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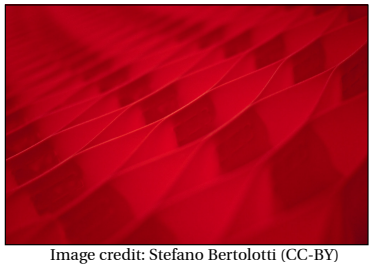

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Insights

Welcome to the June issue of the Technology Innovation Management Review. We invite your comments on the articles in this issue as well as suggestions for future article topics and issue themes.

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Overview
The Technology Innovation Management Review (TIM Review) provides insights about the issues and emerging trends relevant to launching and growing technology businesses. The TIM Review focuses on the theories, strategies, and tools that help small and large technology companies succeed.

Our readers are looking for practical ideas they can apply within their own organizations. The TIM Review brings together diverse viewpoints —from academics, entrepreneurs, companies of all sizes, the public sector, the community sector, and others —to bridge the gap between theory and practice. In particular, we focus on the topics of technology and global entrepreneurship in small and large companies.

We welcome input from readers into upcoming themes. Please visit timreview.ca to suggest themes and nominate authors and guest editors.

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Contribute to the TIM Review in the following ways:
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About TIM

The TIM Review has international contributors and readers, and it is published in association with the Technology Innovation Management program (TIM; timprogram.ca), an international graduate program at Carleton University in Ottawa, Canada.

Editorial: Insights

Stoyan Tanev, Editor-in-Chief and Gregory Sandstrom, Managing Editor

Welcome to the June issue of the *Technology Innovation Management Review*. This issue brings together a mixture of "Insights" into technology entrepreneurship, value proposition development, business strategy analysis, employee-driven innovation, digital economy crowdfunding, technology adaptation and survival of small and medium size enterprises (SMEs).

The issue starts with a paper by **Saurav Pathak** & **Etayankara Muralidharan**, "A Two-Staged Approach to Technology Entrepreneurship: Differential Effects of Intellectual Property Rights". The authors bring a helpful inter-continental perspective in highlighting the importance of value capture through technology entrepreneurship and innovation. The paper presents a two-stage process that involves access to and use of new technology and technological resources by entrepreneurs, as a way of "understanding the effect of strong IPR regimes on different stages of the innovation process" (p. 5). According to the authors, although IPR regimes may at first suppress the ease of accessibility to the latest technologies for entrepreneurs, if such technologies are eventually made available to them, stricter IPR regimes will likely augment their use in developing technology entrepreneurship innovation.

In "What Makes Value Propositions Distinct and Valuable to New Companies Committed to Scale Rapidly?", **Tony Bailetti, Stoyan Tanev** & **Christian Keen** continue the TIM Review's focus on value propositions in the context of early and rapidly scaling high-tech companies. Here they address the importance of having a portfolio of value propositions that align with company scale-up strategies. They claim that there are two features in particular that make value propositions of new companies distinct: 1. business transactions between the company and its external stakeholders, and 2. investments to create and improve company's value propositions. The paper discusses the features that make a value proposition distinct from other new company resources, along with the factors that make it valuable or beneficial to a company.

The following paper, "Is Porter's Five Forces (P5F) Framework Still Relevant? A study of the capital/labour intensity continuum via mining and IT industries", by **Diane Isabelle**, draws upon the work of her former students **Kevin Horak, Sarah McKinnon** & **Chiara Palumbo**. Isabelle and the students continue the work of Michael E. Porter on business strategy analysis to offer a modified framework augmented by four additional forces: the competitor's level of innovativeness, exposure to globalization, threat of digitalization, and industry exposure to de/regulation activities. They claim that the augmentation is needed because "in this era of internationalization, global value chains, a relentless pace of innovation, and changing regulatory environments, additional forces are applicable to both capital and labor-intensive industries" (p. 37). The paper notes one of its constructive aims of "inciting managers, entrepreneurs, and policymakers to monitor the global business environment of specific industries beyond the traditional five forces to help avoid flawed decision-making" (p. 29).

Next, **Chukwuemeka K. Echebiri** presents "An Empirical Study into the Individual-Level Antecedents to Employee-Driven Innovation (EDI)". Echebiri notes that "organizations today expect more creativity, innovation, and involvement from employees in the rapidly changing business environment" (p. 42). The paper therefore charts a path to understand EDI through an analysis of self-leadership, the need for autonomy, and overall job autonomy. The research was conducted through a survey of 315 banking sector employees. One of the takeaways from the paper is that employees with a high need for autonomy are in a better position to self-lead themselves,. The paper looks at both individual and organisational levels, pointing out that "[i]dea development and implementation require a level of self-leadership on the part of employees that runs beyond resources and other factors associated with the organizational domain" (p. 49).

The next two papers are a continuation of the previous special issue on digitalization and internationalization (https://timreview.ca/issue/1341). In "Fundraising Campaigns in a Digital Economy: Lessons from a Swiss Synthetic Diamond Venture's Initial Coin Offering (ICO)", **Jahja Rrustemi** & **Nils S. Tuchschmid** raise challenging cutting-edge issues involving the financial industry, crowdfunding, venture capital, and cryptocurrencies. They provide a brief introduction to blockchain distributed ledger technology, asset tokenization, and token sales, one of which they tracked in Switzerland. According to the authors the method of 'tokenization' seems to be a way for digital economics to be actualised in practise. The paper closes by briefly exploring technology aspects going beyond ICOs, with the newer security token offerings (STOs) and initial

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exchange offerings (IEOs), within the rapidly changing area of fintech. The paper reveals an approach to potential near-future "entrepreneurial finance" with digitalization, while also addressing the moral hazard in how many ICOs were conducted from 2016-2018. At issue is whether ICOs, STOs, IEOs (or perhaps something newer on the horizon that gets it "just right") constitute "truly innovative and revolutionary capital raising models for investors" (p. 61).

The final paper is "Technology Adaptation and Survival of SMEs: A Longitudinal Study of Developing Countries" by **Supriyo Das, Amit Kundu** & **Arabinda Bhattacharya**. The authors point out that technological development plays a pivotal role in making small and medium enterprises (SMEs) competitive, as well as leading to sustainable growth. The paper thus focuses on sustainability and technology readiness, as well as technological environments in countries with emerging economies, particularly using data from the Global Competitive Index Report (2012-2016). According to the authors, a technological environment is defined by both "institutional capabilities" and "external capabilities". The paper notes that "sustainable SMEs in developing countries are strongly dependent on technological environments that are resilient and adaptive to the high level of technological volatility at the present time" (p. 69-70).

The TIM Review currently has a Call for Papers on the website for a special edition on "Aligning Multiple Stakeholder Value Propositions". For future issues, we invite general submissions of articles on technology entrepreneurship, innovation management, and other topics relevant to launching and scaling technology companies, and solving practical problems in emerging domains. Please contact us with potential article ideas and submissions, or proposals for future special issues.

Stoyan Tanev, Editor-in-Chief
Gregory Sandstrom, Managing Editor

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Keywords: Innovation, technology, entrepreneurship, intellectual property rights, Value proposition, scaling-up, value proposition alignment, scaling company value, new company, Porter's Five Forces framework, internationalization, mining industry, IT industry, regulation, Employee-driven innovation, self-leadership, need for autonomy, job autonomy, financial industry, crowdfunding, venture capital, ICOs, token sales, blockchain, distributed ledger technology, tokenization, crypto assets, cryptocurrencies, token offering, Ethereum, Bitcoin, fintech, STO, IEO, entrepreneurial finance, signaling, moral hazard, SME, sustainability, technology readiness, technological environment, developing countries.

A Two-Staged Approach to Technology Entrepreneurship: Differential Effects of Intellectual Property Rights

Saurav Pathak & Etayankara Muralidharan

> *"Intellectual-property rules are clearly necessary to spur innovation: if every invention could be stolen, or every new drug immediately copied, few people would invest in innovation. But too much protection can strangle competition and can limit what economists call 'incremental innovation' - innovations that build, in some way, on others."*
>
> James Surowiecki
> American Journalist

In this article we examine how the strength of the intellectual property rights (IPR) regime drives technology entrepreneurship innovation (TEI). The latter is comprised of novel unfamiliar technological products and new business models, which in turn lead to new product-market combinations. We consider TEI to be a two-stage process that involves access to and use of new technologies and technological resources by entrepreneurs. While stronger IPR may constrain easy availability of new technologies and technological resources for entrepreneurs, using technology itself helps lead to TEI. We suggest that stronger IPR regimes could lead to TEI. The positive effect of TEI is felt through easier accessibility to the latest technologies and technology resources by entrepreneurs. Our model contributes to understanding the effect of strong IPR regimes on different stages of the innovation process.

Introduction

Technology entrepreneurship (TE), as defined by Bailetti (2012), involves assembling and deploying specialized knowledge and heterogeneous assets to advance knowledge that captures value for the entrepreneur. From this, we infer that value capture through TE involves the use of technology by entrepreneurs to develop innovations, such as or through novel unfamiliar technological products (goods or services), as well as new business models that lead to new product-market combinations (Giones et al., 2013; Pathak et al., 2013; Pathak et al., 2014; Westerlund et al., 2014). The above is in line with the economist Joseph Schumpeter's theory of entrepreneurship (Schumpeter, 1912), wherein invention is considered as the creation of new ideas, which are turned into technologies, and innovation is commercialization or recombination of technology into marketable forms of production.

In this article we define such innovations as technology entrepreneurship innovation (TEI) and use this term interchangeably with entrepreneurial innovation and/or just innovation, throughout. Further, since entrepreneurial behaviors may in part be shaped by the context in which such behaviors are performed (Welter, 2011), the guiding question of this article is: *How does an intellectual property rights (IPR) regime, as a national level contextual factor, drive TEI?*

Extant literature offers mixed evidence on the influence of Intellectual Property Rights (IPR) on TEI. Acs and Sanders (2008) suggest that strong IPR can stifle commercialization (by entrepreneurs) by putting too much power in the hands of inventors. Studies from this perspective suggest potential negative effects of strong IPR on TEI (Autio & Acs, 2010). From a different perspective, the more conventional view (from neo-classical economics) suggests that the IPR regime provides incentives for inventors to invent more, by allowing them to recoup their investments in research and development (R&D) (by extracting value from monopoly rights over invention or innovation). Studies that follow the conventional view consider inventions as public goods and therefore posit a positive association between strong IPR enforcement and TEI (Estrin et al., 2013; Hartmann, 2014).

A Two-Staged Approach to Technology Entrepreneurship: Differential Effects of Intellectual Property Rights *Saurav Pathak & Etayankara Muralidharan*

Highly stringent IPR regimes may therefore hinder knowledge spillover effects that could be critical for TEI. On the other hand, the stringency of IPR regimes and the value they may have for a technology entrepreneur's utility maximization could be an incentive that motivates more and more entrepreneurs to engage in TEI. The contrasting inferences involved suggest that probably more needs to be understood about the IPR-TEI relationship in order to predict the influence of IPR on TEI more accurately. One of the reasons that could contribute to the above contrasting inferences could be how we conceptualize the process of making TEI, which could then help understand how IPR influences TEI.

In a bid to do so, we approached the conceptualization of TEI from a stage-based perspective —that TEI as we know or define it may be the end outcome, but that it progresses through stages. Each stage is influenced differently by IPR. In this regard, we posit that TEI is a two-staged process: (a) first, involving *accessibility* to the latest technologies by entrepreneurs, and thereafter, (b) the *use* of the new technologies in TEI. The way IPR regimes influence the above two stages will then determine the overall influence of IPR on TEI.

In short, we attempt in this paper to resolve the mixed influences of IPR by offering a process-based approach to technology entrepreneurship. The paper proceeds by reviewing prior studies that have examined technology use in entrepreneurship, entrepreneurial innovation, and the influence of IPR. We then introduce our two-stage conceptual model, discuss the implications of our study for future research, and conclude.

Theory Background

Innovation as a stage-based process

Innovation can be considered as an idea, a product, a program, or a technology that is new to the adopting organization (Rogers & Shoemaker, 1971). Many scholars have suggested that the process of innovation diffusion is stage-based. Rogers (1995) suggested five stages: knowledge, persuasion, decision, implementation, and confirmation.

In studying innovations in organizations, scholars have been typically interested in the stages of initiation, adoption, and diffusion of innovation (Nystrom et al., 2002). Information technology innovation adoption in organizations is considered as a sequence of stages that progress from initiation to adoption-decision to implementation (Hameed et al., 2012). Further, in arguing that innovation is a sequence of stages, rather than an event, scholars have suggested that there are different concerns at the various stages (Greenhalgh et al., 2008). Therefore, antecedents of innovation may have different effects at these various stages. In discussing initiation, adoption decision, and implementation of innovations as key phases in innovation adoption, Damanpour et al. (2006) argue that environmental, organizational, and managerial characteristics have different effects at these several stages. We now examine **entrepreneurship** as a stage-based process in **technology innovation**.

Entrepreneurship as a stage-based process

We draw insights from studies on the life-cycle of new ventures that entrepreneurial activity is also stage-based. Reflecting on the dominant problems during a venture's growth process, Kazanjian and Drazin (1990) suggested four stages in the life cycle of new ventures: conception and development, commercialization, growth, and stability. Similarly, other studies have empirically distinguished gestation, infancy, and adolescence as key stages of the life-cycle of new ventures (Korunka et al., 2003). With the aim of helping entrepreneurs navigate through transitions during the life-cycle of their businesses, and focusing on high-technology ventures, Hanks and colleagues (1993) demonstrated using cluster analysis that each life-cycle stage consists of a unique configuration of factors relating to organizational context and structure. Bhave (1994) created a more granular process-based model of entrepreneurial venture creation, also dividing it into four stages: opportunity stage, technology set-up stage, organization-creation stage, and exchange stage. The stages entailed in the entrepreneurial process can therefore be demarcated by key transition points such as, business concept identification, commitment to begin, production technology set-up, and the first actual sale. In our conceptualization we suggest TEI to be a two-stage process, that is, 1. entrepreneurs accessing new technology or new technological resources, and 2. entrepreneurs using technology for TEIs.

Technology accessibility and TEI

Whether entrepreneurs develop new technologies or use the latest ones in their ventures, having access to such technologies is itself important for entrepreneurs engaged in TEI (Fagerberg, 1987). Knowledge spillovers are among the most important drivers of TEIs (Pathak et

al., 2013). Entrepreneurs' talents and abilities to exploit spillovers from extant technological and knowledge bases leads to innovations (Acs & Audretsch, 1988). Lack of access to new technology constrains entrepreneurial intentions and reduces expectations of net gains from entrepreneurial behavior (Pathak et al., 2013). It is also suggested that using the latest technologies for generating innovations may help entrepreneurs achieve competitive parity with incumbents (Fleming, 2001).

In sum, while most innovations in goods and services result from awareness and imitation of existing resources (Glass & Saggi, 2002), the key to TEI may well be the ease of accessibility and usage of new technologies. Extant literature views national institutions as providing the incentive structures that signal the accessibility and degree of ease with which technology entrepreneurs can acquire, mobilize, blend, and recombine resources to introduce TEIs in the market (Douglas & Shepherd, 2002). Specifically, policies concerning IPR are particularly important in that they can either foster or deter TE.

Intellectual property rights and technology entrepreneurship

While the value of intellectual property is central to the strategy of technology companies (Henry, 2011), the extent of IPR enforcement could simultaneously facilitate and constrain TE (Pathak et al., 2013). When IPR regimes are strict, technology entrepreneurs perceive that their TEIs are protected from competitors (Acs & Sanders, 2008). It may also enhance an entrepreneur's access to investment capital from risk averse sources (Pathak et al., 2013). On the other hand, strong IPR regimes may restrict accessibility to the latest available components and resources, by increasing early costs and reducing access to key technologies (Autio & Acs, 2010), thus impeding the imitative and re-combinatory processes that yield TEIs (Fleming, 2001). Specifically, high costs could deter TEIs from entrepreneurs' quests to exploit new combinations of technology resources strongly protected by IPRs (for example, patented or copyrighted components) (Pathak et al., 2013). In view of the above mixed effects regarding the strength of IPR on TEI as observed by extant research, it may be that the IPR regime's design relevant to the stage at which the innovation is in matters more. In short, strong IPR could be good for all, if it is designed with both the interests of incumbents and new entrants in mind. In the next sections, we develop propositions that comprise our model regarding the influence of IPR on TEI.

Proposition Development

IPR and technology accessibility for TEI

The knowledge spillover theory of entrepreneurship suggests that endogenous forces first create knowledge, and then spillovers allow entrepreneurs to spot such knowledge and exploit opportunities (Acs et al., 2009). It is therefore the entrepreneur's talents and abilities to exploit such knowledge spillovers from an extant knowledge base that lead to innovations through recombinatory processes, despite incumbent firms bringing new technologies to the market (Acs & Audretsch, 1988). However, the success of such entrepreneurs may in part depend on easy access to high technology products, services, or inventions that are owned or controlled by others. Specifically, the strength of a country's IPR regime influences the ease or difficulty of acquiring someone's innovations from that country (Pathak et al., 2013). Whereas a softer IPR regime that ensures easy access to the latest technological resources could foster entrepreneurial intentions, one that is too stringent may stifle them because of accessibility barriers, or high transaction costs.

For instance, while 3D printing technology is considered to have the potential to change the overall manufacturing paradigm (Hahn et al., 2014), patents on 3D printing technologies have been cited as expensive for startup entrepreneurs to access. On the other hand, the availability of free Apache server software and open source Java language and other tools for download, makes it relatively easy for an entrepreneur to start a website. Combined with easy access to payment services, such as Paypal, crowdsourcing such as Kickstarter, and labour from platforms like Upwork, entrepreneurs have never had easier access to such resources to start a business.

When an entrepreneur attempts to access the latest technology in order to develop innovations that compete directly with a former employer (that is, spin-outs), maximum damage may be caused to the incumbent(s). This can lead the incumbent(s) to respond defensively, by enacting lawsuits, or applying economic pressure through networks. In particular, institutions such as IPRs offer incumbents legal tools to impose heavy costs on new entrants.

In summary, strong IPR regimes may restrict

accessibility to the latest technology by entrepreneurs who are searching to exploit new combinations or variations of patented and copyrighted components (Pathak et al., 2013).

Proposition 1: *Stronger IPR regimes decrease accessibility to the latest technologies and technological resources by entrepreneurs.*

Technology access and TEI

Explaining the process of innovation as he experienced it during his discovery-making process, Schumpeter (1939) pointed out that innovation is a kind of recombination that involves reconstituting existing resources to create new ones. Nelson and Winter (1982) wrote that, "innovation combines components in a new way, or … consists in carrying out new combinations". Access to the latest technologies may therefore be a prerequisite for TEI.

Many internet companies are "born global" ventures. As a result, they can often access the latest technologies to source, sell, and market their products, and even develop new ones (Tanev, 2012; Rasmussen & Tanev, 2015). For example, the easy accessibility of crowdfunding such as Kickstarter allows for the possibility of quick financing (Gedda et al., 2016), electronic job markets allow for specialized employment to be contracted efficiently (Upwork), online 3d printing services allow for small batches of products to be produced (Shapeways), online shopping sites allow for easy access to global buyers (eBay and Amazon), and marketing automation software allows for broad communications reach.

By contrast, without access to the latest available technologies and technological resources, entrepreneurs instead must pursue limited markets. Again, as suggested by knowledge spillover theory, knowledge spillovers from incumbents provide technological opportunities for new entrepreneurs. Such opportunities are among the key drivers of technological change and economic growth (Kydland & Prescott, 1982). Entrepreneurs with easy access to such know-how are more likely to introduce innovations that incumbents have overlooked (Acs et al., 2009).

Proposition 2: *Easy access to the latest technologies and technological resources by entrepreneurs increases TEI.*

IPR, TEI, and the mediating role of technology access by entrepreneurs

Successful TEI, as per knowledge spillover theory, may in part depend on the availability of high technology resources owned or controlled by others. The strength of an IPR regime influences the ease or difficulty in acquiring these resources by new entrepreneurs for recombination purposes, which leads to new product-market combinations. As mentioned earlier, TE is the process where new applicable knowledge (technology and technological resources) is used by entrepreneurs to create value by developing new product-market combinations. The success of such entrepreneurship is therefore contingent upon accessibility to the latest state of the art technologies and technological resources.

Since the strength of the IPR regime in a country influences the ease or difficulty of acquiring someone else's innovations for recombination purposes, IPR as a contextual influence has a key role in facilitating entrepreneurs' success in effecting TEIs. In particular, IPRs regimes need to provide access to the latest technologies and technological resources for new entrepreneurs, at the same time without these entrepreneurs being in direct competition with the incumbents. Targeting markets that are saturated with similar products is problematic because small entrepreneurs have big disadvantages as compared with large, established companies. In particular, greater access to these technological resources by incumbents is usually enough to allow them to use price wars, exclusive contracts, buyouts, and other such tactics to get rid of the threat of new ventures.

Thus, entrepreneurs are better off to target customers with new products or to target new customers with existing products through effective recombinations of incumbents' technology or technological resources. These, if successfully deployed by a new venture allow it to avoid direct competition with incumbents. For instance, Bower and Christensen (1996) refer to disruptive innovations as those that cater to marginal customers and non-consumers, rather than the mainstream or best customers of incumbents. In the above circumstances, once the latest technologies are accessible by an entrepreneur, strong IPR shifts from being a burden on access to technology and technological resources, to being an asset that helps the entrepreneur protect a new venture and its investments.

At this point, the benefits to incumbents now become available to the innovative entrepreneur as well. Hence,

for a strong IPR regime to facilitate TEI, the latest technologies and technological resources must be easily accessible to entrepreneurs from the start. In other words, the influence of a strong IPR regime on TEI is indirect, and mediated by the positive influence of the IPR regime on entrepreneurs' access to the latest technologies and technological resources.

> **Proposition 3:** *The positive effect of stronger IPR regimes on TEI is indirect, and mediated by an entrepreneur's easy access to the latest technologies and technological resources.*

Our conceptual model is presented in Figure 1 below.

Discussion

As evidence mounts that innovation is a key link between entrepreneurship and economic success leading to growth, scholars have started to narrow in on the antecedents of TEI. This offers fertile ground for new theory development on the contextual influences involved. IPR and their regimes of enforcement have varying effects on different forms of entrepreneurship. Stage-based models of entrepreneurship (Wood & McKinley, 2010) suggest that research examining entrepreneurial behaviors needs to be specific about the stage that is being studied. While Giones and Miralles (2015) discuss the influence of technology in the two main activities or stages of the entrepreneurship process, that is, value creation and value capture, we present a stage-based approach to TEI that has promise to disentangle the inconclusive nature of the influence of IPR regime strength on TEI. We argue that stricter IPR regimes suppress easy accessibility to the latest technological resources by entrepreneurs, yet if the latest technological resources could be made accessible to entrepreneurs, then stricter IPR regimes would augment using those latest technological resources in TEIs.

In other words, the influence of IPR on TEI is felt via its influence on the easy accessibility of the latest technologies by entrepreneurs in the first place. Combining the two stages into one (as considered in previous research) we believe could be why there were mixed findings regarding the influence of IPR on TE. TE may have been considered from a new product development point of view (as an outcome) rather than being considered as a process. Firms or technologies have been predominantly the level of analysis, but seldom the individual's feasibility of using the latest technologies and the ability to combine them into new products and markets (Giones & Brem, 2017). Thus, our model suggests that the same institutions can have differing effects across various types of entrepreneurial behaviors.

As such, our proposed model offers several contributions to the entrepreneurship literature examining contextual influences. It contributes to theory building by establishing a way to consider the influence of IPR on technology entrepreneurship using a process perspective (Bailetti et al., 2012). The model specifically contributes to the emerging literature on innovative forms of entrepreneurship, rather than seeking to predict rates of entrepreneurship in general. A specific focus on innovative entrepreneurs allows for a more fine-grained analysis of institutional influences. Our conceptual model demonstrates that the same institutions can have different or even opposite effects on various stages of entrepreneurship.

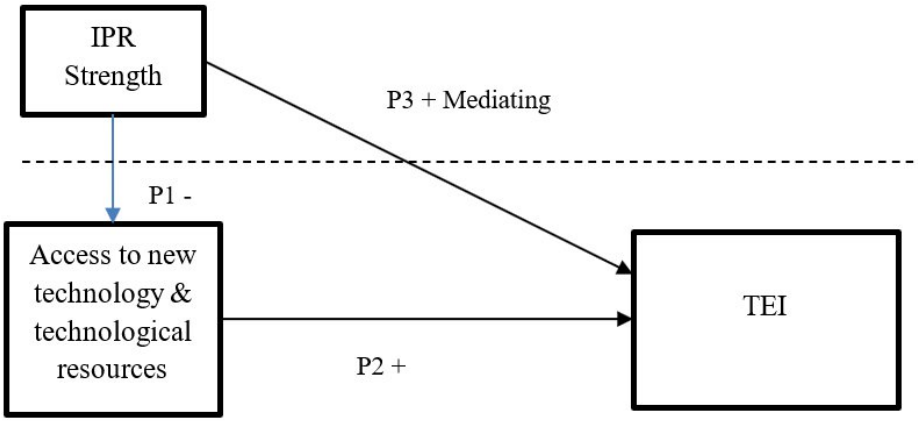

Figure 1. Mediation Model

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Implications for policy and practice

Innovation and entrepreneurship are often seen as important and required factors that contribute to growth in society (Braunerhjelm et al., 2010). Policy makers, while talking about 'innovation systems', 'innovation strategies', 'innovation systems', etc., emphasize the role of R&D in the advancement of new knowledge, yet may also give insufficient attention to the aspects of growth in society such as commercialization and business creation (Landström et al., 2013). Our conceptual framework, while emphasizing the business formation aspect, implies that policy-makers can adjust the strength of IPR in favor of innovative entrepreneurs, though it comes at the expense of less innovative entrepreneurs.

Implications for practice are relevant to entrepreneurs themselves. Entrepreneurs should first recognize what importance the use of the latest technologies has for their ventures. This is important so that they can become candidates for more innovations. Once they have attained a technology setup that utilizes the latest available technologies and resources, they can focus on innovation, such as pursuing new product-market combinations. In particular, at this stage, IPR shifts from being a burden on access to the latest technological resources and components, to being an asset that helps the firm protect its investments.

Thus, when thinking and researching about IPR to gain access to technology, entrepreneurs should not be too deflated, as it is likely they will be able to benefit from IPR too, in due time. This is particularly relevant when studying the effects of IPR across countries. IPR may have differential influences across developed and emerging economies. Emerging economies often lag in technology and may have barriers to technology adoption that prevent their indigenous entrepreneurs from acquiring and using the latest available technologies in their ventures.

Future Research

Future research examining the influence of contextual factors on entrepreneurial behaviors may need to be specific about the type of behavior being studied. For example, IPR support in a startup ecosystem may be adapted to different types of high-technology startups (Wallin et al., 2016). Further, policy implications drawn from such studies, if they are based on crude measures of entrepreneurial behaviors, may be counter-productive, depending on the type of entrepreneurship that is desired.

Our conceptual model could be strengthened by incorporating other formal institutions, such as regulations, the role of a country's political system (Laplume et al., 2014), and informal institutions that are culturally embedded (Pathak & Muralidharan, 2016; Muralidharan & Pathak, 2017; Muralidharan & Pathak, 2018). Further, acquiring licenses to older technologies may also be considered a viable strategy for TE, although this strategy needs to be properly evaluated to avoid issues that could outweigh perceived value (Smith, 2013). The availability of older technologies and their potential value may also be considered in our conceptual model by future research. Innovation processes are different for complex products and systems compared to mass-produced consumer products, where most of the conventional wisdom on innovation resides (Hobday et al., 2000). In the innovation processes of such systems, the user and the developer are mutually involved in the innovation processes (Hobday et al., 2005).

In considering our model, future research may need to clearly distinguish entrepreneurs (as developers and users of new technology) from those that source and use new technologies for TEIs in theorizing the role of IPR regimes. Inter-firm collaborations could serve to reduce the costs for adopting new technologies by TEI entrepreneurs. For example, transaction costs to access new technologies may be reduced through modern patent pools, where a patent pool is an agreement between two or more parties to license their patents to one another (Vakil, 2016). Similarly, as part of strategy, firms can make their IPRs available to others for use at a low cost in order to facilitate complementary innovations, such as in the case of open source software (Wen et al., 2015). Subsequent research may need to factor in the above conditions for future theorizing. Finally, our model assumes that the process of TEI necessarily uses new technology and technological resources. Future conceptualization may need to factor in disruptive innovations where entrepreneurs with fewer resources were able to successfully challenge established businesses (Christensen et al., 2015).

Conclusion

IPR in particular seems to be an incumbent's game. They get the lion's share of the benefits created by IPR. However, in understanding TE as a stage-based process, in this paper we suggested that although IPR regimes may at first suppress the ease of accessibility to the latest technologies for entrepreneurs, if such technologies are

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eventually made available to them, then stricter IPR regimes will likely augment their use in developing TEI. Having easy access to the latest technologies is therefore an important precursor for entrepreneurs to TEI. Once an entrepreneur gains access to the latest technologies and begins to innovate, institutions often shift from being constraints to the entrepreneur into being facilitators.

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What Makes Value Propositions Distinct and Valuable to New Companies Committed to Scale Rapidly?

Tony Bailetti, Stoyan Tanev and Christian Keen

> *"Consistent alignment of capabilities and internal processes with the customer value proposition is the core of any strategy execution."*
>
> Robert Samuel Kaplan
> Emeritus Professor of Leadership Development,
> Harvard Business School

One of the most valuable resources a company owns is the "portfolio of value propositions" to its diverse external stakeholders, such as customers, investors, and resource owners. In this article, we fill a gap in the value proposition literature by identifying features that make the value propositions of new companies different from other resources, along with factors that make them valuable. A value proposition is conceived as being what enables and improves business transactions between a new company and external stakeholders. We reason that two features in particular make value propositions of new companies distinct: (1) business transactions between a new company and one or more external stakeholders, and (2) investments to create and improve a new company's value propositions that enable business transactions. We provide a definition of "value proposition" and postulate that a value proposition will benefit a new company when it: (1) strengthens the new company's capabilities to scale; (2) increases demand for the new company's products and services; and (3) increases the number, diversity, and rapidity of external investments in the new company's value proposition portfolio.

Introduction

We focus in this paper on value propositions for external stakeholders created by new companies that are committed to scale, that is, to growing the amounts they are worth rapidly. For example, a company that grows its value from $0 to $1 billion in less than ten years is a company that scaled. Scaling company value is the guiding principle that these focal companies use to manage their internal affairs, as well as their interactions with external stakeholders. For these new companies, the value propositions that matter most are those that help them scale, and value proposition portfolios for their stakeholders are their most valuable assets.

The purpose of this article is to identify (1) features that make a value proposition for an external stakeholder different from other new company resources, and (2) factors that make a value proposition beneficial to a new company committed to scale.

Important contributions have been made to improve our understanding of the value proposition concept since it was first introduced in 1983 (Lanning & Michaels, 1988; Lanning, 2020). While these contributions have been widely discussed and cited (Goldring, 2017; Payne et al., 2017; Eggert et al., 2018; Wouters et al., 2018; Payne et al., 2020), we find it difficult to understand what the features are that make a value proposition distinct from other company resources, what the factors are that make a value proposition for external stakeholders valuable, and how new companies that wish to scale can cost-effectively develop, communicate, and deliver value propositions.

Most of the extant research on value propositions focuses on established companies, rather than new companies committed to scale. These studies implicitly assume that a company that can invest in refining or enhancing its value propositions already has an established customer base, distribution channels,

knowledge of the markets, and efficient business relationships with suppliers, investors, and other external stakeholders. However, the reality that new companies face when developing value propositions is far messier, particularly what is faced by those new companies that are capital-asset light (they own no or only a few assets), and yet still wish to scale their company value rapidly.

In addition to the challenges that new companies face to access, combine, deploy, and align internal and external resources (Bussgang & Stern, 2015; Kaartemo et al., 2018; Clough et al., 2019), they have to convince a diverse set of external stakeholders that the company's value propositions will benefit them over the short-, medium- and long-term. The context of new companies committed to scaling thus requires a better understanding of what is special about the value proposition concept, and what factors affect the value of a value proposition.

New companies committed to scale need to operate across borders, innovate relentlessly, profitably adopt emerging technologies, and execute capital investment programs that enable them to meet aggressive growth objectives. The successful operations of such companies depend on their constructive engagement with multiple external stakeholder groups. Each stakeholder group has unique needs and objectives. The multiplicity of critically relevant external stakeholders necessitates the formulation of multiple valuable propositions that target very different groups with dissimilar roles, needs, and priorities.

Managing a "portfolio of diverse value propositions" requires the development of company capabilities that can configure internal and external resources in a way to deliver promises made to the different external stakeholders, as well as achieve the objectives of the company's master scaling plan. New companies that wish to scale rapidly require value proposition development capabilities that go beyond the ones required by companies that have small or moderate growth objectives. Diverse value propositions, all having a logic to scale early and rapidly since inception, must be developed. Each value proposition must then be aligned with the value propositions of all other key stakeholders, as well as with the new company's pathway to scale.

Most of the resources that an asset-light company uses to scale rapidly at early stage of its development are owned by external organizations. Quite often, these new companies develop value propositions for investors and resource owners before they operationalize customer value propositions. Most companies that manage to scale rapidly advocate shaping their investor value propositions as much as they advocate their customer value propositions. Clearly a multiple external stakeholder approach to value proposition development, communication, and delivery is required, rather than just an approach that focuses predominantly on customer value propositions and related customer transactions.

An implicit assumption of our research is that one of the most valuable resources (perhaps the most valuable resource) that a new asset-light company owns is its portfolio of value propositions to diverse external stakeholders. Yet, the conceptualization of what makes a value proposition itself valuable has received little attention in the literature.

In response to this, the article is organized as follows. We first identify the gap in the literature that later we attempt to fill. Next, we identify features that make a value proposition distinct for an external stakeholder, as well as insights gained from examining the "elemental version" of a value proposition. Following this, we identify factors that influence the benefits of value propositions. We then close with some conclusions.

2. Literature Gap to be Filled

At least five excellent reviews of the literature on value propositions have been published in the last three years (Goldring, 2017; Payne et al., 2017; Eggert et al., 2018; Wouters et al., 2018; Payne et al., 2020).

The extant literature provides at least seven constitutive perspectives on value propositions. A value proposition has been conceptualized as a:

1. Component of a business model (Johnson et al., 2008; Zott et al., 2011; Coombes & Nicholson, 2013; Goyal et al., 2017).

2. Narrative that describes the compelling reasons to buy products and services (Moore, 2002; Blank, 2007; Payne et al., 2017).

3. Promise of value creation that builds upon a configuration of resources and practices (Lusch & Vargo, 2006; Kowalkowski, 2011; Chandler & Lusch,

2015; Skålén et al., 2015; Vargo, 2020).

4. Framework to enhance the effectiveness of customer value creation and communication processes (Lanning & Michaels, 1988; Lanning, 2000; Webster, 2002; Anderson et al., 2007; Barnes et al., 2009; Osterwalder et al., 2014; Barnes et al., 2017; Dennis, 2018).

5. Market shaping device and customer contextualization strategy (Kumar et al., 2000; Holttinen, 2014; Kindström et al., 2018; Spinuzzi et al., 2018; Nenonen et al., 2019; Nenonen et al., 2020).

6. Process to address strategic and implementation concerns (Payne et al., 2020).

7. Mechanism to engage multiple stakeholders for developing market offers (Grünbacher et al., 2006; Ballantyne et al., 2011; Frow & Payne, 2011; Truong et al., 2012; Baldassarre et al., 2017; Eggert et al., 2018).

One of the constitutive perspectives on value propositions argues that conceptualizing value needs to take place in a multiple stakeholder setting, rather than just being embedded in a single stakeholder setting (for example, customers). We argue however that the adoption of a multiple stakeholder perspective can result in explicitly formulating value propositions for all relevant stakeholders, and not just a few stakeholders on company's customer value proposition development. We find this emphasis significant in practice and believe that companies failing to realize its importance are likely bound to continuously struggle in pursuing a scaling path.

This should be taken into consideration while keeping in mind that value creation in industrial markets, "usually involves many companies and other actors where the links between them are interdependent and project tasks are not completely controlled by any one of them" (Ballantyne et al., 2011). It seems to imply the need for "a shift in a company's strategic point-of-view to recognize the network of relationships in which they and their customers, suppliers, other institutions and their respective employees are embedded" (Ballantyne et al., 2011).

Payne, Ballantyne, and Christopher (2005), Frow and Payne (2011) and Ballantyne et al. (2011), all adopted a relational framework of six stakeholder groups to develop a value proposition. Ballantyne et al. (2011) proposed a process for shaping reciprocal value propositions that requires an initiator who can develop a provisional yet reciprocal view of what might be of value to the focal company, along with each of its most relevant counterparts. The process is enabled through workshops that bring both sides into one shared communicative framework. The initiator role of the process does not need to be credited or attached to a single stakeholder group. This reciprocity in value proposition development allows for innovating and optimizing the implementation of the process in specific contexts to meet diverse stakeholder needs.

Eggert et al. (2018) also emphasize the need to adopt a multiple stakeholder perspective for value proposition development in business-to-business (B2B) companies. They argue that, (1) business value should be conceptualized in an ecosystem perspective by understanding the complex network of relationships and "how these relate to the idiosyncratic value of an individual actor", (2) there is a need to better understand how value propositions at various levels of granularity are linked together, and (3) business-to-business companies should develop multiple value propositions to reflect increasing levels of personalization for their clients and customers (Eggert et al., 2018).

We thus extracted two important lessons from our study of value propositions literature to highlight in this section: (A) Value proposition development efforts need to focus on multiple external stakeholders, rather than just on a single set of stakeholders, likely customers, and (B) Engaging reciprocally with all relevant actors enables the shaping of mutually beneficial value propositions and the development of new market offers (Grünbacher et al., 2006; Ballantyne et al., 2011; Frow & Payne, 2011; Truong et al., 2012; Baldassarre et al., 2017; Eggert et al., 2018).

One of the conclusions that can be drawn from engaging multiple stakeholders to develop value propositions is the existence of a need for aligning these propositions both with each other and with the new company's scaling objectives. Unfortunately, theoretical approaches have not been proposed so far to address this need.

Martinez and Bititci (2006) offered one of the few studies that has examined the alignment of multiple value propositions among supply chain members in an

industry. Their in-depth case study focused on the fashion industry, showing that: (i) the strategic members of a supply chain are those who hold the chain's core competencies; (ii) the value propositions of a supply chain's strategic members dictate its overall value proposition; (iii) the value propositions of the supply chain's strategic members should be aligned to enhance its overall value proposition; (iv) if regular (not-strategic) members of the supply chain have value propositions that go beyond the needs of the supply chain, they should nevertheless support its overall value proposition; (v) the value proposition of the overall supply chain is the same as that of the company that is facing the end customer; (vi) the alignment of supply chain members' value propositions with the overall supply chain's value proposition ensures the alignment of strategic competencies; and (vii) strategic members collaborate to improve the supply chain's competencies. However, the Martinez and Bititci (2006) findings do not apply to the case of new companies committed to scaling, which is what we have chosen as the main focus of this paper.

3. Key Features of a Value Proposition

The purpose of this section is to identify key features that make a new company's value proposition different from other company resources.

We apply the logic used to identify what makes multisided platforms special by Haigu and Wright (2015), along with the "elemental version" approach to formalize insights from various theories of the firm used by Gibbons (2005), to argue that at the most fundamental level, a new company's value proposition has two key features that make it distinct:

1. **Business transactions:** a value proposition enables a new company and an external stakeholder to directly interact via transactions between one another without the need of an intermediary.

2. **Investment to create and improve business transactions:** a value proposition attracts, both from new company owners and external stakeholders, the investments that are necessary to create, actualize, and improve a value proposition.

By "directly interact" between one another, we mean that the company and the external stakeholder "retain control over the key terms of the interaction" (Hagiu & Wright, 2015). An independent third party does not control the terms of the business transaction. While we applied the same logic that Hagiu and Wright (2015) used, the business transactions and direct interactions that we are concerned about are those between the company and external stakeholders, rather than those that occur between two external stakeholders.

By "investments that are necessary to create, actualize, and improve a value proposition", we mean the cash and in-kind (time, effort, reputation) contributions that the company and external stakeholders allocate to the development, maintenance, execution, communication, and implementation of the value proposition portfolio, which enables business transactions. These investments are tangible evidence of organizational commitments to the development and evolution of the new company's value propositions as a way to facilitate business transactions with external stakeholders.

Figure 1 illustrates the elemental version of our perspective, which was inspired by Gibbons (2005). It reduces to stark simplicity what makes a value proposition special: business transactions between the new company and its external stakeholders, along with investments that create and improve value propositions.

The elemental version of our value proposition perspective applies to multiple stakeholders and incorporates what we call "reciprocal dialogues". It highlights the need for a new company to develop two types of value propositions (1) value propositions to anchor business transactions (set prices for good and services) or investment (set company valuation), and (2) value propositions to attract external partners to make commitments to create and improve the already existing value propositions that enable business transactions (set terms for information and technology exchanges during product feature co-creation).

Figure 1 illustrates that the company and an external stakeholder execute business transactions anchored on an existing value proposition. For example, a customer value proposition enables transactions between the company and a customer for the purpose of the sale/purchase of goods and services. Each side retains control over the terms of the transaction. These terms may involve price, quality, delivery, timing, levels of service, and so on. Setting the terms of a transaction may take place before, during, and after the

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sale/purchase.

The external stakeholder could also be an investor, resource owner, partner, etc. In the investor's case, an investor value proposition enables business transactions between the company and the investor. The company and the investor both retain control of the terms of the business transactions.

A value proposition is thus the outcome of a reciprocal process that takes place between a company and one or more of its external stakeholders. The formulation and implementation of a reciprocal process leading to the creation and improvement of a value proposition requires both the company and the external stakeholder to invest. These combined investments both maintain and enhance their commitments to one another. The investments are necessary for the two parties to be able to carry out business transactions with each other. For example, product co-creation requires that both company and customer invest money, time, effort, and reputation to produce the customer value proposition that anchors or will anchor their business transactions. Similarly, the preparation of a funding agreement, due diligence, and so on, requires the new company and investor to make cash and in-kind investments to develop an investor value proposition, and thus to anchor their business transactions. Lastly, the acquisition of any resource requires that the company and resource owner co-invest to create and improve the resource-owner value proposition that will anchor their direct transactions.

4. Insights about Elemental Versions of Value Propositions

Definition of value proposition
We define a value proposition as follows, based on our conceptualization of the two features that make it distinct:

> *A company's value proposition makes explicit how a stakeholder and the company benefit from, (1) completing transactions with each other, and/or (2) improving how (the process by which) these transactions are completed.*

Two classes of value propositions
A new company that wishes to scale rapidly needs to engage multiple stakeholder groups with value propositions. These propositions can be organized into two classes: (1) value propositions to carry out business transactions (for example, customer value propositions for the sale of goods and services; investment value propositions for funding rounds, resource owner value propositions for capital leases), and (2) value propositions for external stakeholders to invest in the development and improvement of the value propositions for business transactions.

Consider two possible scenarios for the experience between a new company and a customer. Note that the

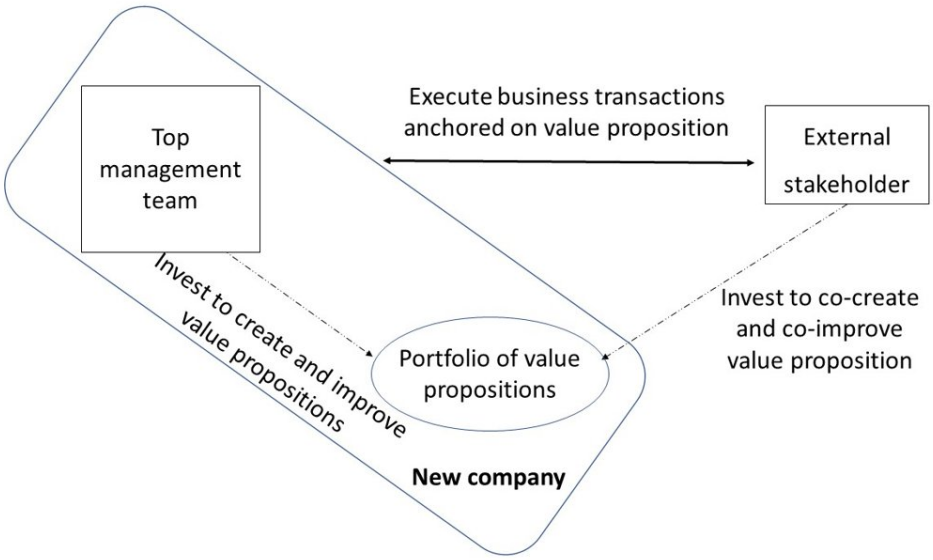

Figure 1. Elemental version of a value proposition

logic used in this example also applies to other external stakeholder groups such as investors and resource owners.

In Scenario 1, the experience is that of a business transaction, which has been defined by a value proposition known to both parties.

In Scenario 2, the business transaction experience has been defined by a value proposition co-created by a customer and the new company. The customer has a "preferred customer" status because it is investing to work with the new company in order to create and improve one or more value propositions for business transactions.

The Scenario 2 preferred customer experience can be viewed as having two parts: the business transaction experience, and the investment experience. One outcome of the investment experience is co-developing or co-improving the value propositions that define the experience for all customers carrying out business transactions.

Preferred stakeholders are stakeholders that invest to co-create and co-improve the new company's value propositions. Therefore, for each preferred stakeholder the new company holds two different value propositions; one that enables business transactions, and the other that attracts investments to create and improve value propositions.

Consider two portfolios of value propositions for external stakeholders. The first portfolio is comprised of five value propositions that were developed by the new company's founders working in isolation. The second portfolio is comprised of five value propositions that were co-developed by the founders working with preferred stakeholders. It is reasonable to hypothesize that the second portfolio is more valuable to more people than the first.

Figure 2 illustrates the two scenarios identified above. It shows that new companies and their customers carry out business transactions in both scenarios. These transactions are anchored in a tested and validated customer value proposition. In Scenario 1, the new company and the customer use a predefined value proposition to complete a business transaction. In this example, the new company sets a price that meets the customer's willingness to pay, reduces the buying cost by streamlining the buying process, mitigates opportunities for resistance, and reduces the transaction's pain points. The customer in Scenario 1 evaluates the value of the purchase, accepts the price, and pays the buying costs.

In Scenario 2, both the preferred customer and the new company invest to co-create and co-improve the value proposition that defines the business transaction experience for all customers. In this scenario, the new company uses an investor value proposition to convince the customer not only to make the purchase, but also to invest in the definition and improvement of the value proposition for possible future purchases, in a way that mutually enhances the business transaction experiences.

Figure 2 illustrates a customer's perspective when assessing a new company's prospective offer to them. The customer needs to answer two questions: (1) Is the value of the offer worth the price?, and (2) What investment in the new company that provided the valuable offer is required for it to continue to deliver an offer that provides value we want?

Wouters, Anderson, and Kirchberger (2018) examined technology startups that are in the process of shaping customer value propositions for large established companies. They found that companies "needs to screen a large number of potential startups and assess each time: What is the value of the startup's offering to our business, and what resources and support will the startup need so we can actually obtain its offering?"(p. 101). The authors recommend that startups should construct two value propositions for each large customer, that include (i) an Innovative Offering Value Proposition (IOVP), and (ii) a Leveraging Assistance Value Proposition (LAVP). The IOVP communicates how the startup's market offer creates superior value for the customer than what they currently get. The LAVP conveys what the customer firm, in a B2B scenario, will receive in return for providing support and resources to the startup.

Attracting investment to create and improve the new company's value propositions

A prospective stakeholder needs to spend effort to ensure that it will receive the benefits it requires from a new company. New companies meanwhile need to develop, communicate, and deliver value propositions that compel stakeholders to spend their cash, time, and effort helping them to define suitable value propositions as a way to anchor their business transactions. Literature

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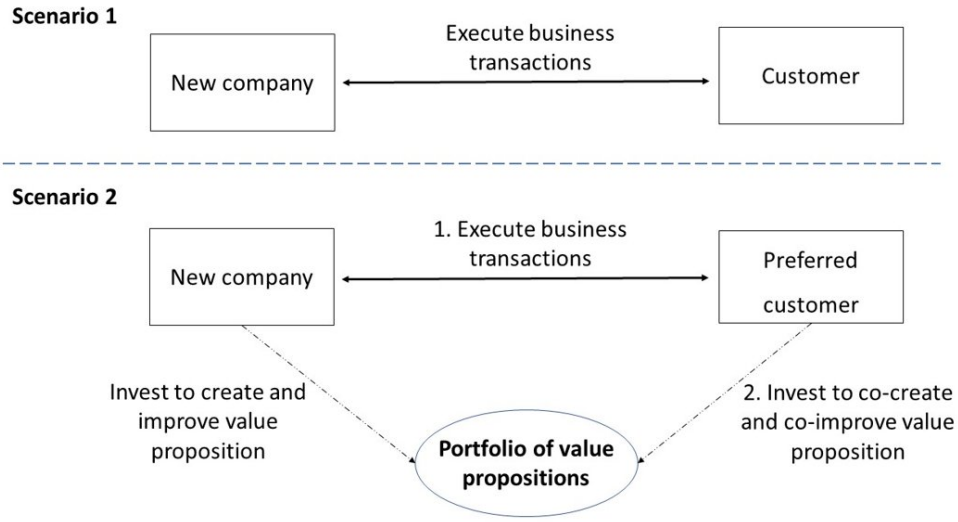

Figure 2. Two value proposition classes

that focuses on ways to attract stakeholders to invest in co-creating and co-improving new company's value propositions is so far not well developed.

The few articles published on how to improve the relationships with customers suggest that new companies' customer value propositions should offer to: (1) provide preferred status (Bemelmans et al., 2015; Schiele et al., 2012), (2) allocate better resources, and deliver products and services first in case of production problems (Steinle & Schiele, 2008; Schiele et al., 2011), (3) help customers design their products (Cramer, 2019), (4) reduce costs and charge lower prices (Hald et al., 2009; Nollet et al., 2012), (5) provide accurate and up-to-date information (Ishengoma & Lokina, 2017), (6) help increase the perception that their customer is mature and responsible in managing supplier relationships (Bemelmans et al., 2015), and (7) shorten the lead time needed for execution (Ulaga, 2003; Christiansen & Maltz, 2010)

Value proposition co-creation
Consider the null-set situation where a new company's portfolio of value propositions is empty, that it includes no value propositions. Assume that the division of a large company and the new company in question are collaborating in the design and development of a product that a foreign division in that large company may purchase. In this case, both the new company and the large company are investing to co-create a value proposition that works for both parties. They are not engaging in the transaction for the standard purpose of selling or purchasing goods and services. Thus, the outcome of their investments will include a unique customer value proposition that anchors direct business transactions between the new company and the large company's foreign division.

Adding a value proposition to existing portfolio
Now examine a case where a new company's portfolio of value propositions includes 10 value propositions for diverse stakeholders, including customers, investors, power users, resource owners, etc. Next assume that the new company and a venture capital firm invest to co-create a new value proposition that will anchor their business transactions.

The development, communication, and delivery of the new investor value proposition will have to consider the needs of key organizations that are part of the investor's and new company's network. To these needs, they will align the 10 value propositions from the portfolio, thereby helping achieve the new company's scaling objectives.

5. What Makes a Value Proposition Valuable?

The purpose of this section is to identify factors that make a value proposition beneficial to a new company ex-ante (that is, the value proposition's benefit is based on anticipated new outcomes, not results from past performance).

We postulate that three factors influence the ex-ante benefit of a value proposition. A value proposition will benefit a new company committed to scale its worth rapidly when it:

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1. Strengthens the new company's capabilities to scale (Cepeda & Vera, 2007; Lindgren et al., 2009).

2. Increases demand for the new company's products and services (Osterwalder et al., 2014).

3. Increases the number, diversity, and rapidity of investments in the conceptualisation, development, maintenance, and refinement of value propositions for external stakeholders (Emerson, 2003; Frow & Payne, 2011; Bussgang & Stern, 2015)

The remainder of this section provides a set of statements of what a new company can do to increase the benefit of its value propositions for the purpose of growth and scaling. Some of the collected statements below are based on insights emerging from existing literature, while others are based on insights that come from a team of experienced practitioners associated with our research project.

Strengthen capabilities to scale

1. Attract individuals who have the requisite experience and knowledge to increase the spread between customers' willingness to pay for a product and the cost of the product (Emerson, 2003; Schmidt & Keil, 2013; Banker et al., 2014; Bussgang & Stern, 2015).

2. Most significant stakeholder benefits should be quantified in specific, measurable, attainable, relevant, and time bound terms (Barnes et al., 2009; Hudson, 2017; Eggert et al., 2018).

3. Use an end-to-end (E2E) solution that links procurement directly with end customers, in order to eliminate or reduce inventory and the number of intermediaries between the company and customers (Walters & Lancaster, 2000; Rodriguez et al., 2008).

4. Customize ideal next steps to coordinate activities between new company and customers (Buttle, 1999; Ballantyne et al., 2011).

5. Digitize as much of your company as you can to create value for customers, reduce costs, and increase security (Hervé et al., 2020: Westerlund, 2020).

6. Build internet-based capabilities to acquire and retain customers, investors, and owners of resources required to scale (Ordanini & Rubera, 2008).

7. Learn from value propositions of companies that have scaled early, rapidly, and securely, and use them to differentiate your company (Bussgang, 2015).

8. Increase the value chain's competence(Walters & Lancaster, 2000; Carlucci et al., 2004).

9. Access, combine, and deploy resources required to create value and scale, by providing all external resource owners with returns they cannot gain on their own (Melancon et al., 2010; Girotra & Netessine, 2013; 2014; Bussgang & Stern, 2015).

10. Deploy combinations of resources that will create value that exceeds the sum of the value created from each resource separately (Bititci et al., 2004; Tantalo, & Priem, 2016).

11. Articulate a compelling image of your future company, using it to convince investors to provide funding, and resource owners to provide resources needed to scale the business (Dennis et al., 2007; Park et al., 2010; Davidsson, 2015).

12. Align your most valuable resource configuration with your master scaling plan (Di Pietro et al., 2018; Bailetti & Tanev, 2020).

13. Enable customers, users, investors, and others to automatically extract information from company data for the purpose of decreasing costs and adding value to stakeholders (Dawar, 2016).

14. Apply big data analytics to produce insightful information about users, suppliers, and customers (Schermann et al., 2014; Elia et al., 2020).

Increase demand

1. Grow customers' willingness and ability to directly interact with the new company for the purpose of consuming its products and services (Lindič & da Silva, 2011; Berman, 2012).

2. Adapt value propositions to changes in customer segments (Kowalkowski, 2011; Payne et al., 2017).

3. Use data and artificial intelligence to personalize

offers to consumers (Pires et al., 2006).

4. Constantly monitor customers' buying habits and deliver offers that are convenient, cater to customer demands, are secure, and offer excellent customer experiences (Fifield, 2007; Blocker, 2011).

5. Deliver better performance on the metrics that customers care about (Kowalkowski, 2011; Ling-Yee, 2011).

6. Define the ideal target customer profiles and engage them relentlessly (Anderson et al., 2006; Osterwalder et al., 2014).

7. Continuously improve value propositions based on results and feedback (Ballantyne, & Varey, 2006; Payne & Frow, 2014).

8. Listen to your customers, take their feedback seriously, and adjust operations as needed (Hardy, 2005; Walker, 2008).

Increase investments to enable direct interactions

1. Adopt a stakeholder-centric approach to satisfy the expectations of customers, investors, resource owners, and other important actors, as required to scale (Frow & Payne, 2011; Lusch & Webster, 2011; Corvellec & Hultman, 2014; Bailetti & Tanev, 2020)

2. Establish a position in external networks that increases stakeholders' investments to improve the volume, variety, and velocity of direct interactions with the new company (Bititci et al., 2004; Windahl, & Lakemond, 2006; Schmidt & Keil, 2013).

3. Develop value propositions for key members of the value chain that align with other key members' value propositions, as well as improving the overall competence of the value chain (Flint, & Mentzer, 2006; Martinez & Bititci, 2006; Frow et al., 2014).

4. Engage customers to produce testimonials, reviews, and ratings that help new customers to make purchasing decisions with knowledge of other customers' experiences (Payne et al., 2008; Saarijärvi, 2012).

5. Collaborate with the company's value chain to determine optimal offers that achieve customer fulfillment and enhance customer value (Martinez & Bititci, 2006).

6. Establish trust and positive rapport with your customers that nurtures long-term, mutually beneficial business relationships (Osterwalder & Pigneur, 2003; Capon & Hulbert, 2007).

7. Attract great people with high customer and high growth orientation (Frow & Payne, 2011; Pandita, 2011; Nyman & Stamer, 2013).

8. Always think from your customer's perspective both organizationally and personally (Capon & Hulbert, 2007; Buttle, 2019).

9. Track changes in stakeholders' value propositions and use the information to realign the value propositions (Baldassarre et al., 2017).

6. Conclusion

The delivery and improvement of value propositions to external stakeholders is what determines whether a new company operates as a functional/actual business, or rather exists as an opportunity still merely wanting to become a business.

In this paper, we have attempted to fill a gap in the literature by examining the features that make a value proposition distinct from other new company resources, along with the factors that make it valuable or beneficial to a company. We framed the "portfolio of value propositions" for external stakeholders as one of the most important resources a new company holds. This portfolio aligns value propositions to one another, as well as investments to a new company's scaling objectives. Marketable value propositions are a key source of competitive advantage for a new company.

New companies committed to scaling their business rapidly must design, communicate, and implement value propositions for diverse external stakeholders. Two features make these value propositions distinct: (1) value propositions anchor business transactions between the new company and external stakeholders, and (2) value propositions attract external stakeholder investments to create and improve the value propositions portfolio.

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A value proposition will benefit a new company when it: (1) Strengthens the new company's capabilities to scale; (2) Increases demand for the new company's products and services; and (3) Increases the number, diversity, and rapidity of external investments in the conceptualisation, development, maintenance, and refinement of value propositions for external stakeholders.

The presence of preferred stakeholders combined with the continuous creation of new value propositions, along with improvement of existing value propositions, can add significant value to a new company's value propositions portfolio.

We suggest that future research should focus on identifying dynamic capabilities that support a new company's scaling activities, how to improve value propositions by interacting with preferred stakeholders over time, and features that make each of the identified seven perspectives above regarding value propositions distinct. In addition, future research should explicitly explore the attributes of business transactions that enable scaling company value in the near-, mid-, and longer-term. A more detailed exploration of business transactions in the context of new companies willing and attempting to scale rapidly and securely would also require differentiating between ex-ante and ex-post company value, as well as identifying clear-cut criteria about what turns certain transactions into value-adding mechanisms for a new company that wishes to scale.

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Is Porter's Five Forces Framework Still Relevant? A study of the capital/labour intensity continuum via mining and IT industries

Diane Isabelle, Kevin Horak, Sarah McKinnon, Chiara Palumbo

"A horse never runs so fast as when he has other horses to catch up and outpace."

- Ovid

Porter's Five Forces (P5F) framework, published in 1979, helps us to understand the attractiveness of an industry. The five competitive forces are: the threat of new entrants, the bargaining power of buyers, the bargaining power of suppliers, the threat of substitute products of services, and the rivalry among existing competitors. This framework has recently come under scrutiny and been called into question. To contribute to the debate, this paper investigates the relevance of Porter's framework by contrasting vastly different industries. The use cases consist of a resource-based, capital-intensive industry, the mining industry, and a knowledge-based, labor-intensive industry, the information technology industry. Drawing from research on Porter's Five Forces framework, and through an internationalization lens, the paper proposes a modified framework augmented with four additional forces. These additional forces are: the competitor's level of innovativeness, exposure to globalization, threat of digitalization, and industry exposure to de/regulation activities. These forces were added to capture the increased interconnectivity and complexity of businesses operating in the 21st century. The paper contributes to this body of knowledge by augmenting a popular framework and applying it to vital industrial sectors. The findings aim to incite researchers, managers, entrepreneurs and policymakers to go beyond the traditional five forces as a way to help monitor their business environment and enhance decision-making processes, particularly in a post-COVID-19 world.

Introduction

In 1979, Michael E. Porter published a seminal framework about competitive forces, the five forces framework, which quickly became the definitive tool to identify forces driving industry competition (Porter, 1979). The five forces - threat of new entrants, bargaining power of buyers, bargaining power of suppliers, threat of substitute products or services, and rivalry among existing competitors - were considered applicable to every industry, regardless of level of technology or economic development (Porter, 2008). The business world has become increasingly more global and complex since then, which is prompting a reappraisal of this highly popular managerial tool.

Without a doubt, among the most significant changes to the business world is globalization, which has intensified rapidly since the 1980s. Recent technological innovations and the presence of increasing numbers of people with international business experience have helped establish new foundations for internationalization (Oviatt & McDougall, 2005) resulting in businesses further expanding their trade footprints. Even with the weakening of globalization lately due to geopolitics, economic isolationism, and the COVID-19 pandemic, economies around the world are highly integrated and industries interdependent. Globalization is clearly a key driver of internationalizing firms (Zucchella et al., 2007), which can be a gradual process, as per the Uppsala model (Johanson & Vahlne, 1977), or accelerated (Rennie, 1993; Oviatt & McDougall, 1994). Over the last decades, even small firms in their early lifecycle stage are increasingly driving international expansion.

In spite of some adjustments to Porter's Five Forces over the past 40 years, questions remain about its

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relevance in the 21st century. Critics argue that Porter's Five Forces framework is too static, and hence omits changes in the competitive environment (Thyrlby, 1998; Grundy, 2006) such as the drivers of internationalization. Consider that back in 1979, information technology (IT) was viewed as a means of supporting the original five forces rather than as a distinct force. Nowadays, IT, or as often labelled "the tech industry", is a $5.2USD trillion global market, and still growing at a fast pace (CompTIA, 2019).

In light of the above, the research questions for this paper are: *Is the P5F framework still relevant in the 21st century's hypercompetitive business environment? Can the framework apply to vastly different industries such as a traditional resource-based capital-intensive industry, as well as a labour-intensive knowledge-based industry? Are additional forces also applicable to these industries?*

The objective of this article is to explore the relevance of Porter's Five Forces (P5F) by contrasting the mining industry, a resource-based, capital-intensive industry, with the information technology industry, a knowledge-intensive industry. A comparison between these two industries at different ends of the capital-intensity continuum allows for a careful investigation of the contemporary relevance of P5F. Further, these two particular industries are crucial for Canada and many other countries in terms of economic development.

The paper's contributions are therefore threefold: First, adding to the management literature by building from research on P5F and internationalization theories to examine the relevance of the model to vastly different industries. Second, broadening the research on P5F by augmenting the framework with additional forces that are applicable to many industries today. Third, inciting managers, entrepreneurs, and policymakers to monitor the global business environment of specific industries beyond the traditional five forces to help avoid flawed decision-making.

Literature Review

We present a brief synthesis of the relevant literature related to P5F framework and internationalization.

Porter's Five Forces (P5F)

Porter introduced his five forces framework in 1979 as a way to understand an industry's attractiveness. His framework revolutionized the way managers and entrepreneurs analyze their industry's competitive environment by examining specific forces driving industrial competition. It has become one of the most popular business strategy tools.

The five forces are: the threat of new entrants, the bargaining power of buyers, the bargaining power of suppliers, the threat of substitute products or services, and the rivalry among existing competitors (Porter 1979). The first four forces determine the fifth force, competitive rivalry, which can be minimal or intense depending on the number and strength of competitors. The strength of each of the forces negatively impacts profitability. Importantly, Porter assumed these five forces were applicable to every industry, regardless of its level of technology, whether in a developed or emerging economy, and with or without government interventions (Porter, 2008). These assumptions are now coming under threat, or at least are once again being vigorously discussed. Figure 1 (below) illustrates the framework.

The continued popularity of this management tool in the academic and practitioner domains is evident. A cursory Google Scholar search of "Porter five forces" over the past five years yielded thousands of academic articles. Yet scholars nevertheless still argue about its relevance in today's globalized world. This creates an opportunity for the contribution of this research.

Critiques of P5F

In recent years, the P5F framework has come under fire. Scholars have raised several shortcomings. For example, Lee et al. (2012) argue that the framework is difficult to operationalize, while Narayanan and Fahey (2005) question the framework's validity. Some believe that the framework has already become frozen in time (Thyrlby, 1998; Grundy, 2006). Others point out that it has a specific emphasis on large organizations (Bruijl, 2018) and value chains over ecosystems (Keen & Williams, 2013).

There are essentially three schools of thought on the criticisms of P5F. Researchers from the first school of thought believe that only minor adjustments are needed (Slater & Olson, 2002). The second school argues for moderate changes to the forces in order to take into consideration such factors as time dynamics (Dulčić et al., 2012), not-for-profit organizations (Breedveld et al., 2006; Indiatsy et al., 2014), corporate social responsibility (Maxfield, 2008) collaboration and strategic alliances (Holm et al., 1996), and small businesses (Bruijl, 2018). A third school of thought

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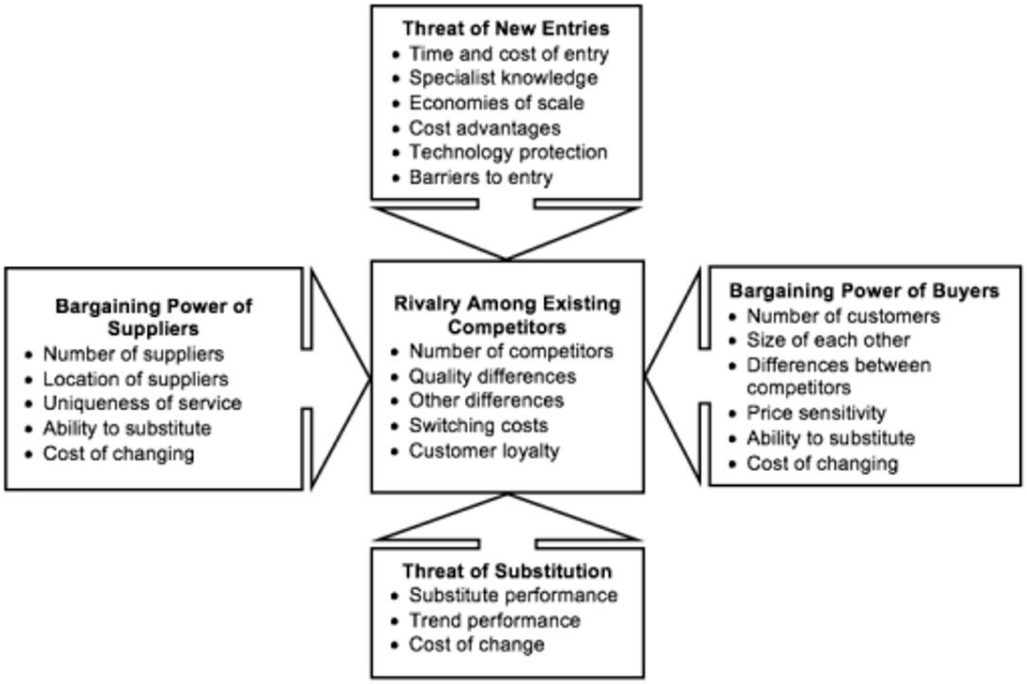

Figure 1. Porter's Five Forces framework (Porter, 1979)

argues for major adjustments to the framework (Narayanan & Fahey, 2005; Lee et al., 2012) by either reconsidering the forces or combining the framework with alternative strategic frameworks, such as a resource-based view (Barney, 1991), using the so-called Delta model, which emphasizes the importance of attracting, satisfying, and retaining customers (Hax & Wilde Ii, 2001), or with a Blue Ocean strategy, which is a first mover approach (Kim & Mauborgne, 2005).

The vast majority of academics in the field consider that anywhere from medium to major adjustments to the framework are currently required. (Johnson, 2014). Wahlström (2019) notes that many companies do not go beyond the five forces to monitor their business environment. Nevertheless, the implementation of scenario-planning related to globalization, digital transformation, or sustainable development, in terms of their potential impacts to company operations, would also likely bring about critical knowledge and enhance business decision-making.

Downes (1997) has gained popularity among researchers who argue against P5F by proposing three additional forces driving industry competition to complement P5F: *globalization, digitalization,* and *deregulation*. Johnson (2014) added another force, the *level of innovativeness*. In earlier years, the level of innovativeness was considered an internal factor leading to a competitive advantage, but it now considered a vital external factor among forces driving industry competition (Bruijl, 2018). This research shows that the framework is indeed in need of major revisions, hence the purpose of this study.

Internationalization theories

At the time Porter published his P5F in the 1970s, internationalization was primarily conducted by multinational enterprises (MNEs). Past literature has outlined the need for a stage-based process to internationalization, which supports the idea that only large companies have the necessary resources to access international markets. Johanson and Vahlne's (1977) seminal Uppsala model advocated for a gradual process of internationalization via a series of incremental steps to enter geographically and culturally closer markets with low-risk modes of entry, then later to gradually enter more distant foreign markets. Since then, early and fast internationalization has picked up in pace, in particular with high-tech start-ups such as born-global (BGs) firms (Rennie, 1993) and international new ventures (INVs) (Oviatt & McDougall, 1994), enabled by lower communication and transportation costs. There has also been extensive research done on the early internationalization of firms operating in technology-intensive industries, as well as other industries (Madsen

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& Servais, 1997; Cavusgil & Knight, 2015; Del Sarto et al., 2019). Interestingly, early internationalization, which is considered riskier, is often associated with experienced entrepreneurs who might have used the Uppsala model before founding their born-global firm (Neubert, 2017). A business internationalization lens is considered particularly relevant to our investigation of P5F.

Comparative Analysis of the Mining Industry and the Information Technology Industry

This section presents an overview of two selected industries to highlight their specific characteristics, as well as global data and trends related to these industries. The purpose is to apply the P5F to these industries to answer our above research questions.

Overview of the mining industry

The mining industry is a resource-based, capital-intensive industry, which explains why we selected that industry to contrast it with IT, a knowledge-based industry. Operating in the exploration, extraction, and processing of natural resource materials, the mining industry has deep historic roots as a player in global business, economics, and trade. The revenue of the top 40 global mining companies was 683 billion USD in 2018 (Statista, 2019). The mining sector delivers the raw materials to support the so-called "fourth industrial revolution" (Schwab, 2015; PWC, 2019). In Canada, the total value of mineral production in 2018 was $47 billion CAD. Canada is the global leader in the production of potash and ranks among the top five global producers for cadmium, cobalt, diamonds, gemstones, gold, graphite, indium, nickel, niobium, platinum group metals, salt, titanium concentrate, and uranium. Canada also accounts for a significant proportion of the global production of primary aluminum from imported bauxite and alumina (NRCan, 2020).

As a resource-based industry, mining demands a high level of international involvement. The metals and minerals are only found in specific geological areas, thus confining operations to those locations, before being distributed and sold around the globe. It thereby requires an international network in order to function. The general operations of mining firms consist of four lifecycle stages: exploration, development, production, and closure (Natural Resource Governance Institute, 2015). While each individual mine site will undergo this lifecycle, the large costs associated with initial testing, exploration, and construction has encouraged some firms to expand operations through merger and acquisition activity. We often observe multinational firms absorbing smaller and more regional firms into their operations. Internationalization is thus an already existing key factor for mining companies that wish to succeed within the industry. Significant industry players, therefore, consist mainly of large private or state-sponsored firms that oversee multiple international operations. These international new venture companies are usually headquartered in one nation, while operating mines exclusively outside of their domestic market. There is also a mixture of smaller regional and small-scale international firms (Natural Resource Governance Institute, 2015).

Taken as a whole, the mining industry, and its role as a supplier of base materials to diverse sectors, therefore lends itself to be substantially influenced and impacted by macroeconomic trends and movements in the global economy. Commodities markets are highly cyclical, with largely recognizable periods of rise and decline occurring over a period of years. As producers of mostly non-differentiated products, mining companies are particularly vulnerable to the behaviour of this cycle (Collings, 2013). Further, as commodities traded on the global market are often priced in US dollars, changes in the actual or perceived strength of the American economy, as well as shifts in USD value relative to other currencies, directly influence commodities sellers, resulting in an inverse relationship between commodities prices and USD. Foreign exchange risk, depending on the host nation's taxation and regulations regime, is a relevant consideration for any international ventures, and even more so for the mining industry due to the diverse geographic presence of its players.

Mining industry trends

Trends and issues facing the mining industry include trade wars, geopolitical crises, and climate change. The industry provides carbon-based raw materials such as coal, and is a substantial creator of CO2 emissions. China comprises 10 companies out of the Global Top 40 mining companies, while Australia, the UK, and South Africa have 7, Canada has 6, with the balance spread among the USA, Russia, Brazil, Switzerland, Poland, Indonesia, Japan and Mexico (PWC, 2019). Mergers and acquisitions in the mining industry have recently picked up. Safety, however, remains a challenge, and thus so does the industry's image. Investors and stakeholders continue to be concerned that the mining industry is lagging behind regarding new factors that have not traditionally been the industry's focus, in particular dealing with greenhouse gas emissions, the greening of

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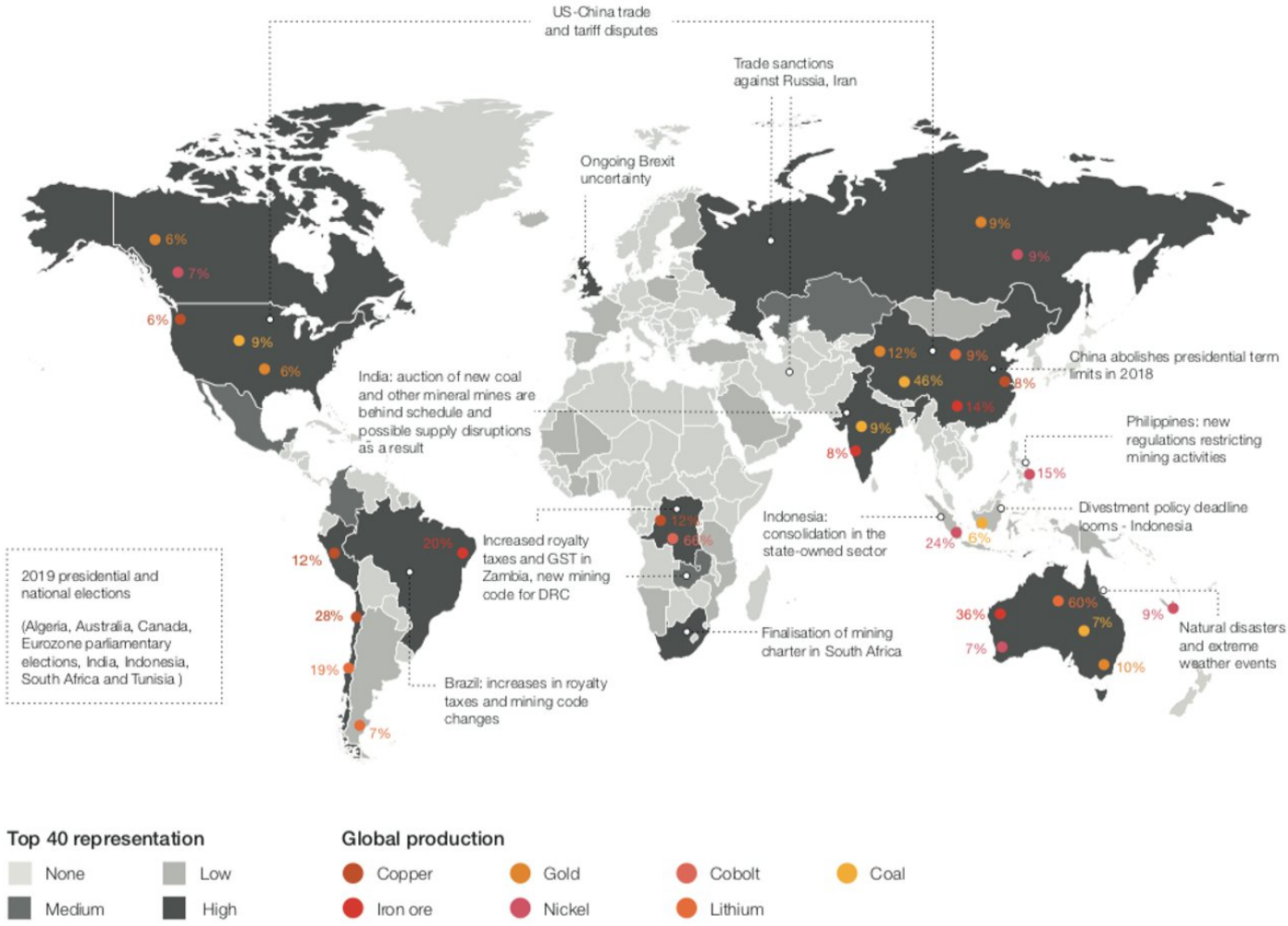

Figure 2. Top 40 reach and external market drivers (PWC, 2019)

the supply chain, and investing in technology that includes digital innovation (Kusi-Sarpong et al., 2015; PWC, 2019). Figure 2 below illustrates the Top 40 reach and external market drivers.

Overview of the Information Technology (IT) industry

IT is a knowledge-based industry that has developed rapidly since the 70s, such that it is now ubiquitous and pervasive. The term 'information technology' (IT) is used to describe a wide variety of aspects relating to information systems based on computers (Economy Watch, 2010). This broad definition includes areas ranging from software development and hardware, to the design, implementation, study, and development of IT management systems, as well as telecom services (CompTIA 2019; Economy Watch, 2010). One key differentiator from the mining industry is that IT is inherently knowledge-based, meaning that much of its characteristics are derived from the labour force (CompTIA 2019).

Based on research by the Computing Technology Industry Association (CompTIA, 2019), the global IT industry is already worth $5.2 trillion USD (2019), and one of the most significant contributors to GDP growth in many countries. Approximately $1.7 trillion USD (33% of the industry) is transacted in the USA. Among global regions, China has clearly established itself as a major player, while western Europe remains a significant contributor. In Canada, the sector is represented under the label "information and communications technologies" (ICT). In 2018, ITC accounted for $193B CAD in revenue, contributing to 4.5% of GDP, and $23B CAD in exports, or 15% of total Canadian exports (Government of Canada, 2019). The sector, which provides 1 million direct and indirect jobs, is considered the engine of growth in Canada, and is the largest private-sector performer in R&D. Of note, 86% of the

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Figure 3. Ten trends to watch for in 2020 (CompTIA, 2019)

37,000 firms in the sector are small businesses (ITAC, 2020).

IT industry trends

CompTIA (2019) has identified 10 trends to watch for in 2020 and beyond, which is illustrated in Figure 3. This section considers some of them in the context of this paper. Tech-washing and marketing hyperbole will not allow growth. Rather, sound digital transformation business models are needed for large and small firms to flourish. Further, businesses will be more strategic in their approach to integrate technology into their market offerings. As for hype-meeting-reality with emerging technologies, significant gains are expected this year from emerging tech adoption. However, adoption rates have been very slow across several new trends, in spite

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of industry hype, as some companies moved too quickly into a new technology trend, and had to face harsh realities of immature or unready markets.

That said, Internet of Things (IoT) and artificial intelligence (AI) are two trends gaining significant traction and beginning to reach critical mass, especially since cloud computing acts as a key enabler for AI by lowering the barrier for software development and distribution (Hudson, 2017; Groher et al., 2019). Also enabled by cloud systems, firms are now actively integrating platforms, applications, and data, and starting to move deeper into complex automation. Among other trends, cybersecurity is expected to shift from being seen as merely a component of IT, to instead being a critical business function itself. The video and voice forgery software of "deep fakes" has the potential to wreak havoc on society, personal lives, politics and beyond. Such misuses of IT will proliferate in the digital era and require sophisticated data management systems to handle exponentially larger data volumes, enabled by newly rolled-out 5G networks (CompTIA, 2019; Westerlund, 2019). The potential for increased government regulation around such issues as privacy, data protection, election interference, and others is an obvious concern as the tech industry matures and grows more complex.

The technology ecosystem in Canada is currently considered as being more self-sustaining than ever before, driven by talent, strong infrastructure, and committed government support. Further, the following Canadian trends bode well for the creation and retention of strong tech firms: greater ability to retain ownership control of the company during financing phases, as well as growing availability of tech talent, partly due to colleges and universities graduating students with needed skills and immigration policies (Aten et al., 2016).

Findings

Contrasting the mining and IT industries with the original Porter's Five Forces Framework

The purpose of this research is to apply P5F to two industries positioned at different ends of the capital-labor intensity continuum. Doing so provides fertile ground to explore the continued relevance of the P5F framework given today's complex and global business environment. Table 1 summarizes a comparison of the original P5F (1979) between the mining industry and the IT industry.

Augmented Porter's Five Forces

Based on prior research and this analysis, we argue that the original P5F framework no longer meets the more complex needs of operating in the 21st century, and could lead to flawed decision-making processes nowadays. Therefore, drawing from the literature that proposes changes to the framework, in particular the work of Downes (1997) and Johnson (2014), a revised framework is presented in this study. This augmented framework is made to be applicable not only to the selected mining and IT industries in this paper, but more broadly to both capital-intensive as well as knowledge-intensive industries, meaning industries along the capital-labor intensity continuum. Figure 4 highlights the proposed augmented P5F.

Threat of digitalization

While there is no generally accepted definition of "digitalization", the term refers to a technology-induced transformation process with its goal to improve a business' flexibility, agility, and responsiveness, by aligning operations, strategy, business processes, and organizational as well as IT structures (Holotiuk & Deimborn, 2017). In contrast, the term "digitization" carries a narrower scope of transforming analogous information into a digital representation, for example, books, journals, documents, or archives (Legner et al., 2017). The new force proposed for the augmented P5F focuses on the impacts of increased digitalization on an industry. The need for this dimension stems from a larger observation that firms no longer only face competition within their own industry, but also across industries (Downes, 1997; Neubert, 2018). This dimension can be measured by looking at four elements of digitalization in an industry: infrastructure (sophistication of existing IT technology), digital input (extent of digital processes in the procurement stage of the business), digital processing (degree to which processes are integrated, both internally and with external partners), and digital output (importance of digital processes in the sales function) (Friedrich, 2011; Johnson, 2014). The important observation along this dimension is that the better digitalized an industry is, the fiercer the competition is expected to be within that industry.

Competitors' level of Innovativeness

The dimension of innovativeness, previously considered as one of many resources a firm possesses to create a competitive advantage, is now becoming a source of competitive advantage. Studies have shown that the presence of foreign competitors in a market and the

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likelihood of a given firm to pioneer innovation grow in tandem (Johnson, 2014). In today's fast-paced IT sector, product life cycles are continuously shrinking, therefore firms must increase their speed of innovation to remain relevant. To measure the attractiveness of an industry in this dimension, a company should monitor the number of patents registered in that industry or market. Likewise with the Intellectual Property Index (IPI), as patents can either encourage or discourage innovation, depending on certain present market conditions. An industry is particularly attractive for a company to grow in if the number of patents and the IPI are both low, as it is thought that a competitive advantage can be achieved relatively easily in that environment (Jalles, 2010).

Table 1. Porter's Five Forces applied to mining and IT industries

Force	Mining Industry	IT industry
Threats of New Entrants	**LOW** - Highly capital-intensive - Existing firms absorbing smaller players limits the emergence of new players. - Highly volatile commodities market, strict legal requirements, and environmental regulations. - Competition largely a battle between those already present	**HIGH** - Low barriers to entry. - Firms can compete globally with little to no physical presence. - Entry of firms from outside of the technology sector. - Digitally-based business models are much less capital intensive and more easily scalable.
Bargaining power of buyers	**MODERATE** - Minimal product differentiation. - Demand and power held by buyers that are dependent upon segments and varieties of end uses - automotive, construction, manufacturing, and engineering represent the largest buyers. - Size of a buyer lends them a certain degree of power, but tempered through the use of long-term contracts with mining firms. - Pricing advantages of one geographic region over another derived largely through currency behaviour.	**HIGH** - Many options for consumers to choose from due to large amount of IT firms and easy access to information. - High pressure placed on IT firms to satisfy ever evolving expectations for the digital customer experience. - Pressure on industry to pioneer leading & innovative business solutions.
Bargaining power of suppliers	Two separate supplier sources: 1) **LOW**: Specialization required to service the mining industry ties suppliers closely with the mining companies they do business with. 2) **HIGH**: Land ownership and the estimated reserves held within that land means significant power over mining companies.	**HIGH** The notion of supplier is expanding: - In a sharing economy, suppliers can use their high bargaining power to slow down disruptive models. - Suppliers can be government regulators, supplying the industry with critical permits and licenses. E.g. Uber, Airbnb - Human resources supply challenge: finding and retaining employees in the IT sector is difficult - Other suppliers such as data aggregators enjoy immense bargaining power over firms given their expertise.

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Table 1. Porter's Five Forces applied to mining and IT industries (cont'd)

Threat of substitution	**LOW** - In spite of some substitution (plastics, aluminum) across industries, metals remain largely irreplaceable. -Greater metal recycling efforts represents a minimal threat. - Greater threats lie between metal segments, other metals, and synthetic materials replacing each other in reaction to industry demand and changing cost pressures.	**HIGH** - Ease of doing business internationally - Substitute products can be digital or hybrid. - Low switching costs. - Emergence of digital marketplaces
Rivalry among existing competitors	**HIGH** - Highly competitive landscape with a mix of powerful multinational companies, large state sponsored operations, and SMEs. - Scalability of mining operations and resulting cost-savings favours the creation and growth of larger companies, either through organic expansion or acquisitions. - Huge costs associated with exploration, development and financing of new mines. - Cyclical process of market behaviour and high cost of exiting the industry lock existing firms within the sector. - Competitive firms either specialize within one location or specific metal, or seek diversification in product or geography. - Younger players seek out more niche fields or operate mines in more obscure locations.	**HIGH** - Rivalry among firms is exacerbated by the rise of digital technologies and e-business coupled with the comparative low-cost of business models. - Companies no longer required to own their physical infrastructures. - Large firms have financial resources to invest in or acquire innovative companies, thus giving them a competitive edge in the market. -Increased coopetition

Exposure to Globalization

This dimension is grounded by the notion that for successful internationalization firms must manage far-reaching networks of partners and develop long-lasting relationships with their clients, regardless of location. This dimension can be measured by looking at the rate of a country's tax increases and government expenditure (countries with a lower rate of government consumption are generally more globalized), the index of capital account openness, and the level of foreign direct investment (Johnson, 2014). It is argued that firms should weigh all of these factors equally as they can have a profound effect on industry/market viability.

Industry exposure to de/regulation activities

The deregulation dimension emerged from an observation that government influence in certain industries has dramatically shrunk over the last few decades. As industries become deregulated, they are more conducive to unimpeded business operations that are controlled and guided by the free market. However, this dimension is challenging to measure, as the level of deregulation depends largely on the sitting government, their decisions, and the political context at the current moment (Johnson, 2014).

However, a nuanced approach involving industry exposure to de/regulation activities is presented here. Prior research (Downes, 1997; Johnson, 2014) added deregulation as a force to P5F, citing a sharp decrease in government regulations in industries such as telecommunications, banking, airlines, and utilities in the USA and Europe. These studies were primarily based in the 1990s, a decade which experienced a reduction in regulations owing to a variety of factors. However, we have now entered an era of increased

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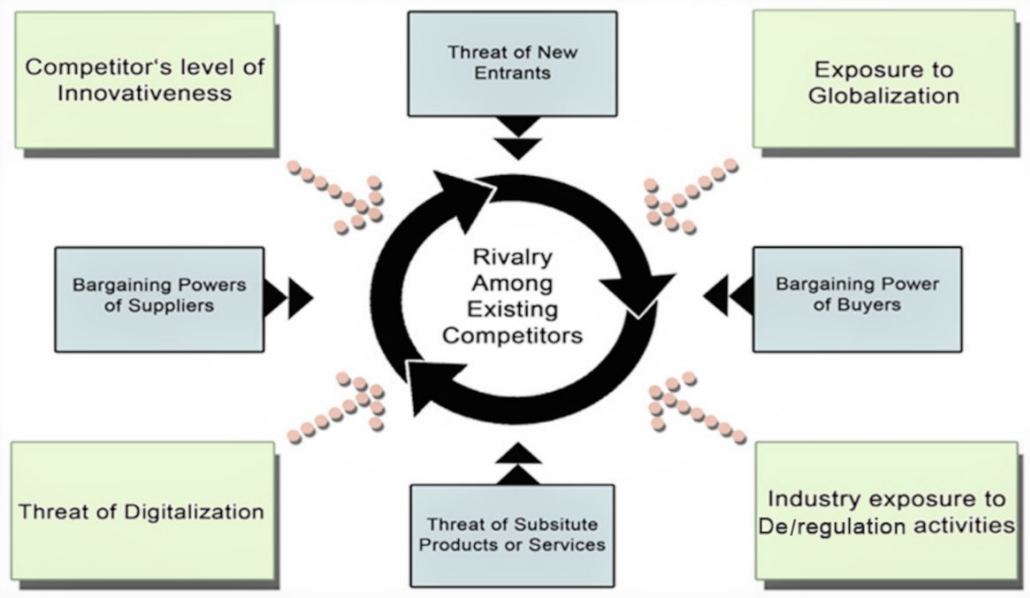

Figure 4. Proposed Augmented Porter's Five Forces Model

government regulations, be it related to climate change, anti-competitive business practices, health and safety, information privacy, and currently COVID-19. These regulations, at times, are introduced in a haphazard fashion. Consequently, we augment this force by adding both regulation as well as deregulation activities that firms must consider in order to analyze their industry and reduce their exposure to regulation and deregulation.

Discussion and Conclusion

Theoretical implications

We revisited Porter's Five Forces framework published in 1979 with the following research questions: *Is the P5F framework still relevant in the 21st century's hypercompetitive business environment? Can the framework apply to vastly different industries such as a resource-based, capital-intensive industry, as well as a knowledge-based labour-intensive IT industry? Are additional forces proposed in the literature also applicable to these industries?*

Prior research has proposed modifications to P5F since Porter's time. No research is known to have been conducted that actually corroborates the proposed additional forces. Further, no studies have contrasted resource-based, capital-intensive industries with knowledge-based, labor-intensive industries using an augmented P5F. Nor have studies attempted to apply an internationalization theoretical lens to the P5F framework.

The paper has demonstrated that in this era of internationalization, global value chains, a relentless pace of innovation, and changing regulatory environments, additional forces are applicable to both capital and labor-intensive industries. The paper also proposes a modified deregulation force to consider both regulation and deregulation. Furthermore, it contributes to an existing body of knowledge by highlighting the importance of critiquing and updating research frameworks, and applying them to industrial sectors that are vital to many countries.

Managerial implications

The key managerial implications from this research are as follows:

- The exposure to additional forces than P5F is now a constant reality in the IT industry. Consider that in Canada, only a third of small businesses operate on e-commerce platforms. Of these, half are facing challenges dealing with complex trade procedures, regulations, and lack of necessary resources to hire digital and international business specialists, which impedes their internationalization efforts and competitiveness. Digitalization offers plenty of opportunities to increase effectiveness, even though digital implementation can be significantly challenging. The mining industry has been comparatively slow in adopting digital technologies

(Lakshmanan et al., 2019). Yet this industry is facing several challenges that new technologies, for instance, combining big data together with other technologies such as automation, have the potential to address (Qi, 2020). Fortunately, prior research has validated the significant impact of digitalization on internationalization (Neubert, 2018), and gives a positive finding that should motivate firms to embark more deeply on a path that reaps benefits and increases their global competitiveness.

- Whether in resource or labor-intensive industries, firms should monitor their competitors' level of innovativeness, particularly given the short length of product life cycles often driving industry competition. For instance, companies should monitor the number of patents and trademarks registered in an industry or market (Jaffe, 2010; Gotsch & Hipp, 2014). In the mining industry, implementation of new technologies such as IoT, artificial intelligence, drones, thermal technology, and deep-sea mining, among others, could replace older methods for exploration, inspection and extraction (Dehran et al., 2018; Visser et al., 2019).

- It is crucial that firms closely monitor changes in regulation and deregulation, as well as increasing their advocacy role, given that many countries, including Canada, have now entered a period of increased regulation.

Governments of many countries are enacting new rules and regulations that industries are being asked to comply with. Examples include regulation that affects actors in the sharing economy, such as Uber and Airbnb, the General Data Protection Regulation (GDPR) in the EU that affects the IT industry, and the new Canadian Impact Assessment Act (CIAA) in the mining industry. However, there are various ways that new rules and regulation could also further the advancement of industries. For instance, rare-earth minerals represent another area where the traditional P5F is inadequate for the 21st century. Rare earth minerals are increasingly needed for electric cars, solar panels, and wind turbines, as well as other high-tech and military products. As a global mining powerhouse, new regulations in Canada could ensure that the country becomes a key player in the global EV battery supply chain. Moving in that direction, Canada and the USA are cooperating to reduce their reliance on China, which could control supply chain governance given that it has the largest share of the world's rare-earth mineral reserves. Canada is also working on a national rare-earth strategy (NRCan, 2020), with initiatives that will support the mining industry.

Experience shows that competitive landscapes can change very quickly with unforeseen situations, as evidenced with the COVID-19 global pandemic. Currently, Canadian mining firms, most of which operate mines around the world, are grappling with the pandemic and are facing the impacts of a potential global recession. Likewise, the IT industry is impacted by the pandemic. In both IT and mining industries, like in most industries, recovery from the pandemic will require massive changes to business models, innovativeness, rapid adoption of digital technologies and automation, and increased resiliency to succeed in whatever becomes the "new normal". These realities further stress the importance of our augmented P5F to appreciate rapidly evolving and globally competitive landscapes.

Limitations and future research areas

A limitation of this study is its focus on the mining and IT industries, although the findings should be generalizable to other similar industries, given previous applications of P5F. Nonetheless, our findings offer avenues for future investigations in other industries. Further, additional studies could apply our augmented P5F in a variety of industrial and geographic contexts. It is hoped that this revised and updated framework will incite researchers, managers, entrepreneurs, and policymakers to better understand business environments beyond the traditional five forces, as a way to enhance their decision-making processes in this turbulent business environment. Thorough analyses and monitoring of forces will in one way or another continue to be particularly crucial in a post-COVID-19 world, owing to greater social and economic uncertainties and with the expectation of accelerated adoption of technological innovations by several key industries to help ensure survival and prosperity.

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An Empirical Study into the Individual-Level Antecedents to Employee-Driven Innovation

Chukwuemeka K. Echebiri

> *"Employees at all levels of the organization are perceived as innovation capital or innovation assets."*
>
> Kesting and Ulhøi (2010)

The purpose of this paper is to link individual-level factors (such as need for autonomy, self-leadership, and perceived job autonomy) to employee-driven innovation with self-leadership as an indirect link. The study is based on survey data of 315 employees in the banking sector, collected in two waves where the variables were separated in time. The hypothesized model was analysed using a structural equation model on Stata. First, it was found that the need for autonomy had an indirect association with employee-driven innovation through self-leadership. Second, the findings show that self-leadership had a positive relationship with employee-driven innovation. Finally, there was no support found for the moderating role of perceived job autonomy between self-leadership and employee-driven innovation. The findings in this paper are important because they identify individual-level antecedents of employee-driven innovation.

Introduction

Innovation refers to the series of steps organizations take to transform ideas into improved products, services, or processes, as a way of competing to differentiate themselves in the marketplace (Baregheh et al., 2009). Up to this point, innovation studies have been primarily concerned with innovations that mainly emanate from research and development (R&D) departments. Recently, the roles of ordinary employees in innovation processes have become a focal point in innovation literature (Aasen et al., 2012; Deslee & Dahan, 2018; Voxted, 2018). It has become imperative to regard all employees, irrespective of their role or capacity, as the "innovation capital" or asset of every organization (Kesting & Ulhøi, 2010). As a result, organizations today expect more creativity, innovation, and involvement from employees in the rapidly changing business environment. This has led to a focus on the potential of ordinary employees as contributors to innovation (Price et al., 2012; Wihlman et al., 2014; Engen & Magnusson, 2015).

R&D-focused innovation in most companies has relied on the assumption that innovation requires special skills and should be restricted to a small group in the organization that possess these skills (Harmaakorpi & Melkas, 2012). Today, this assumption is no longer tenable as previous studies have shown that all employees have the potential to contribute to innovation (Engen, 2016; Båckstrom & Lindberg, 2018; Renkema, 2018). Employee-Driven Innovation (EDI) is a construct that describes an innovation emanating from employees who are not overtly required to do so (Høyrup, 2010; Kesting & Ulhøi, 2010). Specifically, it refers to new ideas that are initiated and driven by ordinary employees well beyond their regular duties (Wihlman et al., 2014; Xin, 2016; Holmquist & Johansson, 2019). On this basis, EDI is described as an extra role behaviour (Buhl, 2018; Renkema, 2018) that begins at the job task and worker level (Høyrup, 2012). What this suggests is that employees who get involved in EDI are merely acting on their own free will. They are innovators, so they innovate at their place of work. It is on this basis that Alasoini (2013) argued that the starting point for EDI is an employee's internal desire for creativity, learning, and development based on what De Spiegelaere and Gyes (2012) described as direct participation in the innovation process.

As stated above, EDI revolves around individuals who decide to accept and take on roles outside of their officially allotted duties. We thus require a better understanding of the factors that motivate individuals to participate in this kind of extra role behaviour. Specifically, this paper focuses on self-leadership, the

need for autonomy, and perceived job autonomy in relation to EDI. Perceived job autonomy may not be considered among individual factors such as the need for autonomy and self-leadership. However, the perception of job autonomy by individual employees will depend on their own personal interpretation. This implies that different employees will recognise the same job and its level of job autonomy differently. Research shows that individual-level factors are essential in predicting organizational performance (Kim, 2005). In this paper, it is argued that the presence, perception, and interpretation by employees of these three mentioned factors serves as a form of motivation, whereby employees are encouraged to engage in EDI. Nevertheless, up to the present time individual-level antecedents to EDI have not been previously investigated. Therefore, this paper aims to examine the association between individual-level factors and EDI.

Self-leadership refers to the process through which an individual acquires and develops self-influence to achieve self-direction and self-motivation skills that are necessary to perform effectively in the workplace (Manz, 1992; Stewart et al., 2011; Amundsen & Martinsen, 2015). The need for autonomy and perceived job autonomy looks at autonomy from various perspectives. Perceived job autonomy is related to the job characteristic model and comes across more as an external type of autonomy driven by workplace conditions (Hackman & Oldham, 1975; Parker et al., 2017). Alternatively, the need for autonomy is considered as a basic need according to self-determination theory, suggesting more of an internal type of autonomy tied to the characteristics of individual employees (Ryan & Deci, 2000; Deci & Ryan, 2008b).

Accordingly, this paper makes the following contributions. First, this study empirically links individual-level factors to employee-driven innovation, thereby deepening and extending our understanding of the central role of individual factors when it comes to EDI. Second, through the positive association between a need for employee autonomy and self-leadership, this paper provides further empirical evidence of this relationship and extends it to EDI. In this regard, it further demonstrates a positive relationship between self-leadership and EDI. Additionally, self-leadership acted as an indirect link between the need for autonomy and EDI.

The rest of this article is structured as follows. The next section focuses on key constructs in this study, and builds the argument for setting up the research model and hypotheses. The research methodology section follows this. Next, the results are presented, and finally, the discussion and conclusions.

Theory and Hypotheses

Need for autonomy and self-leadership

Self-determination theory (SDT) is conceived as a macro-level theory of human motivation that addresses issues such as personality development, self-regulation, and universal psychological needs (Deci & Ryan, 2008b). SDT centres around differentiation between autonomous motivation and controlled motivation, and suggests that these two types of motivations are different with respect to both their underlying regulatory processes and their accompanying experiences (Deci & Ryan, 2008a). Furthermore, SDT suggests that behaviours are characterized depending on whether they are shaped by autonomous versus controlled motivation (Gagné & Deci, 2005). Individuals who are autonomously motivated, experience volition in action, whereas those who are control motivated instead experience pressure to think and behave in a specific way (Deci & Ryan, 2008b). In line with this, Yun, Neck, Cox, and Sims (2006) defined the need for autonomy as "a trait, predisposition, or an individual difference variable that refers to a personal need or eagerness to express one's initiative in doing one's job", while Norris (2008) defined it as "a person's desire to engage in activities of his or her choosing".

Self-leadership is about the influence one exerts over oneself to achieve self-motivation and self-direction, contingent on behaving in desirable ways (Manz, 1992; Neck & Manz, 1996; Carmeli et al., 2006; Yun et al., 2006). It is rooted in several inter-related theories of self-influence, including self-regulation, self-control, intrinsic motivation, and self-management (Houghton & Neck, 2002; Carmeli et al., 2006; Neck & Houghton, 2006; Yun et al., 2006). This combination of theories is in contrast to conventional top-down leadership approaches, in which a single leader or a group of leaders aims to influence and control their work subordinates through certain behaviours and actions (Carmeli et al., 2006; Houghton et al., 2014). Instead, through self-leadership, individuals develop the requisite skills to enable their intrinsic motivational abilities to shine forth, instead of merely relying on their leaders for this (Williams, 1997). Self-leadership at work is thus an acknowledgement that even when employee behaviours are shaped by external forces such as

hierarchical leadership in a company, they are ultimately controlled by forces internal to individual employees (Stewart et al., 2011).

Literature shows over time that three distinct but complementary cognitive and behavioural strategies of self-leadership have emerged. They are, namely: behaviour-focused strategies, natural reward strategies, and constructive thought pattern strategies (Carmeli et al., 2006; Houghton et al., 2012). Together these make up the construct of self-leadership (Houghton et al., 2012; Houghton & Neck, 2002). Behaviour-focused strategies imply strategies that are aimed at increasing self-awareness, leading to greater management of behaviours (Manz, 1992), such as self-observation, goal setting, self-rewarding, self-correcting feedback and practice. (Carmeli et al., 2006; Houghton & Neck, 2002). The natural reward strategies in contrast focus on positive experiences associated with a task and the process through which it is achieved. Finally, constructive thought pattern strategies involve visualizing successful performances, engaging in positive self-talk, and raising consciousness about beliefs and assumptions needed to change dysfunctional thinking (Houghton & Neck, 2002).

Even though self-leadership and the need for autonomy are closely related, the need for autonomy at work is a latent trait, while self-leadership is a manifestation of a person's overall level of self-control (Yun et al., 2006). Self-leadership is influenced by the need for personal autonomy and helps motivate autonomous action (Norris, 2008). As Deci and Ryan (2008b) suggested, the need for autonomy is seen as an essential element of individualism, where taking personal responsibility is also crucial for self-leadership. Norris (2008) argued that employees who possess a personal need for autonomy appear to be more likely to take responsibility, participate in decision making, and practice self-leadership strategies.

Empirical studies have complemented theory to suggest a link between the need for autonomy and self-leadership. For example, Yun et al. (2006) found that an individual's perceived need for personal autonomy can subsequently determine the extent to which that individual engages in self-leadership. This is attributable to the fact that such employees are better able to make their own choices, act independently, and take action on certain decisions (Norris, 2008).

Based on the above arguments, the following hypothesis is proposed:

H1: *There is a positive relationship between the need for autonomy and self-leadership.*

EDI and self-leadership

EDI refers to the generation and implementation of new ideas by ordinary employees who are not formally assigned the task of innovation (Høyrup, 2012). Empirical evidence no longer upholds the view that only specific individuals or groups dominate creative thinking (Høyrup, 2012; Haapasaari et al., 2017; Bäckström & Bengtsson, 2019). However, the notion of EDI focuses on the participation of ordinary employees in the company's innovation process. First, EDI indicates that innovative ideas can come from those outside of a selected group of employees with non-innovation specific roles. Instead, innovation could emerge from the insights of employees within the organization, such as customer-facing employees, shop-floor workers, and middle managers, among others (Kesting & Ulhøi, 2010; Xin, 2016). Second, employees who engage in EDI perform extra-role behaviours because they engage in duties not formally assigned to them. Third, it shows that employees who always have been primarily involved in the execution of ideas can also generate, and/or select the most suitable ideas as well (Xin, 2016).

Innovations are typically described as complex procedures, consisting of a variety of different activities (Kesting et al., 2015). Previous studies have suggested that various stages of innovation belong to different domains of an organization. The ideation phases mostly occurs at the individual level, whereas the implementation phase occurs at the organizational level (Axtell et al., 2000). Accordingly, Echebiri, Engen, and Amundsen (Forthcoming, 2020) stated that EDI consists of three encompassing dimensions, namely: the emergence of and search for ideas, idea generation, and idea development and implementation. The emergence of and search for ideas along with idea generation, occur at the individual level. In contrast, idea development and implementation occur at the team or organizational level. The team's importance shows, as argued by Smith, Ulhøi, and Kesting (2012), that to successfully drive forward an idea implies that employees are involved throughout the process. Therefore, ordinary employees are enabled to be actively involved throughout the three phases of EDI.

Several studies have shown the positive effects of self-leadership on work outcomes (e.g. Neck, DiLiello, & Houghton, 2006; Stewart et al., 2011), and emphasized its importance for the innovation process (e.g. Gomes,

Curral, & Caetano, 2015; Neck et al., 2006). Carmeli et al. (2006) found that self-leadership was positively associated with both self and supervisor ratings of innovative behaviours. Carmeli et al. (2006) suggested that people who possess good self-leadership qualities at the same time know how to achieve high levels of self-direction and self-motivation. The outcome is that these individuals can learn to lead themselves and others. In their study, Neck et al. (2006) suggested that individuals with strong self-leadership are more likely to consider themselves as more creative and innovative, unlike those with weak self-leadership. According to Neck and Manz (1996), applying self-leadership strategies may result in several predictable outcomes such as creating a tendency towards creativity and innovation. Prussia, Anderson, and Manz (1998) described self-leadership as a vital foundation for an organization. Neck et al. (2006) argued that employees who possess high levels of self-leadership are more likely to achieve higher innovation and creative potential than employees who are low in self-leadership. Since behaviour-focused strategies increase self-awareness through such things as self-observation and natural reward strategies, potential exists for promoting a positive experience concerning one's task. Consequently, self-leadership is crucial for employees in order to help initiate and drive company innovation. This likely means promoting extra-role behaviour by individuals at work, as well as positively encouraging EDI.

Based on the above, this study states the following hypothesis:

H2: *There is a positive relationship between self-leadership and EDI.*

Need for autonomy and EDI

Building on the previous argument regarding the need for personal autonomy along with EDI, this paper argues that employees with a higher need for autonomy are more inclined to engage in EDI. Thus, the following hypothesis is stated:

H3: *There is a positive relationship between the need for autonomy and EDI.*

The mediating role of self-leadership

The mediating role of self-leadership is not a new mechanism in the literature (Amundsen & Martinsen, 2015). However, this paper proposes that the relationship between the need for autonomy and EDI are mediated by self-leadership. As previously stated, self-leadership is an actual manifestation of self-control (Yun et al., 2006). Considering what actually happens in social reality regarding innovation, the mediation of self-leadership should be expected only to be partial.

H4: *Self-leadership partially mediates the relationship between need for autonomy and EDI.*

The moderating role of perceived job autonomy

Job autonomy is defined as "the degree to which the job provides substantial freedom, independence, and discretion to the employee in scheduling the work and in determining the procedures to be used in carrying it out" (Hackman & Oldham, 1975). Based on the job characteristics model (JCM), job autonomy emerges as one of the five job characteristics that make a job more satisfying (Humphrey et al., 2007; Parker et al., 2017). Also, it is one of the four sub-dimensions of psychological empowerment (Spreitzer, 1995). Unlike the need for autonomy earlier discussed, perceived job autonomy is a more global concept, one that touches upon almost all aspects of a job (Kuvaas et al., 2016). At the core of job autonomy is the notion of perceived control concerning one's job (Ng & Feldman, 2014). That is to the extent to which employees have the freedom to make decisions and carry out their tasks with less supervision (Morrison et al., 2005; Smith et al., 2012).

When a workplace environment offers higher autonomy, it implies that employees have significant freedom and discretion on how to plan and execute their job tasks (Morgeson & Humphrey, 2006). Having a higher level of job autonomy means that employees assume greater responsibility for their own decisions and initiative, thus depending less on their supervisors (Hackman & Oldham, 1975; Yun et al., 2006). As argued by Spector (1986), the extent that employees believe they can have a considerable impact on their work environment will influence how they react to it. On the contrary, lack of job control has been suggested to result in a sense of lower personal accomplishment (Kim & Stoner, 2008). Axtell and Parker (2003) argued that giving employees more autonomy in their job encourages employees to go beyond their assigned roles and responsibilities.

In their meta-analysis of 415 empirical samples, Ng and Feldman (2014) observed that job autonomy was positively and significantly related to a wide variety of positive work outcomes that cut across sectional and longitudinal designs. Dhar's (2016) study shows that job autonomy, as a moderator, strengthened the relationship between leadership and innovative behaviour. In a recent study, Kurz, Husig, and Dowling (2018) found that job autonomy had a positive

relationship with innovative behaviour. Previous studies show that perceived job autonomy is most crucial at the individual level, especially for the ideation stages. Employees who worked in a high task-autonomy work environment were found to have generated more creative ideas (Zhou, 1998). Smith et al. (2012) proposed that autonomous work structures are positively related to employee-driven idea generation. Consequently, when a job or "position" is designed in a manner that provides employees with high levels of autonomy, it will likely result in increased opportunities for EDI.

Based on this, the following hypothesis is proposed:

H5: *Perceived job autonomy will moderate the relationship between self-leadership and EDI, such that this relationship will be stronger with higher perceived job autonomy, and weaker with lower perceived job autonomy.*

Method

Data for this study was collected from employees working in the Norwegian banking sector, which is dominated by a few very large commercial banks, some regionally based and several small savings banks spread across the country (Cook, 2018). The bank was chosen because of its focus on innovation-driven by its employees. The survey was designed on an online platform called Nettskjema. Following research cooperation between the research team and the organization, the link to the survey was sent to an HR person in the organization, who then distributed the survey to the employees within the scope of the study.

To help minimize the effect of common method variance, which arises from self-report surveys (Chang et al., 2010), two ex-ante remedies were applied as recommended (Chang et al., 2010; Podsakoff et al., 2003). The variables were separated in time by collecting data in two waves. Self-leadership and need for autonomy were measured at time 1 (T1) whereas EDI and perceived job autonomy were measured at time 2 (T2). There was a time lag of 10 days between T1 and T2. Second, the items were counterbalanced in their order.

A total of 715 employees received the survey. At T1, 443 completed the survey, while 377 participated at T2. After linking respondents who completed both T1 and T2, there was a usable sample of 315 respondents representing a response rate of 44 percent. Table 1 shows the description of the respondents.

Survey instruments
The study used a survey-based approach and respondents were asked to rate the questions on a five-point Likert scale ranging from "1 - strongly disagree to 5 - strongly agree."

EDI
EDI was measured based on a 13-item scale developed by (Echebiri, Engen, & Amundsen, in press). The scale consists of the following three sub-dimensions: Emergence and search for ideas (four items), idea generation (three items), and idea development and implementation (six items). Sample items include emergence and search for ideas ("I recognize when there is an opportunity for improvement with a practice"), idea generation ("I come up with creative ideas that might improve the daily work"), and idea development and implementation ("When a developed idea is put into practice, it becomes part of the routine"). The reliability for EDI was .70.

Perceived job autonomy
Three items were adopted from the work design questionnaire (Morgeson & Humphrey, 2006). The items were: "The job gives me good opportunities to take personal initiatives or consider how to do the work", "The job allows me to make my own decisions", and "I have great freedom of decision in my work". Cronbach's alpha was .77

Self-leadership
The items were adopted from the abbreviated self-leadership questionnaire (Houghton et al., 2012). The scale comprises of three dimensions with each dimension measured with three items. The dimensions were: Behaviour Awareness & Volition (I establish specific goals for my own performance), Task Motivation (I visualize myself successfully performing a task before I do it), and Constructive cognition (Sometimes I talk to myself, out loud or in my head, to work through a difficult situation). The factor reliability coefficient of self-leadership was .73.

Need for autonomy
Three items were adopted from Yun (2006). The items include: "I would find solutions to my problems at work without consulting my supervisor", "I would make decisions on my own initiative without involving my supervisor", and "I would collaborate with other employees at my level to accomplish tasks without involving my supervisor". Cronbach's alpha was .80.

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Table 1. Respondents profile (N = 315)

	Frequency	Percentage
Gender		
Female	159	50.5
Male	156	49.5
Contact with customers/users		
Yes	250	79.4
No	65	20.6
Education		
Secondary	36	11.4
One year post-secondary	68	21.6
Bachelors degree	129	41.0
Master degree or higher	82	26.0

Data analysis

Structural equation modelling (SEM) was performed with Stata version 15.1 using a maximum likelihood estimation. The analyses were carried out in four major steps. First, the measurement model was validated using a confirmatory factor analysis (CFA). Next, the analysis proceeded with the structural model, as recommended in previous studies (Acock, 2013; Mehmet & Jakobsen, 2017). SEM was performed based on the measurement model to estimate the fit of the hypothesized model to the data. Next, the analysis of the indirect effect was performed on Stata. Finally, the moderation analysis was performed using SPSS version 25.

Results

The means, standard deviations and latent bivariate correlations for all the variables included in the present study are reported in Table 2.

Measurement model

The measurement model consisted of one first-order construct (the need for autonomy), and two-second order constructs that had multiple indicators (self-leadership and EDI). Perceived job autonomy was not included because the moderation was performed separately, as previously stated. The model indicated a good fit [$\chi^2(243) = 395.29$; CFI = .93; TLI = .92; RMSEA= .05; SRMR = .06]. The average variance extracted that was used to gauge construct validity did not reveal any problems. With a satisfactory measurement model, the next step was to test the structural model.

Hypotheses testing

Since H1, H2, and H3 were based on the bivariate relationships, the hypotheses were tested based on latent variable correlations obtained in Table 1. H1 suggested a positive association between the need for autonomy and self-leadership. This hypothesis was

Table 2. Descriptive statistics and latent variables correlations

	Mean(SD)	1	2	3	4	5	6
ES	4.7(.47)						
IG	3.8(.74)	.48***					
IDM	3.7(.64)	.43***	.45***				
EDI	4.1(.46)	.NA	NA	NA			
NFA	3.7(.85)	.07	.16**	-.04	.12		
PJA	4.1(.77)	41.***	.44***	.52***	70.***	-.03	
SL	3.9(.50)	.60***	.38***	.48***	.71***	.16*	19

Note: ES = Emergence and search for ideas, IG = idea generation, IDM = idea development and implementation, EDI = employee-driven innovation, NFA = need for autonomy, PJA = perceived job autonomy and SL = Self-leadership, NA = Not applicable
*$p < .05$, ** $p < .01$, ***$p < .001$

Table 3. Moderation effects of perceived job autonomy

Model		Std. coefficients Beta	Std. Error	t	Sig
1	Constant		.02	183.88	.000
	SL	.26	.04	5.58	.000
	PJA	.47	.03	9.84	.000
	SL x PJA	-.02	.06	-.48	.632

Note: SL = Self-leadership, PJA = Perceived job autonomy. Dependent variable = EDI.

supported (r = .16, p < .05). H2 postulated a positive relationship between self-leadership and EDI. This hypothesis was also supported by the data (r = .71, p < .001). H3 suggested a positive relationship between the need for autonomy and EDI, but was not supported (r = .12, p < .ns). H4 proposed that the relationship between the need for autonomy and EDI is mediated by self-leadership. This mediation hypothesis was not supported because of the non-significant relationship between need for autonomy and EDI. However, with significant relationships between need for autonomy and self-leadership (H1), as well as between self-leadership and EDI (H2), this satisfied the conditions for an indirect relationship in the data between need for autonomy and EDI (Mathieu et al., 2008).

Test of the indirect effect

A test of the indirect effect was conducted based on a structural model, which fit the data well. The test was performed using Monte Carlo replications in Stata. The number of Monte Carlo replications was set to 5,000. The average indirect effect of the need for autonomy in EDI through self-leadership was estimated to .10, SE = .05, p < .05.

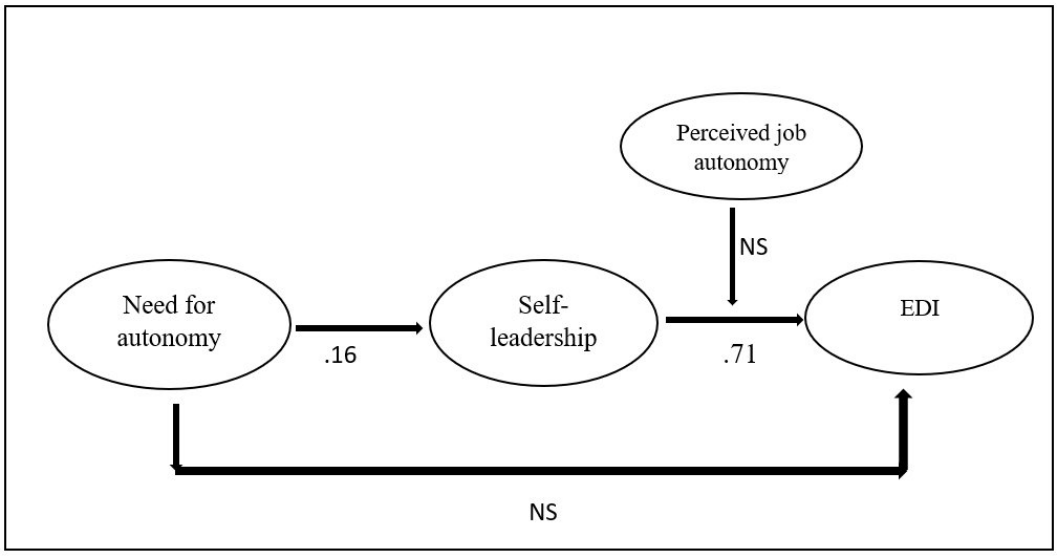
Moderation analyses

H5 suggested that perceived job autonomy would moderate the relationship between self-leadership and EDI, such that this relationship would be stronger when there is higher perceived job autonomy, and weaker with lower perceived job autonomy. To reduce the potential for multicollinearity between lower-order and higher-order terms, the variables were mean-centred. As shown in Table 3, the data did not support the hypothesis.

The results of hypotheses testing are summarized in Figure 1.

Supplementary analysis

A supplementary analysis was performed regarding the relationship between self-leadership and the various sub-dimensions (stages) of EDI. To remind, these are:



NS = Not supported

Figure 1. Complete hypothesized model included results of the hypotheses testing

the emergence and search for ideas, idea generation, and idea development and implementation. This structural model gave a mixture of acceptable and nonacceptable fit indices. The modification indices were used to check for areas of improvement, and indicated allowing two pairs of error terms to correlate that belonged to the same construct. The model improved and indicated that the supplementary model was satisfactory [$\chi^2(181) = 314.01$, $p < .001$; CFI = .94; TLI = .92; RMSEA = .05; SRMR = .07]. It was found that self-leadership had a positive relationship with emergence and search for ideas ($\beta = .71$, $p <. 001$), idea generation ($\beta = .54$, $p <. 001$), and idea development and implementation ($\beta = .59$, $p <. 001$).

Discussion

The main aim of this paper was to investigate how individual-level variables (need for autonomy, perceived job autonomy, and self-leadership) associate with EDI. First, it was found that the need for autonomy had a positive relationship with self-leadership, and an indirect association with EDI through self-leadership. Second, it was established that self-leadership has a positive association with EDI. Contrary to the hypotheses presented, there was no support for a direct positive association between the need for autonomy and EDI, and for the moderating role of perceived job autonomy between self-leadership and EDI. Additionally, the supplementary model indicated that self-leadership has a positive relationship on all stages of EDI.

The findings in this paper give additional support to some earlier findings on relationships in management research. The result of a positive correlation between the need for autonomy and self-leadership agrees with previous results (Yun et al., 2006). This implies that employees who have more need for autonomy are likely to be more motivated to lead themselves because such people can express themselves at work, display positive behaviours (Yun et al., 2006; Ng & Feldman, 2014), and thereby increase the likelihood of becoming more innovative and vice versa.

The positive relationship between self-leadership and EDI is also in line with previous studies where self-leadership was found to predict innovation (Neck et al., 2006). However, this is the first empirical paper to demonstrate a positive relationship between self-leadership and EDI, as well as an indirect association between the need for autonomy and EDI. Similarly, the positive association between self-leadership and the three phases of EDI (emergence and search for ideas, idea generation, and idea development and implementation) is also a crucial finding, as it links self-leadership to both the individual and organizational stages of EDI. Innovation literature suggests that different stages of innovation belong to their respective domains in the organization. For example, individual behaviour such as idea generation belongs to the individual level. In contrast, implementation phases belong to the organizational, group, or team level (Axtell et al., 2000).

These results, clearly underscore the central role of individuals in initiating and driving the innovation process. EDI is about ordinary employees participating in the entire innovation process (De Spiegelaere & Gyes, 2012; Smith et al., 2012). This is because their involvement is beyond mere ideation (Båckstrom & Lindberg, 2018). Furthermore, it also brings to light a new understanding that the development and implementation of an innovative idea within the context of EDI belongs to both the individual and organizational domains. This is theoretically understandable because employees on their own cannot implement innovation, though they are involved in the process.

Therefore, it is safe to say that the supplementary findings in this paper not only re-affirm our understanding of innovation, but also extend this understanding. As earlier stated in this section, the moderating role of perceived job autonomy was not supported by the data. Instead, self-leadership had the same impact on EDI regardless of whether perceived job autonomy is low or high. Nevertheless, despite the design of this paper, it still suffers from the weaknesses associated with a cross-sectional survey that has no real causality.

Theoretical and practical implications

Based on these findings, the following implications can be deduced. From a theoretical point of view, the various implementation phases of an innovation process ideally belong to the organizational domain (Axtell et al., 2000). This paper brings a new perspective to that long-held view. From the perspective of self-leadership studies, this finding is not entirely surprising, as self-leadership has been extended to the group level analysis (Stewart et al., 2011). The finding suggests that EDI, as both a process and an outcome, belongs to individual and organizational domains. Idea development and implementation require a level of self-leadership on the part of employees that runs beyond resources and other factors associated with the organizational domain. This

is the most important theoretical contribution of the paper.

From a practical perspective, external factors such as leadership are crucial for innovation (Hughes, Lee, Tian, Newman, & Legood, 2018). This includes EDI, while self-leadership skills are also important. The management and leadership of an organization should be aware that individual-level factors can engender EDI. There is no guarantee that management or good leadership alone can adequately motivate employees to become innovative if they cannot lead themselves. The implication here is that organizations should strive to complement external influences with internal incentives such as rewarding employees for valuable examples of self-leadership. Employees who can lead themselves are in a better position to identify a problem or perceive an opportunity at work, in a way that allows them to contribute more actively to the development and implementation of their ideas.

In conclusion, the findings in this paper suggest that the management, line managers, supervisors, and human resources department should be aware that employees with a high need for autonomy are in a better position to self-lead themselves. This is in line with Houghton et al. (2014) argument that internal forces ultimately shape behaviours. Organizations should therefore strive to create an opportunity for employees with a high need for autonomy to develop their skills to influence themselves and others, because through self-leadership, they can lead themselves to become more innovative in the company.

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Fundraising Campaigns in a Digital Economy: Lessons from a Swiss Synthetic Diamond Venture's Initial Coin Offering (ICO)

Jahja Rrustemi & Nils S. Tuchschmid

> *"Ideas are easy. Implementation is hard."*
>
> Guy Kawasaki

As economies digitalize and many local businesses gradually internationalize, crowdfunding platforms have offered a new way for ventures to raise capital. Relying on distributed ledger technology (DLT, blockchain), the method of "tokenization" now seems to be the next way for digital economics to be actualised in practise. Digitalizing some of the production and selling processes through crypto-tokenization technology has brought with it new perspectives and opportunities. Any thorough consideration of the logic of "distributed systems" applied to economics is bound to see that it potentially brings considerable disruptions and significant changes in how companies get access to funding. Cryptocurrencies, and subsequently "tokens" initially issued from "initial coin offerings" (ICOs) have answered an obvious need for efficient, borderless, and secure flows of capital. This article first summarizes what early academic research tells us about ICOs based on DLTs and their factors of success. We then use the case of LakeDiamond, a Swiss venture in the business of growing and polishing synthetic diamonds, to present and contextualize the process of holding an ICO, which ultimately did not succeed. In the final section, we present two fund raising models that have recently gained traction and popularity, namely "security token offerings" (STOs) and "initial exchange offerings" (IEOs), and highlight their main advantages compared to ICOs.

I. Introduction

Ten years ago, Pascal Gallo, a French researcher with a fresh doctorate in physics from Toulouse University embarked on a new journey at the Ecole Polytechnique Fédérale de Lausanne (EPFL). During his post-doctorate studies, he began the first experiments on technologies related to growing synthetic diamonds. Later, in 2015, he founded LakeDiamond, a start-up located at the EPFL Innovation Park specializing in lab-grown diamonds. According to LakeDiamond, these lab-grown diamonds have unique properties. Among others, they are "transparent to light, conductors of heat, eco-friendly, chemically inert, hard and elastic and biocompatible" (LakeDiamond — Summary fact sheet, October 2018), a set of characteristics that sounds extraordinary.

Diamonds are used in a variety of fields, from medicine and telecommunications to computer sciences. Industrial demand is there; supply, however, has been lacking. The manufacturing process relies on complex machinery, where layers of carbon are deposited in a crystalline pattern to gradually shape a fully lab-grown diamond. The process is done in reactors that are extremely costly to manufacture. LakeDiamond owned two of these, and intended to acquire fifty more in the next five years if the company could obtain the financing. With a limited number of reactors, the fifteen thousand plates of diamonds produced per year would not have been sufficient to finance such a rapid expansion of the company. Although opportunities were available, the heavy cost of the reactors and the low productivity of the manufacturing process hindered company growth. Under these circumstances, raising capital was the priority for Gallo and his associates, as is often the case when start-ups wish to expand. A decision was then made to launch an Initial Coin Offering (ICO) using the relatively new and still emerging distributed ledger technology (DLT) known popularly as "blockchain" or "Bitcoin" (more below).

Fundraising Campaigns in a Digital Economy: Lessons from a Swiss Synthetic Diamond Venture's Initial Coin Offering (ICO)

Jahja Rrustemi & Nils S. Tuchschmid

In this short paper, we aim to provide for readers a glimpse into the world of digital economics (cf. tokenomics), and specifically into the challenges that can be encountered during a campaign of cryptocurrency fundraising. Given the decline in confidence, we also explore the limits of ICOs, and present alternative solutions. Different models have become more popular nowadays, namely "security token offerings" (STOs) and "initial exchange offerings" (IEOs), for which we briefly highlight the pros and cons of each of these new solutions.

II. Crowdfunding

Obviously, raising capital for a start-up is often synonymous with ownership dilution: it relies on private investors, usually referred to as "business angels" (Elitzur & Gavious, 2003), to invest in the company in exchange for partial ownership of the firm. This "business model" is the most popular way to raise funds, yet the last decade has seen the emergence of new online financing platforms, known as crowdfunding. At its start, crowdfunding typically relied on small donations from a large audience who support the idea of financing a project or venture (Ahlers et al., 2015; Vismara, 2016; Vismara, 2018). Basically, the individuals who propose a new project and need financing will ask for capital without ceding ownership of future revenues or assets of the venture. Some sort of reward or gift may be promised if the project reaches a certain milestone. Or, in the case of simple donations, nothing is given in return. You may ask yourself, why would anyone provide funds without expecting anything in return if the project is successful? For one, the donations are usually in small amounts, rendering the gesture accessible to the public and the money loss not too taxing. Due to the platform being easily accessible and therefore available to everyone, funding can be provided without having to go through conferences or meetings to pitch your idea to potential private investors.

Also, the gains of the "investors" are perceived on the basis of the solutions provided by the project, if successful. From a theoretical standpoint, the last part is quite confusing. Imagine a society where companies can convince the general public that they should get financing free-of-charge for the simple fact that it could be beneficial to them in the future. Now, should the start-up not succeed, the cost of failure would be shouldered by a multitude of donors. Yet, on the other hand, owners would reap early investor rewards from any success. Difficulties arise, however, when individuals with bad intentions promise projects not actually designed to happen, that would "unfortunately" fail, yet bring short-term gains to one or a small few owners?

In an attempt to circumvent some of these issues, other online platforms, such as Crowdcube or AngelList, propose equity crowdfunding, also known as crowdinvesting, where each investor can obtain ownership in the start-up, with the lowest possible investment being as little as 10 dollars. This offers an effective solution that provides a bridge between donation-based crowdfunding and "initial public offerings" (IPOs) (Ritter & Welch, 2002), which are now common, though accessible only to companies that are relatively well-established. In parallel to crowdinvesting, crowdlending platforms have also become popular. On the latter, investors lend money to companies or individuals; amounts can vary from small to large. Nowadays, crowdinvesting and crowdlending represent the bulk of money that circulates on these platforms. In Switzerland for example, out of the circa 500 million CHF (€460 mln EUR, or $700 mln CAD) raised in 2018 through crowdfunding platforms, close to 90% came in the form of equity or loans (Dietrich, 2019).

III. Initial Coin Offering (ICO)

Crowdfunding has reached a turning point in recent years. The hype behind the exponential growth of Bitcoin's price drew in its wake the emergence of numerous Bitcoin-like replicas, also based on blockchain technology. Blockchains thereby changed the economic landscape by allowing users to exchange value without requiring an intermediary in a way that still ensures anonymity and transaction security through "distributed ledger technology" (DLT) (Pilkington, 2016; Vaizeyv & Hancock, 2016). This technology relies on synchronizing multiple databases located on separated devices through peer-to-peer (P2P) networks. There is no feature of a central administrator, and thus no need for a pay-only intermediary.

Distributed system operations are also extremely secure, pushing the leading edge of cybersecurity and artificial intelligence. Each device that is part of a blockchain saves a copy of the ledger independently, thus making a balanced network cryptographically secure. These features are essential in a context of digitally transferring value and assets between individuals.

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It was only a matter of time for alternative ways of financing through new cryptocurrencies to surface. Initial Coin Offerings (ICOs), are a capital raising mechanism based on distributed ledger technology that became extremely popular from 2014-2018 (Adhami et al., 2018; Amsden & Schweizer, 2018; Momtaz, 2018; Momtaz, 2019c). In an ICO, the start-up would issue a cryptocurrency or "token", where the token owners obtain, for example, a right to dividends or some kind of proprietary rights or services. The tokens could also be used as a means of payment.

Note that there is an apparent relationship between the advent of cryptocurrencies and the ever-increasing globalized economy. A borderless economy is no longer a farfetched concept, in small part due to blockchain technology and token economic thinking. ICOs still fall under the general definition of crowdfunding, the initial intent is still the same, though the legal definition of "ICO" for regulations currently varies depending on the jurisdiction in which one resides. The number of possible opportunities is endless as there are innumerable things that can be deemed valuable, where that value can be digitized and made transferable using tokens. In 2017, ICOs raised about $7.5 billion USD, compared to $3.6 billion USD for the venture capital market (Amsden & Schweizer, 2018). The potential for start-ups that, due to their geographic location or lack of internal funding, may not have access to typical fund-raising routes for obtaining much needed new sources of capital, cannot be understated (Neubert, 2019). As the world becomes increasingly connected through various networks, a trend also is found in the flow of capital becoming more and more internationalized (Pieters, 2017).

When it comes to allocating capital to newly founded start-ups, many will see the potential of high returns, the famous "home runs" that come to mind to everyone. Yet, the successful start-ups are few, and investing in them is a risky venture. The same applies to ICOs. The flexibility and freedom made possible thanks to tokenization has also attracted many counterfeits and scamming schemes, as illustrated by the infamous Pincoin and iFan, the crypto startup that raised $660 million USD without any product to show (Shifflett & Jones, 2018; Kean, 2018).

Yet, not all ICOs should be mistaken for frauds or scams. While the latter make the front page of newspapers because they attract readers' attention, the risk of losing or gaining money with ICOs stems more classically from business risk. In a volatile environment, where start-ups come and go, investors always face the possibility that their investment value will be reduced to nothing should the company not be able to successfully develop its product, or not find its client base and end up going bankrupt. Bankruptcy does not spare an ICO from "currency risk" or conversion risk of token devaluation. As tokens, aka. "cryptocurrencies", are extremely volatile compared with fiat currencies, token owners bear an additional risk not present in classic fundraising campaigns. Over the recent period of 2018 and up to June 2020 for example, the annualized volatility of Ether (ETH) and Bitcoin (BTC) with respect to USD were respectively equal to 83% and 66%.

Technological risk can also be associated indirectly with ICOs. If there is a secondary market on a digital platform, for example, on which tokens can trade, there is always a risk that the platform will be hacked. This usually results in wealth vanishing at the hands of someone else with little chance of getting it back.

Of course, with the rapidly growing number of ICOs from 2016-2018 came a growing number of research papers whose scopes are somehow wide. Some papers, for example, have focussed on pricing, or on the performance of tokens (Kostovetsky & Benedetti, 2018; Sockin & Xiong, 2018; Momtaz, 2019). Others analyze how company owners have used their share of the tokens as a way to finance their start-up, and some have tried to measure the success of ICOs in raising capital (Catalini & Gans, 2019; Fisch, 2019). Regulations and the requisite legal frameworks that go with them have also attracted interest among researchers, although the crowdfunding field tends to change quickly as governments and regulators adapt to new technologies, as well as to competition between various financial centers (Zetzsche et al., 2017).

Determining the potential for ICO success is also a major focus of the emerging literature regarding new ventures. In particular, identifying which factors pre-ICO are the main drivers that explain the successful cases of this new type of funding is essential. Due to the lack of an established institutional framework and intermediaries for conducting an ICO campaign, asymmetries between entrepreneurs and investors are almost certain to arise. Hence, start-ups must essentially rely on signals emitted to potential investors, in order to differentiate themselves from the competition. These signals can range, for example, from the availability of a white paper, to other small

investors already lined-up, to the number of patents acquired. The public would then use these signals to separate good ventures from bad ones. In the context of ICOs, the following characteristics of these signals and the context in which they are sent are deemed relevant by the literature.

First, a technical environment is needed. Indeed, due to the highly innovative nature of ICOs, usually linked to DLTs (invented by Satoshi Nakamoto in 2008), ICO-backed ventures (original ICO was Mastercoin, 2013) first need to properly grasp the knowledge required to apply DLTs to fundraising and business model transformation. They also need to convey these processes to a public that does not necessarily have expertise, which creates asymmetries as the knowledge gap can be too wide from the outset (Chester, 2017; Cohney et al., 2018; Long, 2018).

Second, ICOs have proven to be risky investments. They usually happen during the very early stages of a start-up venture, and the simple fact is that digital tokens alone do not offer any real or tangible value at issuance (Russo & Kharif, 2017), unless backed by a security, which most early ICOs were not. Adding to that, the risk of frauds and scams due to participating in a new and unregulated environment, results in a highly risky investment. Yet, this does not seem to deter "crypto investors", who are likely to be much less risk-averse compared to the average investor. The new digital economy environment in terms of cryptocurrencies so far has fostered a market where exaggeration and embellishment have become the norm instead of the exception, further increasing the asymmetries.

Third, the historically anonymous nature of DLTs, and consequently also of ICOs, renders sharing information between investors and new ventures as difficult (Kaal & Dell'Erba, 2018). Crypto-oriented venture companies do not necessarily disclose crucial information to investors, as it is not the norm in this particular industry, in contrast with the desire for anonymity from investors. This secretiveness hence has caused a reciprocal attitude from ventures in return (Kastelein, 2017; Shifflett & Jones, 2018).

In addition, conditions often lack being met for "Know Your Customer" (KYC) regulations, due to the reasons stated above. All of these circumstances combine to result in the current situation, where information sharing is still very opaque, with large asymmetries of information present (Kastelein, 2017; Poutintsev, 2018). Signals are therefore necessary elements as their principal objective is to indicate whether a venture is of high quality or not. Previous research has aimed at determining which signals are useful indicators of a successful ICO campaign. For example, researchers have found that Twitter activity plays a considerable role in detecting whether or not an ICO becomes successful. The availability of the code for developers, together with efforts of the start-up team to fix bugs and update their platform, also provide positive signals (Fisch, 2019). Yet, results have been mixed. For instance, some argue that a technical and well written white paper has a positive effect on the amount of funding raised, while others find the opposite (Adhami et al., 2018). In either case, an ICO that is accompanied by a white paper at least gives the opportunity to explore the start-up's business model and unique value proposition, which fundraising using a "token sale" is supposed to address.

Contradictory evidence has been put forward by Momtaz (2019b), who argues that one of the reasons why signals are difficult to assess for ICOs is due to moral hazard. The latter significantly influences and disrupts the validity of signals. In the context of ICOs as a new type of crowdfunding in the digital economy, a lack of institutional capacity to verify the validity of market signals, and subsequent general lack of ability to "punish" those that are partial or inaccurate, serves to incentivize ventures to bias their signals. Such behavior without adequate regulation and oversight in place partially explains the large amount of exit scams and fraudulent behaviors of ICOs from 2016-2019.

To summarize, the informational asymmetry present in most ICOs has rendered difficult the formal study of precisely which factors determine a successful fund-raising campaign. Hence, when considering the possibility of entering the digital economy through investment in cryptocurrency "tokens", a thorough and diligent analysis of each start-up project, and of the surrounding circumstances are still an essential aspect if one wants to invest successfully.

IV. LKD Token

The founder of LakeDiamond, Gallo, decided to follow an ICO model as a means of raising capital. However, LakeDiamond tokens did not offer any proprietary rights to the synthetic diamonds themselves for potential token owners. The ICO instead allowed

investors to purchase minutes of synthetic diamond production in the form of tokens called LKD.

LakeDiamond thus divided its business operation into two phases: the diamond growth stage and the diamond polishing stage. The investment in minutes of diamond production was therefore tokenized by the start-up under the growth stage. Owners of LKD tokens thus were able to partake in the growth aspect of synthetic diamond production through purchase of tokens in the ICO, and later, on an exchange. The start-up, on the other hand, shouldered costs and revenues related to polishing and auxiliary work on the diamonds. Through this original method of pre-selling minutes to produce synthetic diamonds, the start-up expected to raise capital quickly without ceding ownership.

The LKD tokens proposed by LakeDiamond were not registered as "asset" tokens under Swiss legislation. Instead, they fell under the category of "payment" tokens, meaning that they could not be advertised as an investment vehicle to potential future "investors", although the white paper and public presentations clearly alluded to potential profits. To summarize, the Swiss regulator (FINMA) currently classifies tokens under four different categories: utility, payment, asset, and hybrid. Each category of token falls under different legislation and taxation rules. The owners of LKD tokens could either have purchased diamonds for themselves, transferred the LKD they bought in the ICO using a smart contract, and benefited by this directly through the company's diamond sales, or later sold the LKD tokens on a secondary market. FINMA did not deem relevant the potential investment opportunities of the model and acknowledged mainly the payment characteristic. In other words, LKD tokens had to be treated both as value storage and as payment asset, since they could be traded for fiat or Ethereum currencies.

LakeDiamond developed a framework using blockchain technology to make sure that tokenization of the minutes of production was a transparent and secure procedure. The transaction process worked as follows: an initial order was made from an industrial client, for which a smart contract was created. The smart contract order was then attached with a corresponding Ether value. The owners of LKD tokens could then bid against each other using a smart contract, where the lowest bids gained precedence in the order of selling priority. Note that LKD owners had to enter their bids onto the platform beforehand, that is, ahead of the auction. Meanwhile, LakeDiamond started producing the diamonds and through a distributed ledger, offered proof of production to future minute owners. After the diamonds were delivered to industrial clients, the value of the diamonds was converted into Ether and attached to the specific smart contract. The most beneficial bids for LakeDiamond were selected to fulfill the order. The lowest bidding chosen token owners, finally got Ether in exchange for their LKD tokens.

V. LakeDiamond ICO

The LakeDiamond ICO was launched in October 2018 with the objective to close the ICO in only a few months, after reaching its target. Yet, the complexity of the LakeDiamond ICO design translated into a mitigated problem for investors. By March 2019, it became clear that LakeDiamond had not achieved its objective. During the ICO, it reached only the soft cap of 5 mln CHF ($7.2 mln CAD), a result that remained far less than the 60 mln CHF ($86.2 mln CAD) initially expected, and the minimum needed for the project to start. The start-up then decided to extend its ICO by one year and to focus mainly on institutional investors with a minimal investment of 100,000 CHF ($144,000 CAD). Nevertheless, for the owners of LKD tokens who participated in the first round and were promised that the ICO would come to an end by March 2019, the possibility to bid on tokens for minutes still existed. At the beginning of July 2019, LakeDiamond ran its first auction at a price of 0.61 CHF ($0.88 CAD), and thus the first series of tokens were used, or technically speaking, "burnt". Yet with a soft cap not high enough to have ensured company growth and an uncertain final output for the ICO, LakeDiamond had to resort to more standard financing sources, through loans and equity.

Hidden behind state-of-the art encryption technologies and exciting mechanisms, it seemed there were flaws linked to system design imperfections. A recurrent subject that came up in discussions was, for example, the relationship between industrial clients and token owners. Diamonds could be obtained at a production price through the company's e-commerce website. Hence, what could have prevented potential customers from skipping the bidding mechanism and acquiring diamonds through e-commerce? The answer was not clearly provided in the white paper itself.

In addition, from a supplier's standpoint, having

information on production prices is a peculiar situation. How could LakeDiamond negotiate with industrial clients for profitable prices, if prospective clients are at the same time aware of the minutes of production value? Which leads to another question: what are the token owners really buying? LakeDiamond did not clearly indicate in their white paper or website how they truly set the token price. Did it cover only production costs? Or did it include a portion of the profit margin? Or was there an altogether different formula they used? All of this uncertainty surrounding the use and valuation of the LKD tokens complicated any understanding of the value proposition.

Initial market interest was definitely there. The team and company were present in numerous articles, magazines, and conferences. Yet the capital raised did not meet expectations. Interestingly, LakeDiamond even partnered with Swissquote, a large Swiss banking group, to help promote LKD tokens among potential clients, and set up the LKD trading platform. This partnership should have helped to alleviate some concerns from clients, as Swissquote is a major actor in Switzerland's banking sector. Yet, it seemed that problems with the project from the investor's point of view were too significant and resulted in a disappointing ICO.

VI. What Went Wrong?

In LakeDiamond's defense, the period in which the company operated its ICO fundraising campaign was catastrophic for cryptocurrencies. The so-called "crypto winter" saw cryptocurrency prices decline significantly, and LakeDiamond's ICO came out right in the middle of it. It is thus quite understandable that potential investors were then reluctant to own LKD tokens when market signals were ringing strongly against cryptocurrencies generally. However, the difficulties faced by LakeDiamond stemmed primarily from the lack of clarity of their model and a wrongly designed contract.

If there are no clearly defined descriptions of what the investors are getting into or if the value proposition is difficult to grasp, it will only accentuate the impression that the company may not be prepared well enough to face future challenges. From the start, as researchers, we did not know how to address the many individuals who were looking to be part of the project. Were they donors, as in a crowdfunding venture, or were they potential investors taking part in a profitable opportunity? These two categories seem to be diametrically opposed to each other. Yet LakeDiamond, on its official publications, emphasized that the synthetic diamond technology would help improve society as a whole. They also stressed wishing to "address civilian applications only". If the founders were to lose control of the company by diluting their ownership shares, it could then open the door to military procurement, as it had great use in that sector.

LakeDiamond's argument was clearly directed to a more philanthropic target than financers. And yet in the same official document (LakeDiamond White Paper, 2018), profits or opportunities of monetary gains were also discussed, while "investors" were encouraged to take part in producing and selling synthetic diamonds. Note, however, that the word "investor" was never used in LakeDiamond's official documents after FINMA labelled LKD as a payment token. This prohibited the start-up from presenting the token as an investment product. Nevertheless, it was insinuated in their presentations that it was possible to "invest" in LKD as a way to "profit". Walking along a fine line between two targeted client bases that are motivated by completely opposing ideals could only have added to the confusion of the company's motivations.

As public confusion about the start-up's aims became increasingly apparent, LakeDiamond decided to expand the ICO deadline initially promised at the beginning of 2019, and to look for additional capital sources. This reflected another main cause of public concern: ICO "investors" were completely powerless. The company had no obligations to justify any actions towards them.Investors might have wondered, for example, if they were entitled to legal recourse, in case the company were to decide to lower the issued token price from 0.55 CHF ($0.79 CAD) to 0.30 CHF ($0.43 CAD), which would have caused the initial owners to lose 0.25 CHF ($0.36 CAD) per token.

Potential token owners also had difficulty understanding if they were capturing profit margins or only covering production costs. This crucial detail was left out of the white paper. Yet, it might not have mattered after all due to the particular type of auction system LakeDiamond had initially decided to put in place. If bidding to get access to the smart contracts was to be aggressive, then it was entirely possible to imagine LKD owners ending up with getting scraps compared to what was promised initially. Let us assume, for example, that there was a contract with an industrial client and

that the maximum price of growing the diamond was, for the sake of simplicity, 1 CHF ($1.44 CAD) per minute. Yet, due to the auction system, one should have expected some bids to be low. Let's say the final price was 0.7 CHF ($1 CAD). LakeDiamond would then have earned an additional 0.3 CHF from the auction, that is, the difference between the smart contract offer and the final bid. In short, this presented itself to investors as quite a discouraging system: stronger competition for bids led to lower the bids, and thus more profit for LakeDiamond. If the power structure had not been revealed as being heavily one-sided towards LakeDiamond, be it through voting rights, ownership dilution or guarantees for creditors, the ICO might have met with more success. Note that LakeDiamond became aware of the drawbacks of their auction mechanism and changed it. The new methodology intended to match buy orders with sell orders, starting with the lowest sell (or ask) price. It then had to result in one unique auction price at which these orders could be settled, and which satisfied both buyers and sellers.

Nevertheless, one should not forget the challenging context in which the company conducted its fundraising campaign. Diamond production is a niche industry. Attempting to explain the ins and outs of the production and polishing process to a crypto-investor audience was perhaps destined to be a de facto exercise in confusion. The added complication of requiring an explanation of the value proposition coming from blockchain technology only accentuated this already existing problem.

Swissquote's willingness to collaborate with LakeDiamond and to offer the vital financial services needed to successfully run the token operation came at the right time, but also with a hefty price. To participate in the ICO, one had to open an account on the Swissquote platform. This specific constraint put a limit on the number of potential investors reachable by the company in the partnership. Worse, LakeDiamond was at the same time restricted in terms of access to markets. It had to focus mainly on Swiss and European investors, which somehow went against the global and frontier-free essence of ICOs, even though the list of countries that prohibit ICOs, including the USA and China, was indeed quite long. Stated otherwise, LakeDiamond's difficulties raising funds were the combined product of an unfavorable legal, regulatory, and financial environment that the company had to face.

In the end, it seems to have been the initial idea itself of outsourcing production costs to the public that was not the right one. In hindsight, it is at least questionable whether there could have been actual added economic value from what LakeDiamond was proposing to its "investors". The crux of the problem might simply be that the business model was flawed. Applying blockchain technology and tokenisation must serve an economic purpose. In the case of LKD tokens, other than industrial firms in need of such diamonds, who should have been the main target market for the start-up? It was they, rather than the public, who should have been the marketing focus, as they are the principal actors in the diamond production process. If, instead of focusing on the general public, LakeDiamond had reached out to industrial firms with a competitive model, where diamonds would have been sold to them at a lower price, in exchange for shouldering the costs of production, the situation might have been different today. Instead, bringing in external finance-oriented parties who had no relation to the company's business model led to a confused general public that believed it would lose out entirely if things turned sour.

VII. Transition from ICOs to Newer Forms of Fundraising Mechanisms

The failure of LakeDiamond's ICO emphasizes a need for public and investors to bypass constraints imposed by more conventional method of raising capital. While deregulated environments bring obvious advantages, such as easier access to funding, they also exhibit some detrimental elements, such as little to no protection on the investors' side. By the end of 2019, the number of ICOs had drastically reduced, with a 95% drop in capital raised compared to 2018. Scams and juridical battles that ensued after the ICO hype might certainly explain the recent decline (Myalo, 2019). However, the decline in ICOs is also due to the development of alternative crowdfunding models that have emerged more recently (Oosterhout, 2019).

The new models have improved on some of the negative issues pertaining to ICOs, by providing the needed legal framework to operate transactions and verify ventures' credibility. Two fund raising models in particular have gained recent traction and popularity: STOs and IEOs. Out of the two, Security Token Offerings (STOs) offer the more regulated and rigid model. Recalling the LakeDiamond case, it was almost impossible for investors in ICOs to recoup their investment in case of bankruptcy. An STO's aim, however, is to provide some

investor protection on that specific matter. The tokens, or more precisely the security tokens, are backed by real life assets. A security token is thus a legal investment contract that expresses various rights of ownership, such as ownership of shares, periodic dividends, cashflows, payment of debts, the right to vote, etc. These several forms of ownership are then secured through smart contracts. In addition, STOs are supervised by regulatory authorities, like the SEC, which ensures that investments are protected by law. As a corollary, start-ups that seek to raise capital through STOs will have to go through a more time-consuming and expensive procedure than with ICOs, in exchange for greater confidence from an investor's point of view (Myalo & Glukov, 2019).

Initial Exchange Offerings (IEOs) on the other hand, are less restrictive than STOs, yet they still offer more protection than ICOs for investors. An IEO is a crowdfunding approach where the selection process is done by a cryptocurrency exchange. To summarize, it is the exchange's platform that takes on the responsibility for selecting ventures that will raise capital on their platform. The cryptocurrency exchange platform is also regulated by authorities as it is considered a trading platform (Takahashi, 2020). Note that it is in an exchange's best interest to promote serious and honest ventures. Their reputation would be tarnished and the platform would fail to attract investments if they promote ventures that are either highly unsuccessful or even worse, scams. In IEOs, companies are not required to be backed by assets like with STOs. In fact, IEOs somewhat preserve the same degrees of freedom already present in ICOs and the tokenization process. However, a venture must go through heavy verification processes from exchange platforms that have a restrictive set of requirements. This process is much less costly and time-consuming than for an STO.

In short, start-ups raising money through IEOs do not need to create an exchange platform, as they benefit from an already existing platform to issue and exchange tokens, which is not the case for STOs. The exchange platform has the responsibility of attracting investors and promoting multiple start-ups, thus creating an ecosystem where parties, ventures, and the platform, are mutually beneficial to each other. This means that start-up companies with a feasible DLT use case considering the importance of a trading platform for the company's future success are now faced with the following questions: which platform, if any, to join, and if so, at what costs?

The recent advent of new online fund-raising models exposes the limitations of ICOs, in part explaining why many ICOs were unsuccessful. Regarding LakeDiamond, the choice of raising capital through an ICO surely impacted the fate of the start-up. The company could have opted for an STO, but chose not to do so. At the time, STOs were quite recent and the learning process seemed both long and uncertain. It would have also implied the need for ceding some features of ownership, something that the company was not willing to accept. Unfortunately, the start-up found itself in the middle of a transition phase from ICOs to newer models. Their choice can certainly be criticized, with hindsight, while selecting the right option at the time was not so evident.

VIII. Conclusion

LakeDiamond is a textbook example of how simple misunderstandings of the overall fundraising process and unclear contract design for investors can have lasting effects on a company. The idea of using a digital token as part of a synthetic diamond growing production process looked promising at first, as illustrated by the numerous articles published in prestigious magazines, such as Forbes, and newspapers, such as Le Monde, to name just a couple. Swissquote, a major actor in the Swiss banking industry even partnered with the start-up, bringing an added source of trust to the general public. All signs pointed to a successful ICO for the young company. Yet, the ICO did not achieve the expected outcome. Reasons for this are numerous, but essentially boils down to a confusing tokenization procedure, an incorrectly targeted group of investors, and finally, for potential token owners, to the absence of any basic monitoring, not to mention proprietary right. As we recall from signaling theory, a qualitative white paper can be a significant factor for a successful venture. The LakeDiamond white paper unfortunately did not bridge the knowledge gap with investors and the overall mechanism still remained too difficult to understand.

It would be wrong to highlight only "negatives". The company still raised a few million Swiss Francs and appeared in a position to get its business off the ground. However, the learning curve for the company was steep and the costs, not only monetary, but also in terms of missed opportunities, cannot be neglected. Indeed, according to an article published in "Le Temps" in February 18, 2020 (Ruche), LakeDiamond was "on the brink of bankruptcy", after having already announced

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that they were over-indebted in January 22, 2020.

The choice of using an ICO instead of an STO or IEO can be questioned as well. But, even if a newer model might have offered a clearer pathway to success, it would also have come at a cost: a heavier constraint on the start-up along its fund-raising campaign, and at least partial surrender of control.

Indeed, one cannot ignore that fundraising is always a game played by two entities: the company and investors, both initially motivated by their own interests. Conflicts are thus to be expected, and the search for alignments is part of the deal-making process. For these reasons, the source of financing must be correctly selected. More than just the usual expression of transparency that does not say much, providing information, allowing for some kind of control or at least for a way to appreciate the business situation and to properly manage expectations is needed if one is to target a successful fundraising campaign. In other words, whatever the technology used and whatever its name, be it blockchain, smart contracts, or tokens, ICOs, STOs, or IEOs, the company looking for funds cannot free itself from these basic business-investor constraints. LakeDiamond expected to raise capital without yielding much authority to potential investors. This proved to be an unexpectedly ambitious undertaking that culminated in a complicated situation: a delayed ICO and a company that was still looking for funding.

Finally, one should recall that the revolutionary nature of ICOs was supposed to stem from the removal of intermediaries. The recent rise in popularity of alternatives that offer some measure of control for start-ups, thus somehow seems to go against the distributed mentality behind blockchain's initial large success. Some might argue that the development of new alternatives to ICOs with increased protection for investors was to be expected. Others might respond that traditional models of fundraising campaigns already provide these features. Ultimately, the following question remains: are we just reinventing the wheel with the latest STOs and IEOs, or are the latter truly innovative and revolutionary capital raising models for investors? The future will tell us.

Notes and Acknowledgments

The analysis conducted in this paper is based on documents that were publicly available at the time of LakeDiamond's Initial Coin Offering (ICO). They are made on the basis of the White Paper(s), marketing presentations, some press articles, and presentations at conferences. A first version of this paper was drafted: June 17, 2019.

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Technology Adaptation and Survival of SMEs: A Longitudinal Study of Developing Countries

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"When true technology adoption is achieved, the life of the user is improved."

Dannah Kahn
WalkMe Blog

In the current era of internationalizing business activities and globalizating markets, technology has become an essential tool for enhancing market competitiveness. With globalization, a country's economic and business scenarios can change drastically. Many companies have seized on opportunities to pursue, and sometimes achieve economies of scale. Especially in some countries, however, the technological revolution creates significant challenges for small business entrepreneurs. Technological development plays a pivotal role in making small and medium enterprises (SMEs) competitive, as well as leading to sustainable growth. Under such circumstances, it is relevant to consider a country's technological environment for ways that can lead SMEs towards sustainable development. In the present study, we explore the impact of volatility in technological environments on the sustainability of SMEs in developing countries with emerging economies. We use the Global Competitive Index Report for the period 2012-2016, in which six parameters were applied to define the technological environment of developing nations. Two factors, namely, institutional capabilities and external capabilities emerged as significant factors according to factor analysis. We also studied the impact of emerging factors in new technological environments on the sustainability of SMEs in the specific time period using a regression analysis. The results indicate that both institutional capabilities and external capabilities become significant when time is taken as a selection variable. The high significance of the time variable indicates the dynamism of today's technological environments. As well, institutional capabilities were found to have a strong impact on a business' sustainability, in comparison with external capabilities and the high level of technological volatility.

Introduction

Economic growth requires participation from small businesses, which also act as an important tool for equitable development. The World Bank (2012a) calculated that around 200 million people are currently unemployed, while 600 million jobs need to be created by 2020, mainly in developing countries. A number of those jobs are expected to be generated by small and medium enterprises (SMEs), given their high labour intensity. SMEs thus have a key role to play in facilitating the development of the global economy. SMEs constantly provide a significant contribution to the economy through the creative process, encouraging the advancement of technology, organizational innovation, job creation, income generation, economic competitiveness, and other aspects of social development in general, along with industrial expansion, in particular.

Though SMEs represent the backbone of an economy, a very common problem with SMEs is their high sensitivity to market change. It is a challenge for SMEs in the present environment to keep pace with the turbulent technological advances. This requires constant coordination with global clients to understand their changing demands in order to produce products that reach global standards. It also demands detailed real time information regarding product and service offerings from foreign industries, as a way to keep market competitive.

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The technological environment, and more specifically digitisation initiatives support the advancement and absorption of new technologies, which plays a pivotal role in making SMEs competitive as well as sustainable. Under these circumstances, it is very much relevant to revisit the technological environment in developing countries. Recent policy recommendations from various countries are encouraging digitisation of SMEs and their use of technology-driven platforms. In India, where the authors are based, as with many countries, digitisation is both expected to improve the governance of enterprises, and also reduce their costs of operation (Government of India, 2015). When the right environment is created by policy makers, we believe that peoples' entrepreneurial spirit finds expression, and as a consequence, economic activity, may boom (Dubey, 2014).

Innovative and technology-based SMEs can now turn their attention to think about expanding outside of domestic borders to enter intra-regional and international markets as well as compete with multinational companies to capture higher market share in domestic market. In recent years, many firms have elected to focus their efforts on gaining differentiation through developing capabilities. Very often these capabilities come in the form of specific technologies (Claudia Ogreanet al., 2009).

As globalization takes place, economic and business scenarios have changed drastically and many countries have seized on opportunities to achieve economies of scale. In developing countries, despite high inherent growth capabilities, SMEs are facing a number of problems like sub-optimal operation scale, technological obsolescence, supply chain inefficiencies, increasing domestic and global competition, funding shortages, changes in manufacturing strategies, and a turbulent, uncertain market scenario. At this juncture, current day technologies have changed both perspectives on uncertainty for new ventures, as well as estimates of outcomes (Tripathi & Brahma, 2018)

The majority of SMEs in developing and transitional countries, however, have been either less than able, or even unable to take advantage of the benefits of globalization. These SMEs find that they cannot compete with foreign goods that are sometimes better in terms of

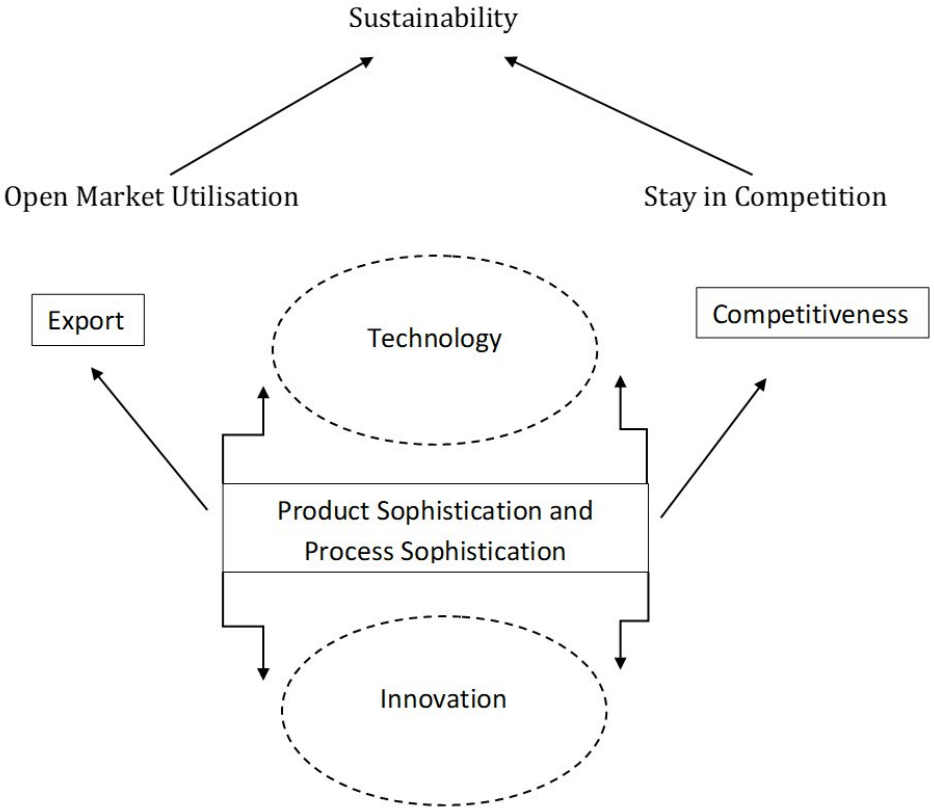

Figure 1. Theoretical Techno-Innovation Framework

both quality and price. Our aim with this research was therefore to study how SMEs in developing countries may come to benefit from globalization. While various researchers have suggested valuable recommendations to make SMEs technologically competent, our approach is an in-depth study of technological attributes for developing countries. We focus on the interrelation between technology and the sustainability of SMEs.

The purpose of the present study is to uncover the critical factors relating to favourable technological environments in developing countries that positively influence the overall performance of SMEs. Accordingly, the paper presents a model that attempts to explain sustainable technological environments for emerging economies. Within what we call a **sustainable technological environment model**, a sustainability measure of enterprise is estimated by the ratio of percentage increase in new entrepreneurial venture and percentage discontinuation of existing one for a specific time period.

We will pursue the following aims in this research paper:

- To understand the overall impact of a technological environment on the sustainability of SMEs.
- To indicate the most significant factors of a technological environment for the sustainability of existing ventures.
- To capture the trend of emerging technological factors in explaining the sustainability of SMEs in a definite time frame.

Literature Review

Technological development is one of the main factors for a firm's competitiveness in national and international markets. Firms that want to develop and maintain a competitive advantage or enter new markets cannot avoid new technologies (Becheikh & Amara, 2006). Positive relationships have been found on export performance of the variables, for example, technological innovativeness, management's attitude toward risk taking, and aggressiveness (Aaby & Slater, 1989).In spite of great opportunity to assess open market, a number of factors hinder or discourage SMEs from fully utilising global market through technological development. Among the main factors are lack of knowledge, resources, and trust. SMEs have disadvantages related to the lower levels of technological and financial resources that can lead not only to problems in their ability to source technology, but also in their capability to absorb it into their organisation and diffuse it into their industrial sector (Jones-Evans, 1998).

The importance of accumulated knowledge and expertise is an important factor determining whether firms are likely to adopt new technology or to act as sources of innovation (Gurisattiet al., 1997). SMEs will likely benefit if governments take initiatives to create a conducive business environment. In addition, internal barriers will be resolved by motivated owners, and this motivation will come from owners' trust of IT and their knowledge to use it. Research suggests that SME business owners and managers with a positive technological attitude are inclined to be more successful in adopting and implementing new technology (Ogbonna & Harris, 2005).

There is considerable evidence showing that technological development in a country and its adoption among small firms is the most important determinant for sustainability in an ever-changing competitive market. Previous research has assumed that short term growth is largely driven by capital investment, while long term growth is attributed to exogenous technological change (Corelyet al., 2002).

It is evident that governments around the world today regard technology diffusion as an important route to increased competitiveness, especially as it diffuses into SMEs. In emerging economies, the development of IT infrastructure has lagged behind that in developed countries, often because of poor policies and insufficient investments in the IT sector (Laryea, 1999). Governments of these countries acknowledge the need and importance of IT, yet have so far managed only to take little concrete action in this area (Enakrire & Onyenania, 2007).

The development of a technological environment can arise through a variety of mechanisms. On the firm level, an entrepreneur's motive is to make profit. The easiest way to do this is either to increase market share or aim for direct export. Strategic technological development may help with either of these tasks. A technologically developed firm has the potential to initiate growth of individual enterprise at the micro level, while spurring to new heights of industry growth at the macro level.

Technological innovation is a key factor in a firm's competitiveness (Becheikh et al., 2006). In global markets, the interplay between globalization and

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technology innovation has created a worldwide competition for market share, pushing larger corporate enterprises and smaller innovative entrepreneurial ventures toward profitability and survivability (Cartwright & Craig, 2006). Gunasekaran et al. (2011) researched some characteristics of small businesses, including new strategies, techniques, and technologies that could help create competitive advantage and growth in global sales. Fadahunsi (2012) found that small business owners who had acquired greater levels of technological sophistication had more growth than similar firms that do not.

A key question that policy makers in developing countries face is how to improve the technological competence of owners and employees of SMEs. Recent studies emphasize low level utilizing of improved technologies by SMEs as a critical challenge confronting SMEs in developing countries. This has held back enhancing their opportunities and participation in world trade (Asare et al., 2015; World Trade Report, 2016; Ntwoku et al., 2017).

Some experts suggest a major factor of SMEs in developing countries remains traditionally low levels of productivity, poor quality products, and limited local markets. In many developing countries, a large number of micro enterprises are also fighting for survival. Nelson and Phelps (1966) show that the facilitation of new knowledge is only possible with a sufficient level of human capital present in a developing country.

Research Gap

Researchers like Kozubikova and Kotaskova (2019) have concentrated on finding out the parameters for technological environments in order to start or hinder starting a venture. Others like Intarakumnerd and Goto, (2016) have focused on specific technology-related policies or programmes in a city, region or country, and examined their effectiveness. Many papers have mainly highlighted a framework to successfully implement the latest technology.

Yet very few studies have been done to access the overall technological-environmental factors of entrepreneurship sustainability in developing countries. Mapping the technological environment, in general, is necessary for identifying significant factors contributing to favourable business opportunities. In general, realising the patterns of changing technological environments may also be useful to understand the present situation and judge future conditions. Technological environments are characterised by the availability of the latest technologies, including firm-level technology absorption, foreign direct investment (FDI) and technology transfer, individuals using the Internet, fixed broadband Internet subscriptions, and international Internet bandwidth.

Sources of Data

The analysis has been made on the basis of identified parameters of technological environment taking developing nations as an experimental unit. The main source of data used was the Global Competitive Index Report (GCIR), 2012-2016.The research also encompasses secondary data from the Global Entrepreneurship Monitor (GEM) report, 2012-2016.

The GEM research project was designed as a long-term multinational endeavour with the purpose of providing a database to study the complex relationship between entrepreneurship and economic growth (Reynolds et al., 1999) and facilitate evidence-based policies that enhance entrepreneurship (Reynolds et al., 2005).

Parameters taken from the GCIR (2012-2016) reflecting the external technological environment are taken as independent variables in the model to measure impact on sustainability for businesses in developing nations.

The identified parameters are as follows:

1. Availability of latest technologies: In a country, to what extent are the latest technologies available?

2. Firm-level technology absorption: In a country, to what extent do businesses adopt the latest technologies?

3. FDI and technology transfer: To what extent does FDI bring new technology in the country?

4. Individuals using Internet: Percentage of individuals using the Internet

5. Fixed broadband Internet subscriptions: Fixed-broadband Internet subscriptions per 100 population

6. International Internet bandwidth: International bandwidth is the contracted capacity of international connection between countries for transmitting internet traffic.

The Global Competitiveness Index (GCI), elaborated by

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World Economic Forum (WEF) was widely applied to evaluate and rank countries based on their level of global competitiveness.

GEM reports for the period 2012-2016 were used to construct sustainable measure of enterprise. This measure is estimated by the ratio of percentage increase in new entrepreneurial ventures and the percentage discontinuation of existing ventures for the time period 2012-2016.It can be used for mapping the overall business environment of a specific country. The sustainable measure of enterprise is taken as a dependent variable to indicate a favourable business environment for developing the model.

Methodology

The GCIR (2012-2016) identified the six most crucial parameters to define the technological environment of a developing country in the time period 2012-2016. A factor analysis was performed considering all six proposed parameters of a technological environment in order to identify the most significant attributes mainly responsible for a technological environment's dynamism.

A regression analysis was performed considering the sustainability measure of enterprise as a dependent variable. Several factors emerged that define the technological environment were treated as independent variables in the time period (2012-2016). The emerged factors are also taken as moderating variable, to study the dominant factor of technological environment in each year of the mentioned period and to capture the trend of the above said environment.

Analysis - Stage I:
These six parameters are generally taken as parts of a technological environment: Availability of the latest technology, firm level technology absorption, FDI and technology transfer, individuals using the Internet, fixed broadband Internet subscriptions, and international Internet bandwidth. In our study, these parameters were used to calibrate the models. There was a strong feature of multicollinearity in all the proposed models among the independent variables.

The construct's validity was tested applying Bartlett's test of sphericity and the Kaiser-Mayer-Olkin (KMO) measure of sampling adequacy analyzing the strength of association among variables. The results reveal that the value of KMO is 0.72 which is above 0.5. The results

Table 1. Validity check of factor analysis: KMO and Bartlett's Test

Kaiser –Meyer –Olkin-Measure of Sampling Adequacy		0.745
Bartlett's Test of Sphericity	Approx Chi -square	703.104
	df	15
	Sig	0.000

for Bartlett's test of sphericity and KMO both were highly significant. Thus, we conclude that factor analysis is suitable.

Analysis - Stage II:
A factor analysis was performed on the basis of the six parameters of technological environments identified above, which in combination form two factors, namely, "institutional capabilities" (F_1) and "external capabilities" (F_2). These two factors were obtained by a factor analysis based on six independent parameters with high multicollinearity. Justification of cluster formation was made based on differences in factor loading value across all values of the identified parameters. The factor loading values of all the perceptual parameters in F_1 have higher values than in F_2 (see Table 2).

Analysis - Stage III:
Model I
A regression analysis was performed with sustainability measure of enterprise as dependent variables on institutional capabilities (F_1) and external capabilities (F_2) which are treated as independent variables for different years (2012-2016).

We found that institutional capabilities became dominant over time. This was reflected in the year wise

Table 2. Justification of two factor formation

Factor Name	Component variables	Factor loading
Factor I (F_1) Institutional Capabilities	Availability of latest technologies	0.91
	Firm-level technology absorption	0.89
	FDI and technology transfer	0.75
	Individuals using Internet	0.72
	Fixed broadband Internet subscription	0.71
Factor II (F_2) External Capabilities	International Internet bandwidth	0.36

Table 3. Summarized year wise results of Model I

Year	R square value	Significance	Significance of the factor score
2012	0.228	Significant at the level of 5%	F_1 (sig at 10%) F_2 (sig at 10%)
2013	0.184	Significant at the level of 5%	F_1 (sig at 5%)
2014	0.297	Significant at the level of 5%	F_1 (sig at 10%) F_2 (sig at 5%)
2015	0.215	Significant at the level of 5%	F_1 (sig at 5%)
2016	-	Not significant	-

regression from 2012 to 2015, as well as in the general case.

External capabilities emerged as an important factor in some years (2012 and 2014). Nevertheless, the data shows a high level of inconsistency. In 2016, a regression analysis indicated that the turbulence of the technological environment is so high that both factors become insignificant.

Analysis - Stage IV:
Model II
In the case of model II, a regression analysis was performed for sustainable measure of enterprise as a dependent variable with respect to the emergent factors F_1 and F_2. Here, the time period was not taken as a moderating variable.

From the results of our research study, it is clear that only institutional capabilities (F_1) play a significant role for the sustenance of SMEs in dynamic technological business environments. The research output also justifies the results of model 1.

Analysis - Stage V:
Model III
In the case of model III, a regression analysis was performed that considered sustainable measure of enterprise as a dependent variable with respect to the emergent factors F_1, F_2, and year (2012-2016).

From the results, it is clear that both factors of technological environment (F_1 and F_2) and the time period are highly significant. It may be concluded that sustainable SMEs in developing countries are strongly

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Table 4. Summarized results of Model II

Year	R square value	Significance	Significance of the factor score
2012-2016	0.08	Significance at the level of 1%	Factor F_1

Table 5. Summarized results of Model III

Year	R square value	Significance of the Factor Score and Year
2012-2016	0.17	Factor F_1 (at the level of 1%) Factor F_2 (at the level of 5%) Year (at the level of 1%)

dependent on technological environments that are resilient and adaptive to the high level of technological volatility at the present time.

Conclusions

Past research on this topic has mainly focused on specific technology-related policies of a country's environment and examined the effectiveness or impact of policy on one specific dimension. The present study has explored research on the topic of constructing technological environments for the benefit and sustainability of SMEs.

From the preliminary research findings, both institutional capabilities and external capabilities emerged as significant factors toward creating sustainable technological environments for entrepreneurs. The research demonstrates that technological environment is defined by both "institutional capabilities" and "external capabilities". Institutional capabilities (F_1), controllable parameters, measured in terms of availability of latest technology: firm level technology absorption, FDI and technology transfer, individuals using internet, fixed broadband internet subscription, and international internet bandwidth have significant impact on sustainability whereas, in contrast, the impact of external capability stands out as not significant.

Limitations of the study

We find it interesting that both the factors of institutional capabilities and external capabilities become significant when time is taken as a selection variable. The high significance of a time variable proves the dynamism of technological environments. As well, institutional capabilities have a strong impact on the sustainability of businesses, in comparison with external capabilities that have a high level of technological volatility.

The study was conducted in international level where model was developed considering all the developing countries on the basis of same technological environmental parameters. The results may be used cautiously in the case of region specific cases where technological environments are not structurally defined or may have some other dimension of the said environment which is not considered in this research. Volatility measures of technological environment may also be taken into consideration to understand the country specific external capabilities of the SMEs.

Future Scope of the Study

This study is rare in that it not only addresses the most influential variables of technological environments in developing countries, generally speaking, but also establishes three separate models that indicate the

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impact of turbulent technological environments for entrepreneurial sustainability and long-term business stability.

The results can be used for assessing overall business environments and also, exploring the impact of critical business issues related to technology on the sustainability of SMEs developing countries. This study shows the role of several important parameters in creating favourable environments to sustain emerging businesses seeking to internationalize with the help of digitisation. It may further be used by the policy makers of a country to enable a specific country to embrace overall a more entrepreneurial technological environment for business.

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Technology Adaptation and Survival of SMEs: A Longitudinal Study of Developing Countries *Supriyo Das, Amit Kundu, Arabinda Bhattacharya*

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