as enablers, moderators, and mediators. With a portfolio of business models, costs play a mediating role. Finally, the role costs play in the business model design phase changes firm value capture mechanisms, potentially enhancing the firm's value. This research makes the following contributions: (1) Technology-, market-, and exit-driven business model portfolios appear to be heterogeneous among TSUs. (2) Costs play enabler and mediator roles in addition to the traditional moderator role. We add to the literature by focusing on the new economy (rather than Porter's cost leadership strategies) through an optimistic and investment-driven approach.

1. Introduction

Technology startups (TSUs) have been a bulwark of business model innovation, the commercialization of innovation, employment creation, and economic growth. However, rather than technology, intellectual property (IP) or public policy, TSU survival and success is based on the mindset of TSU entrepreneurs, who translate technological concepts or ideas into narratives that researchers often refer to as business models (Furnari, 2015). As a cognitive device (Baden-Fuller and Morgan, 2010; Mikhalkina and Cabantous, 2015), business models have played a role in defining and positioning TSUs' plight as part of their evolving narrative to accelerate value creation and value capture by converting intellectual capital into economic value (i.e., monetization). In early-stage TSUs, variations of business models emerge. Some entrepreneurs manage dual (Markides and Charitou, 2004), parallel (Gruber, 2010), or portfolios of business models (Sabatier et al., 2010; Aversa et al., 2015; Snihur and Tarzijan, 2018) to balance risks with promises made, explore technology-related possibilities, and establish or improve their strategic legitimacy (Aldrich and Fiol, 1994; Shepherd and Zacharakis, 2003; Tornikoski and Newbert, 2007; Zimmerman and Zeitz, 2002). Having a portfolio of business models helps not only to alleviate risk, as in contingency planning, but also to identify new opportunities for expansion or scaling (Rong et al., 2018), along with increasing firm value. Although there has been extensive research on business model components, the issue of costs in business model design

has been overlooked in strategy research. Literature on business models addresses costs in general or superficial ways, such as in estimating new product or service cost structures (i.e., goods or services sold) and determining profitability (Chesbrough, 2010; Johnson et al., 2008; Zott and Amit, 2010).

Costs have been addressed by Anthony (1952, 1965), the founding principal of modern management accounting, as controllable input in industrial research organizations. With the dominance of US-based corporations and the drive for cost efficiency and profitability, the focus had been to cut costs, save, reduce, and optimize (Chesbrough, 2010). Porter (1980, 1985) introduced the concept of cost leadership as a strategic advantage. In this article, costs are defined as "a value we assign or the amount we (are willing to) pay to acquire, produce, or maintain an asset (whether intangible or tangible), or to purchase a product or service for a perceived return" (Chammassian, 2016). A cost is a value that may be either real (i.e., stated or paid for) or perceived (i.e., opportunity cost) to acquire an asset, product, or service. Purchased assets, for instance, are recorded in the balance sheet on a "cost basis." An expense is an "incurred cost" that must be captured on the income statement, commonly known as the profit and loss (P&L) statement.

There appears to be a misconception about costs vs. expenses and their application. In strategy, management of technology, and the accounting research, scholars refer to costs as more of an *expense* that is captured on income statements, such as cost of goods sold, transaction

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costs, or marketing costs (i.e., the Porterian *cost leadership* model). In management of technology (MoT) literature, reducing costs (such as transaction costs, cost of information technology, and manufacturing costs) have been viewed as a value extraction or an output of innovation (Kleis et al., 2012; Le and Suh, 2018). The business model literature alludes to cost assumptions as value propositions that must be low enough for the startup to survive, for customers to accept the value at *lower cost* to them, and for revenue to exceed expenses for improved margin and profitability (Ehrenhard et al., 2017; Le and Suh, 2018; Schuelke-Leech, 2018). From an accounting perspective, this categorization usually applies to income statements. The business model literature lacks strategic implications for how cost investments as an input to business models' value-creation process can affect desired outcome through value capture for various stakeholders, such as founders, investors, customers, and potential TSU acquirers. The importance of costs as an input to value creation is even more amplified with early-stage TSUs for which sometimes products and services do not exist or have not yet been identified by the firm. This means that the firm cannot capture these investments on a financial statement. Even so, the captured value may not correspond to intended value. Nonfinancial information, such as intangible assets or intellectual capital, is much higher with early-stage TSUs, although it decreases as TSUs mature (Brinckmann et al., 2010; Hand, 2005; Smith and Cordina, 2014).

The literature on costs has attempted to address costs' importance through strategic management accounting and strategic cost management with forward-looking financial statements (Bromwich, 1990; Shank, 1996; Shank and Govindarajan, 1993). However, these studies have been limited to mature industrialized companies and new product development, where, their perceived approach has had limited impact on results (Aluko et al., 2010; Taipaleenmäki, 2014). Therefore, the literature on costs does not address costs' strategic role in new company development with varying and alternative business models. The following research question then emerges: What role do costs play in business model design in early-stage TSUs?

To investigate this research question, we performed qualitative research consisting of multiple case studies of technology start-ups in Switzerland, France and the United States of America. We identified three main types of business models—technology-driven, market-driven, and exit-driven—and characterized the business model portfolio for each start-up. We then analyzed the role costs play in designing this business model portfolio.

As theoretical contributions, first we argue that costs play different roles depending on the type and configuration of business model (technology-driven, market-driven, or exit driven; single business model or a portfolio of business models): costs as enablers of technology-driven business models, moderators for market-driven business models, and mediators for exit-driven business models. In case of a business model portfolio, costs play the role of a mediator. The enabler and mediator roles represent a departure from Porter's notion of cost leadership (i.e., the moderator for margin and profitability) and creates a more investment-oriented value for firm value capture. The differentiating enabler, moderator, and mediator roles of costs have not been adequately studied in the literature. Second, from a costs perspective, we argue that costs can be recognized on the balance sheet as investments in intangible assets that are amortizable as long-term assets using the fair value principle, since the intent is eventual exit through trade sales.

In terms of managerial contributions, entrepreneurs, managers, and educators should also focus on costs as enablers and mediators in the value-creation process, with future-oriented returns on cost investments in mind as value capture. This research also suggests that a mediating role would enhance the firm's potential value and ultimately, the future value capture for high-technology start-ups.

This paper is organized as follows. Section 2 presents the theoretical foundations related to business models and costs and the inclusion of costs in both the business model literature and strategic perspectives on

costs from the management accounting literature. Section 3 details the research design and methodology. Section 4 presents the results of our contribution to research on business models, which lies in its identification of the different cost roles in business model design, and our contribution to the costs literature.

2. Theoretical foundations

2.1. Business models

Business models have been the core narrative in defining and positioning TSUs in their effort to accelerate the value-creation process (Amit and Zott, 2012; Doganova and Eyquem-Renault, 2009; Magretta, 2002; Teece, 2010, 2018). The process of developing business model narratives evolves in the business model design phase, as do the differing variations of emerging business models (Chesbrough, 2010; Doganova and Eyquem-Renault, 2009; Snihur et al., 2018; Zott and Amit, 2010). A business model as a model and cognitive device focuses on firm value creation and value capture processes (Baden-Fuller and Morgan, 2010; Teece, 2010). It addresses fundamental questions such as the following: "Who is the customer?", "What value is created for that customer in his or her interaction with the firm?", and "How is this value monetized?" (Baden-Fuller and Haefliger, 2013; Baden-Fuller and Mangematin, 2013; Baden-Fuller and Morgan, 2010; Matzler et al., 2013). These questions could lead to opportunities in which a single business model may not be enough (Bojovic et al., 2018), and several business models may emerge to simultaneously address various strategies or market opportunities or to be used as a contingency (Gruber, 2010; Markides and Charitou, 2004; Snihur and Tarzijan, 2018).

Within early-stage TSUs, business models play an important role in determining the rationale of TSU entrepreneurs' thought processes in the positioning and the directional approach the TSU is taking. This is usually the pre-revenue, experimental, market engagement, or new company development stage, in which TSUs are engaged in business model experimentation (Wrigley et al., 2016). This is also a period in which the TSU entrepreneurs' narrative must be convincing enough to attract investors to finance their projects (i.e., seed capital). This convincing process usually involves both firm value creation through technologies and innovation capabilities and the firm's value capture through exit as a preferred method over growing independently (Signori and Vismara, 2017) to create wealth from returns on investment. After all, exits are one of the most important and essential parts of the entrepreneurial process (DeTienne, 2010). When it comes to venture capital (VC) investments, exits are the most important criteria to reap returns on investments (Mahto et al., 2018). However, firms make investments in costs with the majority developing intellectual capital, such as human capital, organizational capital, and relational capital (Beattie and Smith, 2013; Hormiga et al., 2011).

2.1.1. Business models and costs

Within the business model literature, the reference to costs is embedded, albeit limited to economic logic and within a value chain context (Chesbrough and Rosenbloom, 2002; Magretta, 2002). There appears to be a general assumption that manufacturing and transaction costs must be low enough or cost savings adequate enough for customers' acceptance (Ehrenhard et al., 2017; Howell et al., 2018; Le and Suh, 2018; Schuelke-Leech, 2018) to make a sufficient margin to be profitable (Amit and Zott, 2012; DaSilva and Trkman, 2014; Zott and Amit, 2010). Firms review costs within the production process and sell a product or service to achieve improved margins and profitability (Johnson et al., 2008). These are market and profit and loss (P&L) driven. The business model literature lacks a focus on costs from a strategic investment perspective, especially for businesses that require longer-term incubation and development. Since value creation with many early-stage TSUs may not be associated with marketable

products, services or revenue, costs by default should have a different meaning.

Overall, we take costs for granted in the business model literature and cover it with a broad brush in the value-creation process. Zott's et al. (2011) review of business model papers published since 1995 examined "the concept through multiple subject-matter lens" (p. 2); the word *cost* is mentioned 18 times (over 1177 research articles). The role of costs is mainly addressed as *cost structure* in relation to revenue and profitability (i.e., *revenue stream/cost structure*) and as in Porterian cost leadership (see below for further discussion). Although the authors conclude that many scholars from different fields address business models to explain different phenomena, the only collective reference to costs made by the authors is that of the "business model as cost/revenue architecture" (for technology management and innovation scholars interested in explaining the economic mechanisms that allow a firm to commercialize technological innovations)" (p. 22).

2.1.2. Business models and management of technology

There is a vast array of literature addressing management of technology (MoT) (Ratinho et al., 2015). We specifically review MoT from the new economy startup perspective.

In order to address value creation and value capture for customers and investors alike, it is imperative to link technological innovation to business models (Baden-Fuller and Morgan, 2010; Chesbrough and Rosenbloom, 2002; Sabatier et al., 2012; Teece, 2010). Business models mediate between value creation and technological development to reach reasonable value propositions through an iterative process of business model dynamics and formulation (Rong et al., 2018). Whereas speed of development and growth depends on the paths TSUs take, the assistance they receive, and the ecosystems they operate in Miozzo and DiVito (2016).

The advent of the sharing economy has had an immense impact on MoT, leading to diverse business models with heavy reliance on multiple technological inputs, peer-to-peer interactions, and varying platforms for collaboration (Muñoz and Cohen, 2017). Such platforms have also evolved from granting access to suppliers to develop complementary components, to completely giving up control of the platforms to component suppliers to be more innovative (Boudreau, 2010).

In parallel, future potential customers, users, and intermediaries have provided further indirect inputs or drivers to MoT. These include acceptance of the technology, social acceptance, demand for privacy, safety and security features, and the trust factor of these platforms (Le and Suh, 2018). They have not only impacted firm strategies and market behavior, but also changed the way people think, expect, and interact through social networks (Schuelke-Leech, 2018). Consumers of technology expect improved experiences and additional services rather than pure product consumption – a move towards specific and targeted benefits-only services, what Frank et al. (2019) call *servitization of product-driven industries*. Hence, a modularized *technology-service conversion* have become more effective than the traditional manufacturing-oriented MoT focusing on technology fusion (Kodama, 2014). Such drivers have also led to the requirement of multiple technologies as inputs in order to generate desired innovation outputs. This has upended the traditional single technology platform as baseline inputs for product innovation, having a fundamental effect on MoT processes and outputs, such as technology road mapping. This paradigm shift has forced companies to use technology differently with new business models and approaches, such as using a broader *technology landscaping* approach instead of road mapping (Tierney et al., 2013).

The use of information technology combined with R&D has contributed to knowledge production and innovation outputs that are mostly intangible (Kleis et al., 2012). It has introduced new ways to ideas generation and selection, balancing creativity and standardization, and organizational learning in MoT (Argote and Hora, 2017; Kornish and Hutchison-Krupat, 2017; Shalley and Gilson, 2017).

When it comes to early stage TSUs, in addition to the technological

complexity described above, there are higher levels of uncertainty and ambiguity where predicting growth is very difficult in the absence of historical precedence (Coad et al., 2016). Hence, TSUs use diverse ways of developing their innovative capabilities through exploration and exploitation (Bojovic et al., 2018; Jensen and Clausen, 2017). For example, university spinoff TSUs by new graduates and academic entrepreneurs attempt to align value creation of technological innovation with markets as well as investors while developing managerial competencies (Lehoux et al., 2014, 2017; Miozzo and DiVito, 2016). Such spinoffs are usually based on patented technological discoveries seeking new markets as well as the potential to be acquired by a bigger market player. Making the spinoff exit-worthy not only is designed to satisfy investors' needs, but also becomes an active strategy for growth by utilizing the expanded resources of the acquiring company instead of growing organically (Henkel et al., 2015; Lehoux et al., 2014). This is particularly true when TSUs have complementary technologies and marketable product potential that require larger sums for investment, advanced manufacturing capabilities and marketing skills to grow, and would be a good fit for the acquiring company (Andersson and Xiao, 2016). However, literature is scant about linking such deliberate (albeit unpredictable) MoT approaches to costs and business models which incorporate technologies, markets and exits. In most cases, references to costs are about *decreasing* (cost of IT), *minimizing* (manufacturing costs), and *reducing* (transaction costs) to extract higher economic value.

2.1.3. TSUs and portfolio business models

Many TSUs begin their existence through either a university-based technology or innovation or IP such as a patent, a technological concept, or potential market application. This is a strategic stage of positioning the TSU in which the firm continues to determine its direction through experimentation, R&D, and exploration (Bojovic et al., 2018). Systematic thinking about business model design is crucial to generating viable business models for new technologies (Snihur et al., 2018). At times, there may be an identified product or service for which there may be a market and monetization opportunity. Therefore, strategically, early-stage TSUs could either have technology-driven business models, market-driven business models or both (Habtay, 2012; Zott and Amit, 2010). As TSUs adapt their discoveries and experimentation to identify value creation and value capture opportunities through their technology landscapes (Tierney et al., 2013), they may also identify contingency-based business models either as a *plan B* to alleviate risks for failure management or competing separate parallel models that are discovery-driven for opportunity management (Gruber, 2010; Markides and Charitou, 2004; Van de Ven et al., 2013). Such dual or parallel business models may lead to higher innovativeness (i.e., firm value creation) especially when commercializing university-driven research (Clausen and Rasmussen, 2013) and improved performance benefits (i.e., firm value capture) by identifying various market opportunities even before market entry (Gruber et al., 2008, 2013).

Sabatier et al. (2010, p. 432) define a portfolio of business models as different ways a firm delivers value to its customers to ensure both its medium-term viability and its future development. Also referred to by researchers as business model configurations (e.g., Aversa et al., 2015), business model portfolios may build on synergies between business models (Sabatier et al., 2010) or allow the exploration of new opportunities while maintaining an established business model (Øiestad and Bugge, 2014). The complexity of managing a business model portfolio during design (Snihur and Tarzijan, 2018) may call for a different perspective on costs. The strategic role that costs play when there is only one business model could be different when there are two or more business models.

2.2. Costs

The topic of costs has been studied in accounting since the 1960s, and both academics and practitioners have attempted to determine their importance as a firm's strategic component. Almost all of the debates have focused on the context of large, mature industrialized firms with a predominant focus on new product development from the management control perspective (i.e., Anthony, 1965, 1989; Chenhall, 2003; Jørgensen and Messner, 2010; Simons, 1987, 1990, 1994).

2.2.1. A recent history on costs

Anthony (1952, 1965) addressed the notion of costs as having mainly an input role within various value centers of a firm, which he called *responsibility centers*, *expense centers*, *revenue centers*, *profit centers*, and *investment centers* (1965, p. 26). Each of these centers have unique inputs and outputs “measured in monetary terms for which a center manager is responsible” (1965, p. 26). Anthony defined costs as “a monetary measure of the amount of resources used by a responsibility center” (1965, p. 195). He concluded that costs can *almost always* be used in measuring inputs, but outputs cannot always be measured monetarily, since other resources are consumed, even though we attempt to measure outputs in terms of revenue, expense, and cash generation (1965, p. 195). Since these *centers* are managed by people, their most important task is to improve efficiency and effectiveness by linking costs to certain standards to determine some kind of measurable output such as *ratio of outputs to inputs* (1965, pp. 195–197). This could be accomplished using specific approaches and tools such as target costing and activity-based costing (Ansari and Bell, 1997; Cooper, 2002; Cooper and Kaplan, 1991; Mihm, 2010). Cooper and Slagmulder (2004) concluded that *cost efficiency* could apply throughout the product life cycle, not just during product design, to achieve *full-cycle cost management*.

Since Anthony's initial notion on costs, the debates have continued within the context of strategic management accounting, whose original purpose was to explore competitor analysis. This was a departure from internally focused conventional accounting practices based on historical data (Simmonds, 1982). Porter (1980) introduced the notion of cost leadership as a strategic competitive advantage to differentiate a firm from its competitors by incurring lower costs; later (1985), the value-chain model proclaimed that all activities related to a business are a chain of events associated with value creation. From the Porterian perspective, for a business to have a successful strategy, it must both produce products at the lowest possible costs and control costs continuously at all levels of an organization, including production, marketing and non-marketing support functions. From this perspective, experienced firms must aggressively pursue cost reductions, tighten cost controls (especially costs associated with overhead or fixed costs), and minimize costs at all levels to become the lowest-cost producer in its industry.

These views of costs became a standard for product development, efficiency and effectiveness, as well as MoT. The main role that costs played has been that of a moderator to determine the breakeven point through cost-volume-profit (Jaedicke and Robichek, 1964), margin and profitability (Cooper and Kaplan, 1988, 1991), and competitive advantage (Porter, 1980, 1985). Costs need to be reduced, optimized, and avoided where possible to obtain the highest profitability (Lord, 1996). This view became the *modus operandi* since the *industrial evolution* of the 1980s, with the dominance of large U.S. multinationals and the associated *accounting evolution* in which the focus has been on *growth* through accelerated profits reporting and increased short-term dividends distribution to appease shareholders (Richard, 2015). Within this Porterian business model, the view has been all about growing a business through top- and bottom-line growth, improving margins and profitability by reducing, saving, and optimizing costs through a full-cycle cost management technique (e.g., Cooper and Slagmulder, 2004).

This approach has had several behavioral effects. First, costs have played a more negative role in business as a key ‘make or break’ moderator of profitability (Cooper and Slagmulder, 1999; Gopalakrishnan et al., 2015) that must be constantly controlled and used for contingency planning (Chenhall, 2003; Simons 1987, 1991). Second, the word *cost* has been used for both the original intent of the word as an input (per Anthony's notion) and an accounting expense captured in the P&L (as an output). In other words, *costs* and P&L *expense* have been used interchangeably, especially in new product development (Cooper and Slagmulder, 2003; Gopalakrishnan et al., 2015). Since we live in a hyper-profitability-centric business environment, more people associate costs with the latter than with the former (Richard, 2015).¹ Since operating expenses on a P&L statement are an output, the role of costs became more of a management mantra to reduce, control, and save from operations (Gopalakrishnan et al., 2015). Therefore, costs' strategic importance in value creation has been measured mainly through profitability and cash generation lens to improve a firm's stock price as value capture to appease its shareholders (Richard, 2015). Consequently, the general focus on costs in the literature has mainly remained as a problem to address, control, or eliminate its causes in order to extract higher economic value.

Finally, the vast majority of these studies have been within larger, established, industrialized company settings and with new product development. The Porterian perspective overlapped with the strategic management accounting debates, which later included the concept of strategic cost management as a new addition (Shank, 1996; Shank and Govindarajan, 1993). However, because of its complexity, this approach did not gain serious traction, and it could not be adopted as a practical approach relative to the circumstances (Aluko et al., 2010; Taipaleenmäki, 2014). There has been very little discussion in the literature on costs in the new company development environment.

2.2.2. Costs in innovative environments

Some studies have addressed management control systems and costs within innovative environments, such as R&D. Anthony (1952) studied costs within industrial research organizations and found that the most significant *cost factors* (labor, material, and overhead) are different in similar firms. He concluded that people costs are the highest and most-reviewed costs in research-oriented firms (p. 81). He determined that people costs are an input (or an investment) to create improved products and hence firm value. However, since these R&D departments were experimental, and inputs and outputs often change, outputs are not controllable. Furthermore, since the “predictability” (a key component of controlling) of desired outputs is set by people, the only thing that can be controlled is the actions of the people setting outputs (p. 47).

Further studies build the case that as R&D environments are unpredictable, input controls (i.e., budgets and plans) are more important than process or output controls, for instance, product cost targets (Rockness and Shields, 1984). Abernethy and Brownell (1997) noted that personnel controls are more likely to be effective when there is task uncertainty, and traditional controls do not work within innovative R&D environments, especially when founding entrepreneurs rely more on their prior beliefs, personal intuition and controls that form expectations than on traditional management control systems (Chenhall and Moers, 2015; Parker, 2006). Therefore, subjectivity has a greater role than objectivity within innovative business environments (Höppe and Moers, 2011). From these studies, we note that costs appear to play a different role in R&D and innovative environments than in traditional industrial companies.² This role of costs in R&D

¹ Richard believes that this has been at the expense or the “exclusion of human and natural capital from this systematic conservation of capital” (p. 30).

² Here we use the word *industrial companies* to refer to manufacturing, production, sales and marketing.

environments is more of an enabler of value creation (as input and investment), than a moderator of profitability. This perspective is missing from both the management accounting literature and other management disciplines that cover costs in their studies, including business models. [Chenhall and Moers \(2015\)](#), in their overall analysis of management control systems work, suggest that research should diversify from a focus on product innovation to innovation research on processes and business models (i.e., intangibles) since “innovations emerge from the dynamic, adaptive processes of organizations, often in unpredictable ways” (p. 9).

In retrospect, there have been very few studies on costs related to new company development within TSUs. The management accounting literature has not addressed the notion of costs within the non-product innovation, highly ambiguous and uncertain³ environments ([Weick, 2015](#)) of early-stage TSUs in which there is a constant need to explore, experiment, and recalibrate (especially their business models) when historical precedents do not exist. Technology requires long discovery and incubation periods and large sums of investment capital with no immediate revenue streams, profitability, or returns on investment in sight. None of the studies in management accounting and management control systems address costs in business model design as innovative cognitive devices aside from their role as a moderator in the revenue stream/cost structure ([Zott et al., 2011](#)).

2.2.3. Costs, business models, and developments in accounting

In the past few decades, there has been increased attention paid to the role that business models play in financial reporting, which is a function of financial accounting. In 2009, the International Accounting Standards Board ([IASB, 2019](#)) released the initial draft of International Financial Reporting Standards (IFRS) 9, which states that all business entities must disclose their business models to determine how to classify their financial assets. Since IFRS 9 did not actually define what is meant by business models, in 2013, a conceptual framework bulletin was developed on this topic by major European actors in the field of financial reporting ([European Financial Reporting Advisory Group EFRAG, the French Autorité des Normes Comptable ANC, the Accounting Standards Committee of Germany ASCG, the Organismo Italiano di Contabilità OIC and the UK Financial Reporting Council FRC, 2013](#))⁴. EFRAG et al. attempted to define a business model as “the value-creation process of an entity, i.e., how the entity generates cash flows. In case of non-financial institutions, it represents the end-to-end value-creation process or processes of an entity within the business and geographical markets it operates” (par.12). This bulletin was followed by research papers ([EFRAG et al., 2014](#); [Tokuga et al., 2013](#)) and consequently a feedback statement by [EFRAG et al. \(2014\)](#). Although the development of business models in financial reporting is ongoing, costs in financial reporting simply depend on how a company is structured as a result of its business model.⁵ In its research paper,

³ [Weick \(2015\)](#) defines ambiguous as environments with multiple meaning, interpretations, doubts and uncertainties; and uncertainty, as a lack of predictability or assured results and outcomes (p. 118).

⁴ [European Financial Reporting Advisory Group EFRAG, the French Autorité des Normes Comptable ANC, the Accounting Standards Committee of Germany ASCG, the Organismo Italiano di Contabilità OIC and the UK Financial Reporting Council FRC, 2013](#).

⁵ [European Financial Reporting Advisory Group EFRAG, the French Autorité des Normes Comptable ANC, the Accounting Standards Committee of Germany ASCG, the Organismo Italiano di Contabilità OIC and the UK Financial Reporting Council FRC, 2013](#) present the simple example of cotton. Two companies buy cotton for \$100. Company A is a garment manufacturer and Company B is a commodities trader. Both entities record the purchased cotton at the price they bought for \$100 (i.e., the cost basis). In a month's time, the market value of the same cotton increases to \$120. For company A, nothing changes in terms of the value of the purchased cotton as inventory on its balance sheet. For company B, since it is a commodities trader, the value of the cotton must be

[EFRAG et al. \(2014\)](#) state that business models affect how costs are treated. In footnote 5, for example, “under one business model, cost is used as the measurement basis, and under another model fair value accounting is applied with immediate recognition of the gain in profit” (par. B59). The point being made here is that aside from accounting standards on treatment of costs about whether to expense (P&L) or amortize (balance sheet) and the use of the fair value principle, business model design has an impact on how costs are treated in financial statements under the current rules.⁶ Therefore, there is an interdependency between business model design and the role that costs play in financial reporting.

Financial reporting relies on historical information and management accounting is focused more on present and forward-looking statements. Value applies not only to the past (as in *financial reporting*) but also to the present (*operations management*) and to the future (*investment appraisal*), and it should be distinguished between short-term and long-term⁷ importance in value creation ([Tagoe, 2016](#)). Since there is a lack of historical financial information about early-stage TSUs, both founding entrepreneurs and investors rely on *soft information* about a firm's value creation and value capture *potential*. Indeed, they utilize more *fair value* accounting methods for future valuation and decision-making purposes (especially to attract financing) than traditional cost accounting. Hence, they “plant the seeds for the convergence between management accounting and financial accounting ([Taipaleenmäki and Ikäheimo, 2013](#), p. 342) where strategic plans and forecasts sets the precedence to future financial reporting – “an ongoing process of managerialization of financial reporting” ([Zambon, 2011](#), p. 9). Business models as intangibles play a mediating role in setting the tone for how a TSU intends to create and capture value, which in return establishes a financial reporting prerequisite or precedent as to how costs will be treated: a measurement basis versus fair value accounting or both. However, these definitions and cost classification have lagged behind with firms in the new economy, especially TSUs. Applying traditional accounting methods to determine financial value undercuts the value creation and capture potential of disruptive TSUs in the new economy.

2.2.4. Costs in the new economy

With the onset of the new economy, we are in a new phase of post-industrialization with intangible- or knowledge-intensive businesses that have disruptive business models focused on innovation and intellectual capital that operate a different value creation and value capture paradigm ([Ciftci et al., 2014](#); [Lev and Zarowin, 1999](#)). This new economic phase is also marked by highly technology-oriented business models and the ascendance of non-US-based companies and startups with *pop-up* startup concepts for which all that is needed is an Internet connection and a credit card ([Davis, 2016](#)). These new entrants are more human-capital intensive and much less physical-capital driven,

(footnote continued)

restated to the market value following the fair value principle, which is \$120. The extra \$20 would be recorded in the P&L as a gain or profit. The point being made here is that “the nature of an entity's business may affect the measurement of assets, the reporting of profit and presentation” [European Financial Reporting Advisory Group EFRAG, the French Autorité des Normes Comptable ANC, the Accounting Standards Committee of Germany ASCG, the Organismo Italiano di Contabilità OIC and the UK Financial Reporting Council FRC, 2013](#).

⁶ Since this paper is not about accounting standards, we will only use this financial reporting topic to illustrate the convergence of financial (accounting) reporting and managerial accounting point.

⁷ In accounting, short-term is considered as less than one year; whereas long-term is considered as more than one year. Short-term value creation is important for survival and for long-term prospects, but not to the detriment of long-term value capture. The role costs play in the value-creation process is very much dependent on the defined value capture and the development of capabilities and relationships.

and invest much more on intangibles than on tangibles (Haskel and Westlake, 2018). They create an atmosphere of learning, training by doing, and experimenting, which in return leads to employee commitment and improved financial performance (Mahto et al., 2018).

These firms initially rely more on private financing options than on the desire to trade publicly. For more financial capital-intensive TSU, such as medtechs and life sciences, this reliance is extended to private VC firms which eventually seek superior financial returns through initial public offerings (IPOs). However, this has come at a higher cost to the TSU since they have traded ownership with VC firms at higher discounted rates in exchange for VC name recognition, networks, and expertise for relational capital. Nonetheless, these higher costs are no longer justifiable in the new economy due to the hypercompetitive VC environment where high VC reputation may not be associated with superior post-IPO performance (Mahto et al., 2018).

In early stages, TSU valuations are based more on their intangibles, mainly intellectual capital (i.e., human, organizational, and socio-relational) than reliance on traditional profitability models. They create value with their human, social and relational capital through open innovation collaboration to add value through improved partner firm performance (Greco et al., 2016), licensing agreements (Arora et al., 2013), and focused strategic alliances (Hagedoorn and Sadowski, 1999) with the hope that one day they will be acquired by a larger firm interested in knowledge sourcing (Aghasi et al., 2017).

With TSUs, costs are omnipresent throughout their lifecycle. They begin at the onset of the entrepreneur's ideas or *antenarratives* (Boje, 2001) and carry on throughout the development, the evolution of business model narratives, and the TSU lifecycle. Whether they are real, perceived, direct, indirect, sunk, fixed or variable, costs are ever-present. For TSUs, the output of intellectual capital (IC) development costs may be intangible, but the input is cash payments into costs (mainly in people) and investment in time (Chammassian and Blum, 2018). Traditional costing models, such as target costing (Cooper and Slagmulder, 1999; Mihm, 2010), eventually become irrelevant for such startups, since their costs are mostly driven by human capital (Granlund and Taipaleenmäki, 2005). Intangible value will have more relevance to market value or fair value methods than traditional book values (Tagoe, 2016).

There are many factors that influence the decisions and costs associated with TSUs at their early stages, in addition to the ones related to MoT in the new economy (Le and Suh, 2018; Schuelke-Leech, 2018). For instance, time and timing play a major role. Conventional logic shows that whenever there is a transaction or an activity, there is an associated cost (Hope and Hope, 1997). The longer a TSU takes to incubate, develop, and transform technologies into innovative products to market and gain market share, the more transactions it will incur and thus the higher the costs. These costs are more related to developmental transaction volume over time than the unit transaction costs (that need to be reduced) covered in MoT literature (i.e., Kleis et al., 2012; Le and Suh, 2018). This may also apply to opportunity costs in terms of risks and failure, the emergence of competitive technologies, and returns on investment. For instance, Arora and Nandkumar (2011) consider this as “costly actions,” which are “investments that increase the hazard of a cash-out” as well as “the hazard of failure” (p. 1844). Partners and customers may not accept long and costly trials with unpredictable product performance, especially with disruptive technologies (DeKunder and Kohli, 2008). Another example is the reference to experienced entrepreneurs. The literature emphasizes the importance of experience as a catalyst for TSU development, advancement and successful exit (Butler and Ghosh, 2015). However, experience comes at a price: experienced people simply cost more, as they are in high demand. Although the general expectation is that investment in such people will bring better and faster results, there is no guarantee that they will be successful. However, what is generally a reality is their (higher) costs, whether or not the TSU succeeds. Therefore, understanding costs is as much of a fundamental part of comprehending TSU evolution and value

creation as it should be a part of business model design. Similar to business model research, the literature on costs does not address strategic references to business models beyond fringe topics, such as bootstrapping (Mac an Bhaird and Lynn, 2015; Vanacker et al., 2011). Thus, this paper attempts to answer the following research question: what role do costs play in business model design in early-stage technology startups?

3. Methodology

To address the research question of *what role costs play in business model design in early-stage technology start-ups*, we chose a qualitative approach. In the absence of data and historical financial information on costs with early-stage TSUs, we found it is best to comprehend TSU entrepreneurs' narratives through their perceptions on a case-by-case basis. The multiple-case approach allowed us to extract meaning and sensemaking from varying perceptions of entrepreneurs operating in a real world of experimentation (Eisenhardt, 1989; Eisenhardt and Graebner, 2007; Yin, 2014). These perceptions could only be revealed through open-ended, semi-structured questions about TSU evolution from conception to startup and to a certain moment of its existence. This allowed us to explore how firms formulate cost strategies within a business model design, what role costs play within business models (if any), and the similarities and differences from drawn inferences. These cases represented different perceptions of the same topic within the dynamic of multiple instances that are rich in empirical descriptions of perceived realities, whether objective or subjective (Eisenhardt, 1989; Yin, 1994).

From the collected data, we analyzed the perceptions of 15 TSU entrepreneurs from 12 TSUs from various technology domains (see Appendix A: Founder and Startup Characteristics for the list of TSUs) and ecosystems in Switzerland (EPFL Innovation Park ecosystem), France (Rhône valley), and the USA (Silicon Valley) that had survived for three years or more. The selection process was conducted randomly through professional networks and company lists after fulfilling the criteria mentioned below. Switzerland-based startups, the main group, were randomly selected from the EPFL Innovation Park (EIP) website⁸ from a list of companies totaling 200 TSUs at the time of the interviews, with the help of the EIP Director. At least two of these TSUs had a significant presence in the USA. France- and USA-based TSUs as a control sample were randomly selected through professional networks and congresses. None of the TSUs were known to the authors prior to engagement; nor did the authors have any professional or personal relationships with the selected TSUs and interviewees prior, during or after the research. All these TSUs operated in nascent markets in an unstructured world full of ambiguity and uncertainty, where every experience counts and contributes to the discovery process, with little assurance or ability to predict (Davis et al., 2009; Santos and Eisenhardt, 2009; Weick, 2015).

The reasons for selecting these start-ups as case studies are as follows. First, the start-ups were technology-based in general and did not represent any specific sector or domain of technology. We use Coad and Reid's (2012) broad definition of technology “to capture not only the equipment, software or instruments used to produce a good or service but also the (tacit) knowledge, techniques, organizational methods, etc. used to design, develop and market the products and services by businesses (and the public and not for profit sector), in cooperation with other actors in the innovation system” (p. 1). The selected TSU technology sectors ranged from specialized web-based services (such as social networking, pharmaceutical company customer relationship management systems, content curation, and K-12 online education) to more complex technologies, either university-transfer technology IP or the expansion of existing technologies into innovations. The latter

⁸ <https://www.epfl-innovationpark.ch/community/companies/>

group included TSUs in medical devices, life sciences or biotechnology, and semiconductors. Second, the TSUs came from different countries and ecosystems. This was also deliberate, to identify any cultural context, biases or similarities in viewpoints. Furthermore, TSUs have a global impact through their scalability, as the majority of technologies today are borderless. Therefore, country or location is not relevant to TSU characteristics, although an ecosystem or habitat (such as a technology incubator) may encourage or hinder development. We are aware that culture and certain cultural attributes play a role and filter in perceptions of costs. The vast majority of the TSUs, however, had clients, partners, investors, or legal entities in different countries. Third, all the TSUs had survived for more than three years and the majority had raised significant amounts of equity financing. At the time of the interviews, the TSUs either continued to survive or exited through financial harvest, stewardship, and voluntary cessation (DeTienne et al., 2015), including merger, trade sale, or closure caused by bankruptcy. It was necessary to have a survival bias to study the TSUs and their business models' evolution. The main reason for this approach was to interpret and determine how perceptions combined with the impact of day-to-day realities, changes in circumstances, and business model and strategy evolution over time.

The interviewees were all senior leaders, either original founders or leaders who joined later. We initially interviewed three and two senior entrepreneurs from each of the first two cases, respectively. After the initial interviews, we concluded that the narratives of different entrepreneurs of the same TSUs were very similar. We then decided to interview only one senior entrepreneur per TSU. Furthermore, we decided to stop at the 15th interview (12th TSU), since we also thought that we had reached a saturation point in which the majority of the narratives either revealed similar results or did not reveal anything new or novel (Charmaz, 2014).

The research employed semi-structured interviews in which we encouraged the participants to discuss openly what actually happened and how it evolved to understand the notion of costs within their TSUs' development. We did not introduce the topic of costs at the onset of the interviews; this was done only later through generic questions. We digitally recorded, transcribed and analyzed the interviews through qualitative data analysis methods: sorting and synthesizing, in vivo coding, memo writing, and word frequency. Through interpretivism and induction, we used different methods to understand how TSU entrepreneurs attach meaning to costs in their strategies. These included first-cycle coding methods, such as in vivo, line-by-line, and word-frequency coding to allow them to grasp how TSU entrepreneurs' beliefs over time shaped their evolving narratives and their treatment of costs within business model design (Charmaz, 2014; Saldaña, 2015). We then employed QSR International's NVivo 10 Software (NVivo, 2012) to conduct *verbatim* or *literal* coding to preserve the TSU entrepreneurs' meaning and actual language used for sensemaking. We identified several codes and subcodes and categorized them thematically. Simultaneously, we used memo writing to capture thoughts, meaning, and sensemaking. Finally, we conducted word-frequency queries through NVivo to analyze word counts and the relationship of words to specific topics.

4. Results

Our study indicated that early-stage TSUs have three distinct types of business models: technology-driven, market-driven, and exit-driven. We briefly present these three types and then detail the role costs play in these business models. In these business models, TSU entrepreneurs derived value through the eyes of the value beholder. Table 1 summarizes the three business model types, Table 2 shows which case corresponds to which business model, and Appendix B provides additional quotes from the case studies.

4.1. Types of business models observed and configurations

Technology-driven business models were R&D oriented, focusing on developing an emerging technology. TSUs were formed based on a technology, an IP, a university-created patent transfer, or a concept for which marketable uses or a product or services did not exist. They experimented, explored, and discovered adaptive technology uses. People as human capital were the main drivers of knowledge and the know-how generation, which led to creating unique processes, capabilities, procedures, databases, software, patents, and similar intangible assets (i.e., organizational capital). The specific knowledge and competences related to the technology under development were the major source of value for the TSU and its customers. TSUs also created a unique value through special relationships they built with partners, future customers, unique suppliers, specialized ecosystems (such as technology incubators), universities, and reputation building (i.e., social and relational capital). The value-capture mechanism of this type of business model was through accumulated intellectual capital and intangible asset orchestration (i.e., balance-sheet driven) to establish strategic alliances and licensing agreements.

Market-driven business models followed the traditional business models in which the TSU had either marketable products and services from the beginning or a clear focus on developing these products or services to cover unmet market needs. Value was created by selling products or services. The value capture was through sales and revenue generation, cost leadership, cost optimization, improved margins, and profitability. Value capture of purely market-driven business models was initially through product- and/or services sales revenues, margins, profitability, and market share. Financially, the firms were income-statement driven.

Exit-driven business models are the third type of business model we observed, in which TSU entrepreneurs began positioning the TSU for exit from the very early stages of their startups. Even though the exit narrative evolved over time and there was no guarantee that exits would materialize, the TSUs' exit business model design process began in the early stages. The focus of this business model was to develop the TSUs' perceived value in which the TSU was the "actual product" itself. The "material costs" were mainly people costs (i.e., human capital). The TSUs' "future customers" were primarily potential acquirers of the TSUs or acqui-hirers who were interested in knowledge sourcing. Their other customers were their primary stakeholders: investors, who were initially business angels and potentially private equity or venture capital firms. The key TSU features as a product were intellectual capital, scalability of technology, proof of concept, possible marketable products and services, market share, and growth potential. In our study, when TSU entrepreneurs treated their startups as a product for exit sale from the start, they experimented with ways to increase their TSUs' value through their technologies and eventually wanted to find unique and scalable trade sales markets for their TSUs.

Among the twelve case studies, we found four TSUs with a single business model, four TSUs with a portfolio of two business models, and four TSUs with a portfolio of the three business model types (see Tables 2 and 3).

4.2. Costs as enablers of technology-driven business models

As technology-driven business models are exploratory by default, research and development (R&D) factors and where to invest become key strategic decisions. Costs act as an investment in resources and capabilities development, which contribute to technological value creation. In this respect, costs act as an enabler to create value, since they did not have a specific market or value yet given that the technologies were under development. The entrepreneurs created the TSUs to explore further and to develop additional IP, capabilities and resources, and costs were mainly to enable and advance technological developments. TSU entrepreneurs were able to experiment and

Table 1
Types of business models observed and configurations (Source: compiled by authors).

Type of business model	Value creation	Value capture
Technology-driven	New and emerging technologies, IP, or technological concept. Development of intellectual capital, partnerships.	Licensing agreements, royalties, strategic alliances, big data, potential market-driven products/services, and firm value capture through intangible asset orchestration.
Market-driven	Technological products/services with commercial value. Customer acquisition, channels and platforms.	Market share, profit and loss, free cash flow generation.
Exit-driven	Technologies, concepts, IP, R&D pipeline. Development of IC and IP.	Attractiveness to potential buyers; trade sale, IPO, acqui-hiring

innovate. The focus was not cost affordability, but the type of R&D in which to invest.

“[Our] cost is basically all linked to science and technology and clinical trials. So, it's only in the innovative part, of course, it is salaries” (Interviewee 4, TSU 2).

“Team is core. Team is essential... having a team allowed us to make sure that we are balanced, in terms of what is important—money, market, technology” (Interviewee 5, TSU 2).

Among the TSUs with a technology-driven business model, the majority of cost investments were in people (i.e., human capital) whom the entrepreneurs perceived to be the most valuable intangible asset. Investment in people enabled TSUs to develop unique capabilities and organizational capital (i.e., intellectual property), and to forge relationships (i.e., relational capital) that comprise the TSUs’ intellectual capital portfolio.

“I don't think that there is a massive difference between technology and people... People and technology, in a technology start up, are exactly the same” (Interviewee 7, TSU 4).

“We have extremely high KPI in terms of data processed analyzed—KPIs in terms of power of our technology platform.[...] For me, the main cost is really, in our business, the people [...] People is [sic] investment and retention plans is [sic] clearly an investment for us” (Interviewee 6, TSU 3).

4.3. Costs as moderators of market-driven business models

In market-driven business models, costs act as moderators in the value-creation process: the firm's focus is on improving product or service gross margin and thus on profitability or the bottom line. Firms achieve this through reducing or *optimizing* manufacturing costs, as well as improving selling and distribution costs.

“The cost of the product, the cost of production. It's really my focus to reduce the costs, because...the cost of the product for the patient and for the doctors, what they pay and to put a price is not easy... Obviously, if you can reduce the production cost, you can reduce the

Table 2
Business model type by case study (Source: authors).

Case	Technology	Technology-driven business model	Market-driven business model	Exit-driven business model	Configurations
1	Medical device	✓	✓	✓	Portfolio (3)
2	Biopharmaceutical technology	✓	✓	✓	Portfolio (2)
3	Web-based content technology and services	✓	✓	✓	Portfolio (3)
4	Technologies for unmanned aerial vehicles	✓			Single
5	Technologies for unmanned aerial vehicles	✓	✓	✓	Portfolio (3)
6	Software for biopharmaceutical companies	✓	✓		Single
7	Web technologies	✓		✓	Portfolio (2)
8	Technologies for semiconductors	✓		✓	Portfolio (2)
9	Microelectronics for health applications	✓		✓	Portfolio (2)
10	Technologies for biopharmaceuticals	✓			Single
11	Web technologies	✓			Single
12	Web technologies	✓	✓	✓	Portfolio (3)

Table 3
Configurations of business models (Source: authors).

Business models	Technology-driven	Market-driven	Exit-driven
Technology-driven	S=3; P=4		P=4
Market-driven		S=1	
Exit-driven	P=4	P=4	P=4

S= Single BM; P= Portfolio of BMs.

sales price and the cost of the product for the patient and the doctors” (Interviewee 1, TSU 1).

Among the 12 case studies, only one TSU had a single market-driven business model, but this type of business model was more common in a portfolio of business models that included all three business model types, such as technology- and exit-driven business models. The only single market-driven business model was focused on exploiting a specific market niche in the pharmaceutical industry to capture, track, and manage the opinions of industry thought leaders, such as doctors, researchers, and pharmacists. As an example, this firm treated costs as a moderator in creating a high gross margin by outsourcing some of its software developments.

4.4. Costs as mediators of exit-driven business models

In exit-driven business models, costs play the role of mediator to create and then capture value. In this type of business model, the investment is in the TSU itself as the “product” for eventual sale, positioning it to a specific market segment for eventual sale to another player in the marketplace (i.e., acquisition). Cost investments mediate the process of creating enough enterprise value so that value is captured when someone will pay a premium to acquire the TSU.

“Set aside moral goals—the will to do good—the real customers are basically the buyers of the company—Building this company, we'll [be] developing this product so it can interest someone in buying us” (Interviewee 12, TSU 9).

“The amount of acquisition value went to the technology, the platform infrastructure that we had built, and a certain portion of the

value went to acquire a really amazing team of people that we have assembled.” (Interviewee 10, TSU 7).

Among the twelve case studies, none of them had only an exit-driven business model, but four of them had a portfolio of two business models – technology and exit driven business models; and four had all three types of business models – technology-, market-, and exit-driven.

4.5. Costs as mediators in business model portfolios

Portfolio business models consisted of technology-driven and exit-driven business models (Cases 2, 7, 8, and 9) or included all three business model types (Cases 1, 3, 5, and 12). These business models followed the same pattern as technology-driven business models, but they also had either a dual focus on technology and exit from the beginning, or they may have included a market-driven business model and a spinoff product or service from the technology to market and sell. Costs played the mediator role for portfolio business models in this value conversion process, and the firms managed them to increase value capture in the case of exit. In other words, strategically, costs had both a value creation (i.e., input) and a value capture (i.e., process and output) element with portfolio business models.

“We almost never had revenue by the time we were acquired.... We always knew what our revenue generation model was, but we never got to the point of having enough traffic to generate any significant amount of revenue from any such deal” (Interviewee 10, TSU 7).

The difference between two- and three-portfolio business models was the fact that they had market-driven products and services. Furthermore, they can spinoff and sell in focused marketplaces parallel to the firm value creation. Such business models continued to focus on intellectual capital value creation when the firms developed additional ideas, technologies, or concepts. Overall, costs play the mediator’s role in portfolio business models, as the TSUs’ ultimate goal is value capture through exit (see Table 4).

5. Discussion and conclusion

The results of the 12 case studies allow us to distinguish three different roles played by costs in business model design for early technology ventures: enabler, moderator, and mediator (see Fig. 1 below).

Instead of having an approach in which costs constitute either a black box or a constraint, here we see the three different roles of costs. In technology-driven business models, the TSU entrepreneurs’ approach

follows two notions in the cost literature. First, from a cost accountability perspective, strategic cost input controls with the technology-based business model design appeared to be more important than process or output controls (Rockness and Shields, 1984). Second, there was a higher reliance on personal intuition and personal controls of TSU entrepreneurs than on traditional management controls (Abernethy and Brownell, 1997; Anthony, 1965; Chenhall and Moers, 2015). Market-driven business models follow the traditional cost controls approach (Porter, 1980, 1985; Simons, 1987, 1990, 1991, 1994). In exit-driven and business models portfolios, costs play a mediating role in the value creation and capture processes through financial harvest (DeTienne et al., 2015) rather than a contingency or a plan B (Gruber, 2010). We found technology-driven, exit-driven, and portfolio business models to be more heterogeneous, with marked differences in their typology and approach in value creation and value capture in comparison to traditional market-driven business models. These business models follow more intangible- or knowledge-industry trends and do not follow traditional Porterian (1980, 1985) cost leadership and profitability approaches that had been dominant during the second half of the 20th century. This is our primary contribution to the existing body of knowledge in business models.

In the context of early-stage TSUs, costs play a strategic role, an important common denominator and critical link in the value-creation process, from conceptualizing to developing business models to determining competitive advantages through investment in intellectual capital generation. Our study shows that TSU entrepreneurs treat costs as input, a strategic enabler, and a conduit to create value and eventually capture TSU value through exits as an output. Anthony (1952, 1965) initially highlighted the input orientation of costs that could be measurable. However, his study was within a larger firm, *responsibility center* context. While most people refer to investment as the preferred or acceptable terminology, as it evokes a more optimistic perception (for instance, return on investment), TSU entrepreneurs’ implicit sense-making and explicit references treat costs (especially human capital costs) as a strategic enabler to create value instead of a burden, or a cause of value reduction, or a reason for lower profitability. This is a new conceptual and practical dimension of the new economy TSUs that adopts an investment-oriented cost accountability system towards a future value capture or return. It addresses gaps on costs in MoT literature in ideas generation and selection, creativity vs. standardization, organizational learning, and the higher emphasis of indirect inputs and drivers affecting MoT processes (i.e., technological landscaping vs. roadmapping) and innovation outputs (Argote and Hora, 2017;

Table 4
The role of costs in the configurations observed (Source: authors).

Business models	Technology-driven	Market-driven	Exit-driven
Technology-driven	Enabler - To create long-term value - Investment in IC (>70% HC) - Customers are partners, investors and future TSU buyers	NA	Mediator - Intellectual capital generation - Longevity and scalability focused - ID potential TSU buyers from onset - Licensing and royalties agreements
Market-driven	NA	Moderator - Cost leadership - Competitive advantage	NA
Exit-driven	Mediator - Intellectual capital generation - Longevity and scalability focused - ID potential TSU buyers from the outset - Licensing and royalties agreements	NA	Mediator - Future TSU value oriented - Focus on returns on IC (cost) investments - Multiple TSU buyer potential
Technology + market + exit driven	Mediator Focus is creating TSU value through: - Technology IP (organizational capital) - People and their dynamic capabilities (human capital) - Partnerships, licensing and royalty agreements (relational capital) - Sales and marketing, either to show spinoff products/services work or to show proof of market viability, profitability and growth potential - Potentially multiple exit options: better fit, highest-bidding TSU buyers		

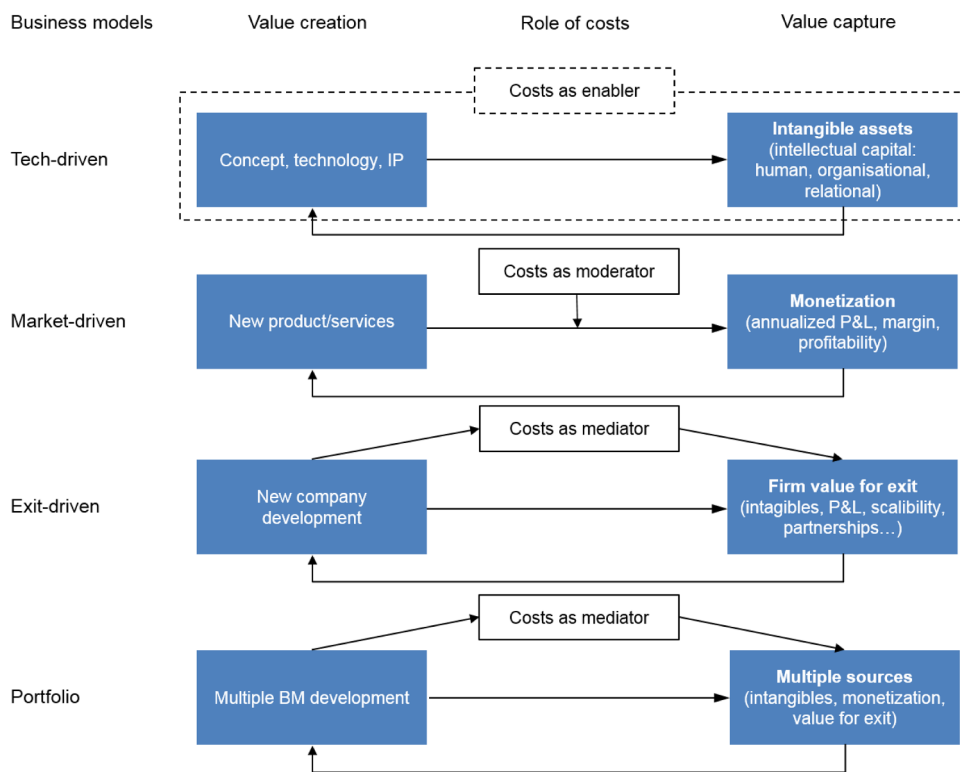


Fig. 1. Role of costs (Source: authors).

Frank et al., 2019; Kodama, 2014; Kornish and Hutchison-Krupat, 2017; Shalley and Gilson, 2017; Tierney et al., 2013). It moves away from a management control-centric mentality (i.e., Chenhall, 2003; Simons, 1987, 1990, 1991, 1994) and towards an investment-centric one to capture value in which firms derive a return on costs from the value that TSU entrepreneurs attempt to create for the future. Therefore, what has traditionally applied to industrialized companies, MoT, and to current business model references does not necessarily apply to innovative TSUs, particularly in their early stages. This new dimension arises within new company development of TSUs instead of new product development. Costs play a strategic role as enabler and mediator in the firm-value creation and capture processes in business model design. This role is a departure from the traditional generic moderator role that costs have played in MoT (i.e., Kleis et al., 2012; Le and Suh, 2018), and the revenue stream/cost structure of business models, as highlighted by Porter (1980, 1985) (Zott et al., 2011). This, we believe, is the second contribution of this paper.

For early-stage TSU entrepreneurs, costs are and should be considered an investment in technology development and intellectual capital creation (i.e., intangible assets), not a financial burden to overcome, control, or optimize for the purposes of improved margins or profitability. This is a departure from the cost control concepts that have been the bedrock of managerial accounting (Simons, 1987, 1990, 1994). The strategic focus of TSU entrepreneurs is investment in intangible asset orchestration (from a balance sheet perspective rather than that of an income statement) to create value, whereas value capture is through successful exits (DeTienne et al., 2015). This sets a more optimistic tone for costs than the pessimistic one traditionally perceived by Porter's cost leadership strategies, and generally acceptable practices in MoT of reducing transaction costs, decreasing cost of IT, and minimizing manufacturing costs.

In all cases, entrepreneurs view costs as value drivers (or inputs) to create value (as a process) or to eventually capture value through successful exit (as the ultimate output). From an early stage, entrepreneurs emphasize return on costs and return on intellectual capital investments (i.e., intangible assets) instead of the traditional return on assets (ROA) or return on equity (ROE), in which profitability is part of

the formula.⁹ Examples include investment in people (training and development, learning and knowledge acquisition) (Mahto et al., 2018) to develop human capital, and in seeking networks and expertise from the higher cost of seeking VC funding (Mahto et al., 2018) as relational capital. This is a new typology that neither the business model, nor the management accounting, nor the MoT literature have addressed. These narratives indicate a different mindset on costs, which is a future-oriented, accountability-driven, optimistic view rather than the short-term, control-oriented, pessimistic approach to which existing practice and literature have alluded. We find this to be a new opportunity for exploration, with the possibility of expanding the current definition of business models in financial reporting to consider technology- and exit-driven business models for fair value accounting and future valuation (Taipaleenmäki and Ikäheimo, 2013). Technology- and exit-driven business models, for instance, are clearly highlighted to be long-term investment oriented. They potentially fall under European Financial Reporting Advisory Group EFRAG, the French Autorité des Normes Comptable ANC, the Accounting Standards Committee of Germany ASCG, the Organismo Italiano di Contabilità OIC and the UK Financial Reporting Council FRC, 2013, European Financial Reporting Advisory Group EFRAG, the French Autorité des Normes Comptable ANC, the Accounting Standards Committee of Germany ASCG, the Organismo Italiano di Contabilità OIC and the UK Financial Reporting Council FRC, 2014) "model [where] fair value accounting is applied with immediate recognition of the gain in profit" (par. B59). With these business model designs, costs are recognized as an investment in intangible assets in the balance sheet that are amortizable as long-term assets using the fair value principle, since the intent is eventual exit through trade sales.

In terms of managerial contributions, this study has a different perspective on investment and strategy for TSU entrepreneurs. Because their focus is on value creation and value capture, practitioners should view costs strategically as a value conduit focusing on the best

⁹ The formula for ROA is Net Profits / Average Total Assets (of 2 periods); ROE is Net Profits / Average Owner's Equity (of 2 periods).

perceived return on cost investments in intellectual capital through utilizing business model portfolios and new approaches to MoT. Current business model frameworks have major limitations in high-tech industries (Snihur et al., 2018), and we show that costs can play different roles in the early years of TSUs. This research also alludes to gaps on costs in MoT literature associated with early stage TSU development. Educators, trainers, and coaches could realign their approaches from purely market-driven business models to technology-driven and exit-driven ones. In regard to costs, they can embrace costs more optimistically with a focus on investment orientation rather than being control-driven. These points are scalable to larger, intrapreneurial settings in which corporations are considering new business models, investments in projects, and MoT.

With respect to limitations, this study sheds light on early-stage TSU strategies and business models and does not address the outcomes about what happens to TSUs at later stages. Additionally, as this study reviews perceptions of TSU entrepreneurs, it does not address how various types of investors, such as business angels, venture capitalists,

private equity, and corporate buyers perceive these strategies based on their experiences.

This research calls for further studies, including a comparative analysis of TSUs that embrace portfolio or single business models; longitudinal studies following TSUs from concept to exit; and research on exited TSUs and how buyers derived value versus how entrepreneurs and investors created and captured value. Furthermore, we suggest further research on incorporating technology- and exit-driven business models into fair value accounting and financial reporting practices.

CRediT author statement

Raffi Chammassian: Conceptualization, methodology, validation, formal analysis, investigation, resources, data curation, writing – original draft, visualization, project administration.

Valerie Sabatier: Conceptualization, validation, writing – review & editing.

Appendix A: Founder and start-up characteristics.¹⁰

	Interviewee Title	Technology	Funding	Interviewee status	Country	
Case 1 Int. 1	Co-founder and CTO	University Technology Transfer (UTT), a medical device startup that monitors the eye's intraocular pressure	3 series	Active	Switzerland	
Case 1 Int. 2	CEO		CHF 52.1M total	Left as CEO to join board	Switzerland	
Case 1 Int. 3	Co-founder and COO			Active	Switzerland	
Case 2 Int. 4	CEO	A research and development biopharmaceutical company specializing in therapies for Alzheimer's disease	4 series	Active	Switzerland	
Case 2 Int. 5	CFO		CHF 84M total			
Case 3 Int. 6	Founder and CEO	A web-based content curation publisher startup that allows individuals to create personalized online newspapers	3 series	Active	Switzerland	
Case 4 Int. 7	Founder and CEO	An unmanned aerial vehicles (UAV) technology based on multiple technologies that deliver specialized information and focuses on measuring and sensing	\$5.1M total	Active	France	
Case 5 Int. 8	Co-founder and CEO	R&D, production and sales and marketing firm specializing in miniature UAVs/drones	2 series	Active	Switzerland	
Case 6 Int. 9	Founder and CEO	A software development and sales company specializing in opinion leader management systems geared towards life sciences pharmaceutical companies	\$5.4M total	Self-funded	USA	
Case 7 Int. 10	CEO	A web-based search engine with a marketing-by-advertising base internet search business model focusing on "natural language search engines".	2 series	Departed	USA	
Case 8 Int. 11	CEO	An R&D company in the semiconductor domain	\$22.5M total	3 series	Departed	Switzerland/ USA
Case 9 Int. 12	CEO	A technology company specializing in micro electrical mechanical systems (MEMS)	\$47M total	3 series	Active	Switzerland
Case 10 Int. 13	Co-founder, chairman and CEO	A biotechnology R&D company specializing in isolating therapeutic targets from different biological material	CHF 24M total	1 series	Active	France
Case 11 Int. 14	Founder and CEO	A web-based service based on the social media/blog concept allowing members to form and contribute to specialized communities	€1M	5 series	Active	USA
Case 12 Int. 15	Co-founder and CEO	A web-based learning management application for various education users	\$14M total	2 series	Departed	Switzerland
				Amount undisclosed		

¹⁰ At the time of the interviews.

Appendix B: Quotes associated with various business models

Technology-driven business models – costs as an enabler:

“I tried to redirect the people to different diseases using the same technology because we thought that their technology was outstanding... In 2003, we had absolutely nothing except a dream to make this medication for what was later Alzheimer's disease—a better technology, which I thought was very powerful... Between July 2003 and July 2006, we created a molecule... to show that the technology works... The American government has chosen this first-ever molecule for a prevention trial for Alzheimer's.” “We don't have sales yet. What we sell is our licenses, but our income is higher than the costs ... depending on how many clinical trials we run and of course, our profitability, in quotation marks, because profitability in the finance sense is going away.” “[Our] cost is basically all linked to science and technology and clinical trials. So, it's only in the innovative part, of course, it is salaries” (Interviewee 4, TSU 2).

“They realized that it's not obvious what to do with that information. That required us to multiply the number of clinical trials to investigate, first of all, to demonstrate the safety of the device, [and] to demonstrate the efficacy of the device.” “Team is core. Team is essential... having a team allowed us to make sure that we are balanced in terms of what is important—money, market, technology” (Interviewee 5, TSU 2).

“We have extremely high KPI in terms of data processed analyzed—KPIs in terms of the power of our technology platform; if I mention, for example, these 200 million different articles per day analyzed semantically.” “For me, the main cost is really, in our business, the people... Our main cost is and always will be people and team and brains.” “People is [sic] investment” and “retention plans is [sic] clearly an investment for us” (Interviewee 6, TSU 3).

“I don't think that there is a massive difference between technology and people... People and technology, in a technology start up, are exactly the same.” “Money, cost, investment, funding, budget, maybe have different shades but can probably be interchanged. That's the point of an [early-stage technology] start-up, because there is no revenue. Whatever goes in goes into a cost... which is an investment.” “Without money, there is no investment, there is no research and development, [and] there is no technical innovation.” “In [a] start-up, most of the costs are related to investment because there is no a clear and regular operation producing income, [and] then the cost is really building assets for the future.” “Costs... [are] how funds or money affect innovation.” “[Does] money impact innovation? Yes, it does” (Interviewee 7, TSU 4).

“Research in bio-inspired mobile robotics, aerial robotics, flying robots... I helped start the drones in academia... I had to develop a lot of pilots... that have now become the core of TSU 5 products.” “At the beginning, I think it was the salaries, because we didn't have to buy big machines or invest in outsourcing or stuff like that. It's still salary—so, people basically.” “We want to make sure that the innovation we create [and] in which we invest are really good in terms of creating value for our customers... [to] minimize the administrative expenses, and we invest a lot into R&D because we want to remain number one for a long time... The biggest costs within the R&D are related to salaries.” (Interviewee 8, TSU 5).

“We were not as interested in making sure we would win a lot of money as we were in having a historical impact, if you wish, to change how surveyors work or change how people look at drones” (Interviewee 8, TSU 5).

“There are two stages in the life of a [TSU] company. The first stage is when you take money and convert it into technology; and the second stage, which is the one that interests us, is when you take the technology and you convert it back into money.” “The semi-conductor R&D industry requires large sums and human capital but also has a very high [cash] burn rate... To solve this really difficult problem, you needed some exceptionally good people.” “There were other costs, but it was primarily salaries... We had pretty high salaries for a start-up... We probably would not have been able to hire the majority of them without offering those salaries... They directly contributed 70% of the budget.” “The intention was not to make [products] ourselves, there are enough companies losing money making [products] without adding another one. But instead, we wanted to license the technology and therefore, I hope for a better chance to have a profitable business model than if we were in the [product] business, which is renowned as a not very profitable business” (Interviewee 11, TSU 8).

“Cost isn't usually ‘I'm throwing money outside my window.’ It usually means I'm spending something to build a better business.” “[People costs are] my investment. So, if I go and hire someone (engineers are very expensive here in Silicon Valley), when you first do it, all you do is the cost... It comes down to people. It's the investment in your teammates” (Interviewee 14, TSU 11).

“When we invested, we wanted to make sure that we get something back. So that was primarily employees or employing more people. This means that we could develop our products, better products, more secure.” “The biggest assessment... was investing in people.” “It was never, from day one until we sold the company, cost was never looked upon as a burden, as a factor that reduced our own view of success or not, which meant we never measured a major issue, even knowing that it was important.” “Seventy to 75% of total costs were salaries” (Interviewee 15, TSU 12).

Market-driven business model – cost as a moderator:

“The cost of the product, the cost of production. It's really my focus to reduce the costs, because... the cost of the product for the patient and for the doctors, in other words, what they pay and to put a price on it, is not easy... Obviously, if you can reduce the production cost, you can reduce the sales price and the cost of the product for the patient and the doctors” (Interviewee 1, TSU 1).

“It's a razor blade model, so we open centers and then the centers keep reusing the device, consuming the lenses, which is a single-use contact lens” (Interviewee 2, TSU 1).

Exit-driven business model – cost as a mediator:

“[Our] exit strategy [was] basically [to] create the company then sell it... We always knew that we wanted to build a sustainable company with an appreciation value that would not be flipped in a year or a few months, and therefore, we needed to understand and articulate our paths to liquidity, acquisitions, and potential targets for being acquired.” “[This investment should produce a] return on our costs” (Interviewee 5, TSU 2).

“The acquisition value went to the technology, the platform infrastructure that we had built, and a certain portion of the value went to acquire a really amazing team of people that we have assembled.” “We almost never had revenue by the time we were acquired... We always knew what our revenue generation model was, but we never got to the point of having enough traffic to generate any significant amount of revenue from such a deal” (Interviewee 10, TSU 7).

“Once you take in funding of a major amount of money, which they [original founders] had, you have to deliver on time something that's exit worthy for the investors; otherwise, it's not going to be a success... It had to make money for the investors. If it solved the problem but didn't make money, it was going to be a failure. If it made money but didn't solve the problem, it could still be a success” (Interviewee 11, TSU 8).

“Set aside moral goals—the will to do good—the real customers are basically the buyers of the company—Building this company, we'll [be] developing this product so it can interest someone in buying us” (Interviewee 12, TSU 9).

“When I invest one dollar into this, I essentially get back some combination of money, intrinsic value, and enterprise value... Even though you're spending and you're increasing monetary risk, you're starting to do what you're supposed to do as a start-up, which is spend money to make money”

(Interviewee 14, TSU 11).

Portfolio business model – cost as a mediator:

“The semi-conductor R&D industry requires large sums and human capital but also has a very high [cash] burn rate... To solve this really difficult problem, you needed some exceptionally good people.” “This wasn't going to be solved by a few students. So, we had an average age of 45 on the engineering team.” “Once you take in funding of a major amount of money, which we did, you have to deliver on time something that's exit worthy for the investors. Otherwise, it's not going to be a success. They [investors] don't have infinite time.” “We started to approach potential licensees. In fact, we did a deal with a major manufacturer for embedding the technology on their processor chips. We did a major [license] deal with another multinational...then we started a joint development with them.” “Technology looked very exciting. It was what I would call a sort of long shot because if this company succeeded, it would either be a billion-dollar company or nothing at all. There was no in-between.” “It [the patents] was a good thing. In the end, it turned out to be pretty helpful for getting some exit money” (Interviewee 11, TSU 8).

“Research in bio-inspired mobile robotics, aerial robotics, flying robots... I helped start drones in academia... I had to develop a lot of pilots... that have now become the core of TSU 5 products.” “Team is core. Team is essential... Having a team allowed us to make sure that we are balanced in terms of what is important: money, market, technology.” “We want to make sure that the innovation we create, what we invest in, are really good in terms of creating value for our customers.” “[Product performance is] being able to deliver, to pass R&D effort into product... [and] the main driver of having a product.” “Since we looked at growth and it was really growing fast, we preferred to sell [the TSU] right away.” “It was helping each other in terms of ramping up, industrialization and R&D.” (Interviewee 8, TSU 5)

“[Our TSU] became the Windows-like application for education in universities, in primary and secondary schools, and in special schools.” “It was quite easy to sell the concept because we're talking about upscaling the business quickly, internationally.” “To us, growing the company meant to increase the revenue, increase the market penetration, and increase the coverage, which meant entering new markets...; [however,] cost is as important as revenue.” “From day one until we sold the company, cost was never looked upon as a burden, as a factor that reduced our own view of success, which meant we never measured a major issue, even knowing that it was important” “When we sold, we realized there is a different world in the corporate sector, where [the focus is on] net profit and how much.” (Interviewee 15, TSU 12).

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