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Organizational Dynamics and Adoption of Innovations: A Study within the Context of Software Firms in Sri Lanka

by RMU Susantha Udagedara and Kurt Allman

This paper examines the effect of organizational dynamics on innovation focus using the residual dominant and emergent theoretical framework (RDE) and the empirical evidence of four case studies. The findings revealed that different types of innovation coexist, but one type becomes dominant over other types at a certain time as the innovation focus is changed in line with the strategic priorities of firms. We found that innovation focus takes the form of product, process, and organizational innovation pattern over time when the firms move from an entrepreneurial organization to a more formal business corporation. More importantly, the RDE framework provides an appropriate lens for practitioners, in identifying the enablers and barriers of innovation.

Introduction

The value of technology-based entrepreneurial firms (TBEFs) to regional and national development, particularly employment and wealth creation, is acknowledged by many researchers (Birch 1979, 1987; Kirchoff 1994; Kirchoff, Linton, and Walsh 2013; Kondratieff 1937; Linton and Walsh 2003; Phillips and Kirchoff 1989; Schumpeter 1947, 1934; Solow 1956; Storey 1994; Yanez, Khalil, and Walsh 2010). The value of entrepreneurial firms to less developed countries (LDCs) cannot be negated as they can be more effective as established large firms despite the lack of capital, technology, resources, and trading history (Christensen 1997; Kirchoff 1994). Innovation activities which are performed by new entrepreneurial firms are of paramount importance to their survival (Kondratieff 1937; Mansfield 1968). For firms operating in LDCs this is particularly crucial as they face more challenges and barriers than new-TBEFs in developed countries

(Aghion, David, and Foray 2009; Bessant 2003; Morrison, Pietrobelli, and Rabbellotti 2008; Simmons and Sower 2012; Williams and Woodson 2012; Zeschky, Widenmayer, and Gassmann 2011). However, despite these barriers, how TBEFs in LDCs manage their evolving organizational capabilities and innovation pipeline when they grow and mature still remains an overlooked area in the existing innovation management literature. As such, the research question of this study attempts to shed insight into this area: How do organizational dynamics affect the adoption of innovation over the life cycle of a TBEF in a LDC. Addressing this question enables an understanding of the effect of organizational changes on innovation activities of a TBEF over time.

In this study, organizational dynamics refer to the changes in a firm over the corporate life cycle. When an entrepreneurial firm passes from one stage to another, the characteristics of the entrepreneurial firm change, introducing new

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managerial challenges, particularly when firms attempt to adopt new forms of innovation. But the effect of such changes on innovation is poorly understood (Koplyay, Chillingworth, and Mitchell 2013). We therefore examine the effect of changing organizational characteristics on innovation, for example, entrepreneurial-informal organizational form to established and formalized processes, as organizational dynamics. Such a study is important as the long-term success of technology-based firms depends on their ability to manage both external and internal constraints (Kirchhoff, Linton, and Walsh 2013). Keller (2004) argues that innovation highly expensive and often depends on environmental, firm specific, or situational factors. As a result, internal factors such as well-designed and focused technological efforts, advanced human capital, and financial resources are some of the prerequisites which determine the potential success of innovation (Fu and Gong 2011; Keller 1996; Lall 1992; Zanello, Fu, and Mohnen 2015).

Many researchers (e.g., Fu and Gong 2011; Morrison, Pietrobelli, and Rabellotti 2008) argue that a firm's ability to adopt innovation by developing and managing its internal capabilities determines the long-term success of businesses in LDCs as unfavorable macro environmental factors such as a lack of supportive economic policies, inadequate absorptive capacity of suppliers and allied industries, poor inter-firm connectivity and weak labor mobility, a lack of well-developed national innovation systems, coupled with weak technology transfer systems act as the barriers for innovation in LDCs (Fu and Gong 2011; Zanello, Fu, and Mohnen 2015).

Nelson and Winter (1982) state that when firms invest in capacity building, such investments enable the introduction of technological changes and innovation. Moreover, firms in LDCs can enhance their innovation capacity through international linkages and other networking activities such as exporting and foreign direct investment opportunities (Altenburg 2006; Barba Navaretti and Venables 2004; Gereffi and Kaplinsky 2001; Morrison, Pietrobelli, and Rabellotti 2008; Pietrobelli and Rabellotti 2007). Prahalad and Hamel (1991) noted that the competences of individuals, good universities, industry research activities, and other resources affect the innovative capacity of firms in LDCs. As such Morrison, Pietrobelli, and Rabellotti (2008) emphasized the importance of a theoretical framework to analyze the process of technological capacity development at the

firm level in LDCs. Yet, research studies that focus on examining innovation in developing countries are considerably less in comparison to the research studies carried in the developed nations (Kim, Song, and Lee 1993; Morrison, Pietrobelli, and Rabellotti 2008; Williams and Woodson 2012). As a result, a considerable knowledge gap related to innovation in LDCs, particularly at the firm level, still exists (Bell and Pavitt 1993; Dantas and Bell 2011; Pietrobelli and Rabellotti 2011; Tiwari and Herstatt 2012).

Theoretical Background

Innovation

As Marquis (1969) discussed, innovation is related to the use of a product or process and it fulfills a specific function, or need. Wheelwright and Clark (1992) discuss three classes of innovation in new products—incremental, new generation, and radically new. Yu and Hang (2009) observed that technological discontinuities often lead to revolutionary, discontinuous, breakthrough, radical, or emergent innovations. A technology is viewed as disruptive if its applications create goods or services with new or modified performance attributes that may require the users to change their behavior (Bower and Christensen 1995; Walsh 2004). As Kasscieh et al. (2002) and Anderson and Tushman (1990) discuss, scientific discoveries often lead to disruptive technologies or breakthrough innovations that make changes in existing product or technology paradigms.

Some researchers define innovation based on the triggers of innovation—technology push and demand pull (Mowery 1983; Myers and Marquis 1969; Rosenberg 1969). The technology push perspective is based on the argument that advances in scientific knowledge determine the capacity to innovate whereby individual firms are expected to invest in acquiring scientific capabilities (Cohen and Levinthal 1990; Mowery 1983). In contrast, researchers who follow the demand pull perspective, argue that changes in market conditions determine the firm's willingness to invest in innovation (Griliches 1957; Rosenberg 1969; Schmookler 1962; Vernon 1966). Others argue that demand-side stimulus and technology-side stimulus jointly decide the success of innovation (Lee 2003) since there is a strong interrelatedness between technology push and market pull stimulus (Brem and Voigt 2009; Burgelman and Sayles 2004).

Historically, though, all types of innovations cannot be explained only through specific

market demands or new technologies. Van de Ven (1986, p. 590) extends these perspectives through defining innovation as “the development and implementation of new ideas by people who over time engage in transactions with others within an institutional order.” This study also accepts this distinction, embracing Van de Ven’s definition as it focuses on the innovation process as well as the outputs of innovation, since both perspectives are required to fully investigate the effect of organizational dynamics on innovation. In this study, types of innovation are, therefore, viewed as the output of the innovation process following the Van de Ven’s definition.

Schumpeter (1934) discusses the types of innovation based on the kind of object change. Following his views, Varis and Littunen (2010) differentiate the types of innovations as product, process, marketing, and organizational innovations. A product innovation refers to a new product or a differentiated product (OECD 2005; Tavassoli and Karlssonb 2015; Varis and Littunen 2010), which also can be a new technology or combination of technologies introduced commercially to meet a user or a market need (Utterback and Abernathy 1975). This suggests that a product innovation can be sold to a customer when manufactured. A process innovation is defined as the introduction of new methods of production which involves the reduction of the costs, preserving or increasing the quality of the product produced, resulting in significant changes in techniques, equipment, and/or software (OECD 2005; Tavassoli and Karlssonb 2015; Varis and Littunen 2010). This suggests that process innovations change process equipment, workforce, task specifications, material inputs, work, and information flows as discussed by Utterback and Abernathy (1975). As Linton and Walsh (2003) highlighted, process technologies can be used to make or improve other technologies and process innovations significantly change or modify the end product features. Organizational innovation refers to the changing routines of firms, improving the efficiency, productivity, or implementation of a new organizational method in the firm’s business practices, workplace organization, or external relations (OECD 2005; Tavassoli and Karlssonb 2015; Varis and Littunen 2010) wherein organizational innovation can change or improve the management practices or organizational structure. Conversely, marketing innovation, which is aimed at the implementation of

a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing (OECD 2005; Tavassoli and Karlssonb 2015; Varis and Littunen 2010), introduces the significant changes in the marketing practices.

Innovation Adoption in Technology-Based Firms

Marquis (1969) observed that each firm has its own innovation pathway which is connected to the disruptive or sustaining nature of the technologies the firm uses and its interest for market pull verses technology push innovation strategies. Bower and Christensen (1995) argue that large firms often prefer to sustain technologies that assist in continuous innovation, rather than disruptive technologies that can create discontinuous innovations. Although disruptive technologies can create more opportunities for entry into existing and the new markets, the associated risk of failure is also high due to customer resistance and rapidly changing technological environment wherein large firms are less interested in investing for disruptive technologies as the commercialization of disruptive technologies can be highly expensive and risky (Walsh, Kirchhoff, and Newbert 2002). On the contrary, small firms are interested in disruptive technologies and discontinuous innovation to acquire competitive advantages as they struggle to challenge the status quo of reputation, scale economies, and sunk investments (Mansfield 1968).

By presenting the technology evolution model, Anderson and Tushman’s (1990) illustrated how and when technological discontinuities emerge, and contrast social and technology dynamics during the period of ferment and incremental innovations. As they state, technological discontinuities often lead to a dominant technology design followed by a period of ferment. During the era of ferment, firms start to introduce various product classes due to the increasing rivalry among firms until a dominant design establishes, which later becomes the industry standard. After a dominant design establishes, various incremental innovations emerge and persist until the next breakthrough innovation take place (Anderson and Tushman 1990; Myers and Marquis 1969).

Following Schumpeter’s “creative destruction” logic, Winter (1984) argues that new firms widen the radical innovation activities of an industry through the sources of knowledge, which often exist outside the established routes. In the early

stages, new start-ups tend to follow multiple technology trajectories since the best technology that can satisfy its users, is unknown to them (Dosi 1982). Hence, they act as the change agents that create new industrial waves (Gort and Klepper 1982). As Klepper (1996) identified, new firms attempt to establish themselves in the industry by introducing product innovations. If they can successfully pass this stage, they enter the next regime, which is known as the routinized stage (Winter 1984) where established new entrants prefer to rely on existing hierarchies, knowledge, market information, distribution channels and depend on the internalized market-based expertise for innovation (Gort and Klepper 1982; Nelson and Winter 1982). Low start-up costs in the early stages of a new industry order allow new firms to easily enter, however, this situation is later changed when the technological regime increases entry barriers and rewards previous sunk investments.

Although firms focus on product innovation in the early period, later, they focus on reducing cost and increasing efficiency by introducing process innovations as the market becomes more price sensitive at the later stages (Klepper 1996). When the industry becomes mature, new entrants and variation of product classes gradually disappear and a dominant design establishes in the industry. Only firms that are capable of reducing cost and increasing efficiencies survive when a few large firms dominate in the industry and enjoy economies of scale and reputation (Klepper 1996). As Pyka (2000) states, although a very high level of technological uncertainty and a strong emphasis on product innovation can be seen in the early stages, later, when demand increases, firms introduce more incremental innovations and the focus shifts from the product to process innovations to meet the customer demand and increasing sophistication, and also to reduce the associated cost of production (Herrmann 2005). Foster (1986) observed that technology progression passes several stages: slow advancement, acceleration, and declining which is similar to the general form of an S-curve. However, these studies have paid less attention to analyzing the effects of organizational evolution on technological evolution.

Life Cycle in Innovation Models

The basis of firm evolution and innovation dynamics often lies in the business life cycle literature as these theories explain changes in a

firm over time (Greiner 1972; Justis 1981; Quinn and Cameron 1983). Researchers (Barras 1990; Damanpour and Gopalakrishnan 2001; Kopyay, Chillingworth, and Mitchell 2013; Tidd and Bessant 2011; Utterback 1994; Utterback and Abernathy 1975) have identified that the pattern of innovation adoption and the relative importance of innovation determinants change over the industry's life cycle (Dao and Zmud 2013; Tavassoli 2015). Based on life cycle theories, Utterback and Abernathy (1975) found that the product-process innovation pattern is more common in business by analyzing data from five different industries. Barras (1990) observed that the types of innovation adoption follow a pattern of process-product pattern in services. Later Kopyay, Chillingworth, and Mitchell (2013) argue that product, marketing, process, and finance innovation adoption pattern is common in businesses.

In their model, Utterback and Abernathy (1975) highlight three development phases in respect to innovations, entitled: fluid, transitional, and specific. The fluid phase is characterized by uncertainty and the main emphasis is on product innovations. During the transitional phase, process innovation becomes the key emphasis followed by market acceptance and the dominant design wherein product innovations start to decline as firms have to choose between product and process innovation efforts. Later, firms focus on producing very specific products more efficiently and attempt to monitor and control both the product and process innovations (Utterback and Abernathy 1975). Adner and Levinthal (2001) also found that firms attempt to meet the minimum thresholds of performance in the early period of the life cycle wherein the key emphasis is placed on product innovation. This emphasis shifts to the process innovation later on, when the industry becomes more price sensitive. Linton and Walsh (2008), however, argue that a similar pattern, which is discussed by Utterback and Abernathy (1975), is not identical to all industries and products. Especially, related to the material-based products, both product and process innovations often take place simultaneously as the changes in the process generally modify the product (Linton and Walsh 2003).

Organization Life Cycle and Innovation Characteristics

The life cycle studies, to some extent, assist in understanding the changing nature of

organizations over time, although they do not provide a strong basis for analyzing the effect of organizational dynamics on innovations due to their unrealistic assumptions and inconsistent findings. For instance, Quinn and Cameron (1983) presented a four-stage model to explain the organizational evolution over time when others (Lester and Parnell 1999; Lester, Parnell, and Carraher 2003) describe the organizational evolution with a five-stage model. According to most researchers, stage one is referred to as the “existence” (Churchill and Lewis 1983) or entrepreneurial stage (Quinn and Cameron 1983) or birth stage (Lippitt and Schmidt 1967), and this is characterized by an informal structure with the key objective of achieving viability. The firm operates with a simple structure or no structure at all and all key decisions are made by the owner or just a few members, and communication is informal. There are no formal procedures or written rules at this stage of development (Greiner 1972; Lester, Parnell, and Carraher 2003; Lippitt and Schmidt 1967; Madhani 2010; Quinn and Cameron 1983; Scott 1972).

Although all new firms are not necessarily small when being established, there is a general assumption by life cycle theorists that the business is small in size, informal in structure and displays potential for efficiency improvements over time (Greiner 1972; Lester, Parnell, and Carraher 2003; Lippitt and Schmidt 1967; Madhani 2010; Quinn and Cameron 1983; Scott 1972). Small businesses have fewer employees, less customers, and limited scope of operations when they are generally owned by one owner or at most, a very few individuals whereas lack of expertise and resources are common to many small businesses and therefore act as barriers to innovation (Cohen and Klepper 1996; Colvin 1999; Damanpour 1992; Schollhammer and Kuriloff 1979). Research studies, which have examined whether large or small technology-based firms are more innovative, have been ended with controversy. Some studies have found that large firms provide a number of advantages due to the technological and R&D capabilities which they develop over the long term (Colvin 1999; Damanpour 1992; Kamien and Schwartz 1982; Kupfer 1998). Conversely, smaller firms are found to be more innovative as they are more flexible and as a result, they have the ability to accept and effect change (Damanpour 1992). In large firms, communication and coordination become a difficult task and hence negatively affect innovation activities

(Damanpour 1992; Gilder 1988). However, other researchers, such as Quinn and Cameron (1983) have argued that firms tend to adopt more innovations during the early stages when they are small and growing than during their later stages; the innovation capabilities of firms gradually decrease, particularly when they become larger and more formalized business entities. Here, Doms, Dunne, and Roberts (1995), however, argue that mature and large firms attempt to survive by adopting more process innovations—producing goods and services more cheaply and efficiently as they diffuse into the market.

Govindarajan and Kopalle (2006) found that a working climate that promotes entrepreneurship, risk-taking, flexibility, and creativity, supports innovation efforts of employees. Here, Quinn and Cameron (1983) observed that at the beginning, the organization is characterized by risk-taking, flexibility, and entrepreneurship wherein more emphasis is given for innovation. The owner becomes the key innovator (Mintzberg 1973; Smith, Mitchell, and Summer 1985; Van de Ven 1980; West III and Noel 2009), largely because of the centralized decision-making and the absence of a hierarchy which frees the entrepreneur to invest in innovation (Miller 1987). The organization focuses on introducing new products to the market before its competitors, mirroring the first-mover strategy discussed by Parnell and Carraher (2002). Madhani (2010) and Williamson (2000) state that at the early stages, firms struggle to attract outstanding employees (Camelo-Ordaz et al. 2011) wherein innovation insights are sought from nonexperts or from a few individuals who have more familiarity with new technologies (Abernathy and Utterback 1978).

The second stage is entitled the “survival” or “collaboration” stage, and as noted by Lester and Parnell (1999), the informality of the early stage gives way to a simple structure where the role of managers is defined and firms attempt to promote the division of work (Lester, Parnell, and Carraher 2003). Most firms are characterized by functional specialization at this stage (Scott 1972), although as Quinn and Cameron (1983) observe, at this stage, collaboration and teamwork are very much encouraged. This is particularly a challenge as Lovea and Roper (2009) argue, especially in supporting cross-functional research and development teams, where these were identified as enablers of innovation. When a firm reaches the growth stage,

more emphasis is placed on acquiring resources, advanced technologies and expertise (Sirmon et al. 2011). At the growth stage, experts with different knowledge backgrounds are used to support innovation (Abernathy and Utterback 1978) as different sources of ideas are an important determinant of innovation (Akhavan and Hosseini 2016; Wagner 2013). This may include formal engineering departments, the creation of R&D teams, or partnerships with external sources of knowledge and expertise (Abernathy and Utterback 1978).

The next stage is labeled as the “success” or “formalization” stage, and at this point the firm is mature and develops more formal structures with written job descriptions, hierarchical reporting, and clear rules and procedures (Lester and Parnell 1999; Lester, Parnell, and Carraher 2003; Madhani 2010; Quinn and Cameron 1983). Hence, firms become less flexible. Researchers (Daugherty, Chen, and Ferrin 2011; Sethi and Iqbal 2008) found that there was a negative relationship between formalization and innovation. Lester, Parnell, Crandall, and Menefee (2008) state that firms that are at the growth stage attempt to differentiate their products from competitors through an enhanced resource base, expertise, and R&D capabilities. Sirmon et al. (2011) argue that mature firms seek to hire experienced employees to support innovation activities at the growth stage. The fourth stage is identified as the “renewal” stage by Lester and Parnell (1999), Lester, Parnell, and Carraher (2003) or as “elaboration” by Quinn and Cameron (1983). Generally, a matrix-type structure emerges at this stage. Quinn and Cameron (1983) argue, at the elaboration stage, business expansion and decentralization are given priority. When firms reach the maturity stage, more attention is given to avoiding risk. Studies by Miles and Snow (1978) and Lester, Parnell, and Carraher (2003) argue that the strategy of controlling its market segment becomes the key focus of the organization as cost control and production efficiency are considered as necessary conditions for success.

Utterback and Abernathy (1975) found that at the later stages, firms focus on minimizing cost as competitive advantage depends on the ability to reduce cost. However, Sirmon et al. (2011) argue that this is not the sole focus as firms attempt to create a balance between innovation and efficiency when in maturity, requiring strategic interventions to reduce the emergence of bureaucratic forms of operation

which subsequently suppress innovation (Miller and Friesen 1984). Hence, the allocation of resources for innovation declines at this stage (Sirmon et al. 2011). Moore (2000) found that when firms become mature, they attempt to develop a fully integrated whole product through standardization and productization, by exploiting existing resources and capabilities. Chiaroni et al. (2010) noted that in the later stages, networking with external institutions such as universities is a common practice since these institutions help them to access specific scientific and technology-specific knowledge (Drejer and Jorgensen 2005). Scott and Bruce (1987) found that firms actively seek new external information as they focus on the business expansion, plant upgrading, and productivity improvements. Emphasis is then placed on external social networks as Kijkuit and Ende (2010) noted. By contrast, Stolwijka et al. (2012) found that at the early stages of technology life cycle, firms often rely on the external technology sourcing to maximize their market performance when the internal technology sourcing becomes the best choice at the later stages.

RDE Framework and Limitations of Life Cycle-Based Studies

We observed that innovation models which are based on life cycle theories, incline to a specific number of stages, and ignore the interaction of organization-specific attributes at different stages of development. Particularly, simple and sequential stage theories fail to investigate the complex and dynamic nature of organizations and innovation itself (Schroeder et al. 1989; Wolfe 1994). The literature suggests that at a certain time, static as well as dynamic factors are likely to be present and can influence the business operations. However, existing innovation models only incorporate either static or dynamic factor due to the theoretical and methodological limitations and therefore suffer from drawbacks in capturing the complexity of innovations (Wolfe 1994).

Bryson (2008) found that at a certain time, static, and dynamic factors coexist and indeed influence organizational activities. She argues that the practical and conceptual limitations of organizational dynamics can be overcome by applying the RDE theoretical framework following the theoretical ideas of Williams (1980). Bryson (2008) found that the RDE framework helps to capture the organization’s change over time, and incorporates the past, present, and

future of the organization while providing a dynamic as well as a static view of the organization. Williams (1980) argues that residual, dominant, and emergent (RDE) constantly interact with each other. Recently, other researchers in organization change and management (Devlin 2010; Silver 2009) identified that the RDE model can be applied in a variety of settings as the wholeness of the model provides a substantial and flexible theoretical framework to understand organizational change. Bryson (2008, p. 749), following Williams's framework, defines the dominant, residual, and emergent organization as follows:

- (1) Dominant represents the practices and beliefs which are organized and lived, that organization members put energy into
- (2) Emergent represents the new practices and beliefs which are continually being created, that may or may not be incorporated
- (3) Residual represents the still practiced or believed residue of earlier life in the organization that assists in making sense of the present.

As Bryson (2008) discussed, residual, dominant, and emergent features of organization life are in a constant struggle. Residual represents the still active elements of the past and is often a form of alternative practice to the dominant [practice] in its most recent forms. The emergent represents the new practices and beliefs, still in development, possibly not clearly defined or articulated, but which are seen as necessary for future commercial success. Coexisting with new practices and beliefs are movements and adjustments to existing or "dominant" innovations, which are also being re-shaped and formed (Devlin 2010; Williams 1980). In the innovation management literature, innovation often refers to new ideas (Van de Ven 1986) which recombine old ideas into new forms, or new ideas that challenge the present or existing procedures, order, customs, or routines (Rogers 1983; Zaltman, Duncan, and Holbek 1973). Here, the interaction of people over time provides a period of ferment where the old overlaps with the new, where dominant ideas or practices are challenged (Van de Ven 1986), and of course new ideas will also be challenged by notions of old practices. The RDE framework argues that a dominant system may only accommodate alternative meanings and values through constant interaction with residual and the emergent

culture. Thereby it affirms that the acceptance or rejection of new ideas is a result of the interaction between three elements—residual, dominant, and emergent forces. The RDE framework therefore provides a strong conceptual foundation for innovation studies, especially in terms of how innovation is influenced by new, existing, and old ideas. Likewise, a close conceptual association between the RDE framework and innovation can be observed when innovation is viewed as movement and adjustment within the dominant meanings, values, and practices (Devlin 2010; Williams 1980).

In this study, we therefore, examine the effects of organizational dynamics on innovation using the RDE framework as it can assist us to investigate how residual, dominant, and emergent organizational factors affect the adoption of innovation. Such an analysis is important for both practitioners and researchers because the use of the RDE framework can reveal the interplay between organizational development and innovation, as well as providing an opportunity to examine both static and dynamic perspectives within an organization. More importantly, it assists in overcoming the limitations of life cycle theories as we can examine the evolutionary processes of an organization—simultaneously capturing the past, present and the future of innovation activities without delimiting its development to prescriptive stages as previously defined in the life cycle theory-based studies.

Methodology

In this study, we used four software companies in Sri Lanka. Sri Lanka was selected to conduct the empirical work because the majority of industries in Sri Lanka are said to be less competitive and have shown a high failure rate (Dutz and O'Connell 2013; Herath and Silva 2011). In comparison to other sectors in Sri Lanka, the software industry has shown a steady growth despite country specific constraints and challenges. As such it is now recognized as an emerging destination for software development (Kearney 2009; United Nations Conference on Trade and Development 2012). Consequently, Sri Lanka and its software industry provide an ideal setting for exploring the research questions posed by gaps in existing literature. Data came from in-depth interviews, annual reports, archival information, marketing documents, company websites, and digital media.

Denzin (1978) notes that the case study is a comprehensive research strategy that allows a researcher to use several data sources. Our research also requires the use of multiple data sources to understand the interplay between residual, dominant, and the emergent organization within its natural settings. This is particularly appropriate as we focus on analyzing the challenges, sense-making, and opportunities arising from past, present and emerging organization on the innovation outcomes of technology-based firms. The case study strategy was therefore identified as the best method to achieve our research aim. Case study-based research studies develop theory by combining existing knowledge with new empirical data (Yin 2009) and enhance understanding through theory development, which realizes our research aim. In addition, the case study strategy allows the investigator to examine the phenomena within its natural settings (Yin 2003), which was particularly important as we were asking participants to reflect upon historical events and contemporary challenges.

The selection of cases was not random. As discussed by Yin (2009) and Eisenhardt and Graebner (2007) carefully selected multiple cases provide more compelling and robust evidence since the findings are expected to replicate within each case. Eisenhardt (1989) argues that 4–10 cases work well in theory building studies. In deciding the number of cases and interviews, we followed the replication logic as advised by Eisenhardt (1989). Each case in this study worked as a distinct analytical unit, and served to build a theory through comparisons and replications. Following the theoretical sampling logic in case study selection, the researchers considered several factors in selecting the four cases. The organization's recognition for innovation served as the basis of selecting each case. However, we also wanted companies, which were different in terms of size, growth, and markets but were similar in terms of their characteristics at the start-up phase as these characteristics were perceived to be different over the life cycle, creating varying challenges and issues for firms. The four case companies, which were included in this study, had a wider recognition for innovation and had started in a very similar period within the sector, as well as with similar capacity. This helped us to understand how these firms managed firm level dynamics and achieved their current status, while facing relatively similar macro

environmental changes and challenges over their life cycle. The following four companies were included and the characteristics of four firms were as follows:

Company A—was founded in 1999 as a software development company in one of the back rooms of the founders' residence in Colombo, Sri Lanka. The founders included husband and wife, two of their foreign friends, and family members. The two Sri Lankan born founders had completed their postgraduate studies in the United States before they set up the company with friends and family. The aspiration of the founders eventually created a leading IT company with a client base serving Global 2000 companies. The company provides a wide range of IT disciplines including outsourcing, mobile application developments, software testing and assets management, and developing software products for leading enterprise software providers. It has a staff base of 1,200 in the Sri Lankan Development Centre and over 5,000 staff globally.

Company B—was established in Sri Lanka in 1999, initially with six employees as Joint Partnership with a small software company based in Sweden. The Sri Lankan business partner had studied in Sweden before the firm was established in Colombo. At present, the company head office is located in Sweden and it operates in 60 countries with 2,700 employees in total. Its Sri Lankan center has a staff of 970. Company B has won prestigious awards including the Customer Value Enhancement Award for its innovations. The company's main business includes service and asset management, manufacturing, supply chain software developments.

Company C—is a Sri Lankan software development company established with four employees, with the aim of supplying high-quality software solutions in 2000. The founder started the firm after several years working in the United Kingdom upon the completion of his postgraduate studies. The company now operates in the United States, Singapore, India, and Malaysia, with a staff base of 130. The company has won several awards, including the prestigious Red Herring Global Award for its innovations. Currently it caters for the telecom and financial markets. The company is recognized for its mobile solution and HR application innovations.

Company D—is a technology leader in the provision of e-security and e-payment solutions to corporates in Sri Lanka. It has a staff base of 45 and was founded in 2000 with three

employees. The founder had completed his degree in software engineering at a local university and worked for over six years before he established the company. It is committed to innovating and implementing world-class IT solutions. The company's core business includes secure electronic payments, information systems security, enterprise automation, and secure personal documentation. It is recognized as a technology leader in the banking and information security domains and it has won several awards for innovation. These include the National Best Quality Software Award and the Asia Pacific ICT Award for innovative mobile banking solutions.

In total, 44 interviews were conducted, and included founders/senior managers, middle managers, and front-line employees. The inclusion of all three levels assists in minimizing the possible bias of participants. Once the agreement to access the firm was received, the semi-structured interview protocol was sent to the respondents to allow them to understand the issues they were expected to discuss. The interview protocol was designed to include an initial open question to establish the participant's background and relax the interviewee. Each participant was invited to talk about their perspectives on and their organization's present situation, from which its past and unfolding future were explored within the context their effect on the innovation. A series of potential prompts were used when necessary, to gain information, and to explore their experiences. All interviews were face-to-face and they ranged between one and a half hours and two hours in length. Data were captured by note-taking as respondents were reluctant to permit voice recording. All notes taken during the interviews were transferred into Microsoft Word documents and were sent to all interviewees to ensure their accuracy before analysis.

As retrospective interviews rely on the accurate recall of past events by individuals, several disadvantages such as incomplete or inaccurate retrieval may arise. In addition, selective or biased recall by the interviewees may occur. This was recognized in advance and triangulation of data helped to check the accuracy of information provided by respondents. To reduce the bias that can occur due to selective or biased recall by the interviewees, initially, all key senior managers were interviewed. Then, after the understanding of events from interviews, middle- and lower-level managers were approached. Finally, the researcher interviewed operational-level software engineers. This

interview procedure helped to reduce the retrospective bias as it helps to triangulate data. In addition, bias from the retrospective account was reduced as many interviewees had worked within these firms from their inception. This means interviewees could recollect events and support the researcher to capture the dynamics of innovation influencing factors and innovation accurately. More importantly, the interview process was conducted and assessed on the collective background as company archives, annual reports, and organization charts were also used to triangulate with the interview data to increase the data validity and reliability of the study.

During data analysis, within case analysis was performed first as it allowed unique patterns of each case to be identified and established the parameters for cross-case analysis (Eisenhardt 1989). Then evidence from all four cases were corroborated. By doing so, the similarities and differences of themes and emergent categories were identified and further explanations were built. Following, Graebner (2004) and Gilbert (2005), the construct tables were used to summarize the case evidence, while providing the selective story descriptions as such approach was recognized as an effective way to present data and show the empirical ground of theory.

Findings

Product Innovation Focused Entrepreneurial Type Organization at the Start-Up Phase

The analysis of organization residuals shows that product innovation, strong social relationships, ad hoc tasks, devolved managerial controls, risk-taking behavior, and top-down innovation focus were the common features in the early phase of organization life, which confirm the entrepreneurial type organization and a strong innovation focus (see Table 1) as discussed by Klepper (1996). At the start-up phase, being small meant all staff knew each other personally which developed strong social relationships and facilitated an informal working climate within the firms. Across all four firms an informal working climate was a common feature that was seen as crucial in fostering product innovation activities.

The previous working environment was very supportive for innovation because all of us had personal relationships even

Table 1
Characteristics of Residual Organization Life

Characteristics	Company			
	A	B	C	D
Strong social relationships and top-down innovation approach	√	√	√	√
Lack of resources and knowledge of advanced technologies	√	√	√	√
Leaders taking risk and a strong focus on product innovation	√	√	√	√
Instant feedback and direct involvement of the senior leadership team with development activities	√		√	√
Ad hoc and uncoordinated tasks as a process of development	√	√	√	√
Significant proportion of staff time deployed toward new product development—which is valued by the senior leadership	√	√	√	√

before we joined the company, and everyone helped each other. The company culture is now based on teamwork and collaboration but relationships are somewhat more formal than the past. We have a different culture now (Senior Manager, Company C).

During the firm’s start-up phase, a top-down innovation approach (leader-led innovation) was the dominant practice. However, when the firms grew, accumulated learning helped them to recognize that such an approach limited the firm’s innovation capacity as the contribution of front line employees in generating new ideas was minimal. This previously dominant approach was no longer valued and saw the emergence of a culture that stressed the importance of having a bottom-up strategy to idea generation.

In the very beginning, most innovative ideas came from the top but we quickly learned that it was the wrong approach as it limited the ideas from front line staff (Senior Manager, Company D).

Interestingly, the case analysis uncovered how these firms, operation in the LDCs, learned at the start-up phase through their global perspectives and networks. In the very early

period, a lack of knowledge workers and required expertise were observed to hamper innovation, which was seen to be a common factor within the all four case companies. During this era, however, individuals within the firms, who have had sufficient international experience, became the main facilitators of innovation and crucially the development of younger and newer staff. Particularly, in these firms, the international experience became a key source for innovation at the start-up phase. Here, the importance of accessibility to the global knowledge base in supporting the growth of firms in LDC was revealed.

Before starting this company, Mr “X” [Owner] had worked in the USA after his studies. He helped us to learn new ways of doing things. We didn’t have these perspectives nor the practical experience in the beginning. We all were fresh graduates at the time the company started (Senior Manager, Company A).

The direct involvement of the senior leadership team with developers was also identified as a special feature at the early stage, and this was found to have a favorable effect on innovation activities, particularly idea generation and implementation activities. This is because immediate feedback and apparent risk-taking behavior

demonstrated by the senior leadership team motivated and facilitated the employees in the implementation of innovation. This practice gradually declined and disappeared as these firms grew and matured, reflecting the changing priorities of senior leaders over time.

You know that managers never take similar risks like the boss. In those days, we shared ideas with the boss directly. But now, we have to go through managers. So things get delayed and people are frustrated (Software Engineer, Company A).

The transition from informal work settings to formal work settings appeared to create conflicts and tensions within the working environments of these firms. A lack of team effort was attributable to the dominant working environment as increased formalities, in comparison to previous approaches, were later introduced. Although strong relationships and group cohesiveness were seen as the key characteristics of the early organization life, and indeed in later stages, they were marginalized against a desire to formalize processes and reduce variability in group cohesiveness. When the firms evolved in size, they introduced substantial changes to their work ethos, and the senior employees with long tenure continuously attempted to maintain their previous work ethos. This behavior created tension between old and new staff, which were seen as a barrier to innovation.

If I tell you the truth, we really like the working environment we had in the past because we worked like a family. Everything was based on friendship. Now this is quite different. People have become more selfish and jealous. They do not think about others as we did in the past. Such environment does not support team efforts and implementing new and riskier things (Senior Manager, Company C)

Although employee freedom was considered as an essential characteristic of corporate life by these companies, organization growth demanded the introduction of managerial controls in both formal and informal settings to a greater extent. This led to the dissatisfaction of longer serving employees, who demonstrated strong resistance to this changing attitude, which was seen as hampering the innovation efforts inside the firms. In the early phase of these firms, freedom to

experiment and implement new ideas enabled the exploration of new products. This practice was later changed where widespread experimentation was no longer valued as the firms grew in size and complexity. Many original employees really valued and appreciated this previous managerial practice.

Before we had more freedom but now managers monitor progress. It has some effects on our job because now we can't implement new solutions as we need and as we did in the past. (Software Engineer, Company D).

As the firms grew, the span of control became an issue resulting in more far-reaching managerial controls being introduced. The notion of freedom, which was attributed to the early form of organization life, became an important emphasis of residual organization life. These experiences, practices, and meanings remained as residuals that affected innovation efforts at the later stages of the organizations' life cycles. The interplay between residual working climate and dominant working climate was explicit and showed the conflicting views between managers and employees.

You know ... freedom does not mean "wild donkey freedom." We value employee freedom and innovation but at the end of the day we have to ensure that we achieve company goals. Now we have over 700 people so some rules and procedures are needed. People do not like it but this is the reality. Actually, they [employees] had more freedom in the past but some people misused it (Senior Manager, Company C).

At the early phase, the organization focused all of its resources on introducing new products to the market before its competitors, mirroring the first-mover strategy as discussed by Parnell and Carraher (2002). Utterback and Abernathy (1975) also found that firms at the early stages focus on developing innovative products to meet specific market or customer needs, or invest in maximize the product's performance. As the case analysis revealed, all four companies, at the early stages, had given priority for adopting product innovation over other three types of innovation in capturing market

opportunities and to establish their brand name in the selected market segments.

In the very beginning, the main focus was developing new solutions and we did frequent experiments after analysing the market conditions. We started as a web developer. Later, we positioned as an internet software developer. Now we have specialisations in insurance, financial and healthcare applications. In comparison to the past we now do not try out new applications because improving our processes are the most important issue for the company's success. But it does not mean that we have completely given up on new projects. We still focus on new market trends and try to cater if things are within our scope (Senior Manager, Company A).

As Quinn and Cameron (1983) discuss, the entrepreneurial emphasis at the start-up phase often value adaptability, flexibility and creativity feature as the major characteristics of the organization. Govindarajan and Koppalle (2006) found that a working climate that promotes entrepreneurship, risk-taking, flexibility, and creativity, enables innovation and a common feature of the four firms was that the organization climate tolerated failures, knowing some may be converted into opportunities. At the start-up phase, all companies experimented in new product developments as this was a key strategic focus, with product failures being a common consequence of this strategy across the four firms.

In the start-up phase, there was no other option except introducing something new to the market and being more creative than our competitors. We first tried to be a web development firm but it did not work for us. Later, we focused on object-oriented software. Actually we tried out lots of new applications in those days. Many failed but a few were a success (Project Manager, Company B).

In the start-up phase, product innovations were mainly stimulated by market demand for software solutions. Continued new entrants increased the rivalry within the industry, consequently selecting the right market segment and innovating products to match with the need of clients became a critical process within the

business. The case data showed that to overcome these challenges, firms relied on product differentiation strategies, coupled with a niche market focus that supported the introduction of new products that were superior to those currently available in the market.

We were into something that was very much in demand. But the challenge was, at the time we started, many innovations were taking place and many players were entering to the industry. So we worked with the idea of product innovation and experimented on selected software solutions in a subset of industries (Senior Manager, Company A).

Klepper (1996) states that product innovations become the key strategy for new entrants to establish themselves in the industry. The cross-case analysis also confirmed that in the early stages, the four software firms had introduced various product innovations to respond the market opportunities and establish themselves in the industry. The analysis of residuals showed that the company gradually introduced some formalities and controls within the working environment, which was as expected in the literature (Quinn and Cameron 1983). These controls were, however, identified by employees as barrier to innovation at the later stages.

Teamwork, People and Process Innovation Oriented Working Environment as the Dominant Focus at the Growth Stage

The analysis of dominant organization characteristics showed that within all the four companies, innovation, team work, and creativity were valued as the key attributes of dominant working environments, which shaped members' behavior while constituting the dominant working ethos. As cross-case analysis confirmed, certain managerial controls were gradually introduced at the growth stage, and this had a negative effect on interpersonal relationships among employees. As a result, the senior management promoted teamwork, trust, and collaboration among employees, as these ingredients were accepted as vital for innovation. However, increasing tension and competitiveness among employees were also evident and this appeared to hamper the free exchange of ideas and information. The promotion of teamwork and openness as core values were found to be associated

with the growth phase, whereby senior management had to make extra efforts to promote them. Efforts to preserve the residual work ethos were also seen and showed the struggle between residual and dominant working environments. A software engineer from Company B explained the core value of their working culture:

Creativity, openness and team spirit are the core elements of our company's working culture. Innovation is in every thought and act of our people. Learning and exploring innovations forms a way of life in the company.

A senior manager from Company B explained why they had to promote these values:

Although the working environment is now somewhat formal, we still want to work like a family. In the past mutual understanding was very strong among all of us but new guys do not trust each other and no one is ready to take on the major responsibilities. They do not share their knowledge with colleagues, possibly believing that retaining some knowledge may support their own career. This injects some bad values into the company culture, although we try not to allow them to do so.

As Van de Ven (1986) discussed, innovation is a result of the development and implementation of new ideas by people who over time engage in transactions with others within an institutional order. The cross-case analysis revealed that innovation processes were increasingly characterized by centralized research, idea generation and implementation activities at the early stages, mainly due to the lack of technology capabilities. However, as the firms grew, with their enhanced technological capabilities, the innovation process was increasingly focused toward front line employees, requiring greater engagement in idea generation and implementation activities.

In the very beginning, all ideas came from the head office. Our job was to follow the instructions and it really did not work for the company. Many projects failed. Because we did not have the required

experience and no one showed positive attitudes to the taking of risk. So they had to encourage people to take risk and work independently. Now we have the chance to plan and do what we feel is good. This practice is very effective as it helps to get everybody involved in the process. You know ... innovation does not come from one head, it comes from many heads (Project Manager, Company B).

Once organizations passed through this stage, they began to look for the right people to sustain the growth already achieved. When these four firms reached the growth stage, more emphasis was thus placed on human resource development and leaders attempted to develop specific employee capabilities, all designed to support the successful implementation of innovation. Experts with different knowledge and backgrounds were used to support innovation. The case data showed that the lack of diverse skills and expertise were common in the early stages.

We invest in developing our people because without them how would we expect to deliver innovation? They should be equipped with the latest technologies and be able to handle complex developments (Business Analyst, Company C).

A common feature of all these firms is that developing human resources, bottom-up innovation, teamwork, and process improvements became the dominant attributes of day to day life at the growth stage (Table 2). As cross-case analysis confirmed, the dominant working environments of firms emphasized process improvements and the competencies of employees aimed at reducing process inefficiencies and the time to market. Unsurprisingly, this emphasis was found to have a favorable effect on process innovation activities during the growth phase.

Short business cycles, a quick response to new requests, and reduced time to market are the mandatory requirements in this field. So that improving process through the agile approach is the main emphasis in our working life now (Business Analyst, Company C).

As Utterback and Abernathy (1975) found, at the growth stage, the adoption of process

Table 2
Characteristics of Dominant Organization life

Characteristics	Company			
	A	B	C	D
A focus on openness and clustered teamwork dynamics.	√	√	√	√
Promotes a bottom-up innovation approach.	√	√	√	√
Less direct involvement with technical development activities by senior leaders.	√	√		√
Increasing introduction of managerial controls and boundaries	√	√	√	
Increasing emphasis on a customer focus (offer/service)	√	√	√	√
Systemic interpersonal relationships reducing in importance and frequency	√	√	√	√
More prescriptive and formalized development of people and process improvements.	√	√	√	√
Increasing internal tension and competitiveness between sub-groups/teams.	√	√	√	
Lack of flexible working hours and arrangements (increasing task focus).	√	√	√	√
Increasing inequality in the perceived potential contributions between new and old colleagues.	√	√	√	

innovation is given a priority as firms attempt to differentiate their existing products from those of their rivals rather than creating new products, here process improvements assisted in meeting increasing market demand. Hence the focus is on exploring methods that support process improvement. A similar situation was evident within the case companies, as process innovation was seen to have become the dominant focus, which was stimulated by the emphasis on reducing costs and time to market.

We have to cope with competition, process inefficiencies, cost and delivery time, if we want to succeed. These have become the key emphasis of the working culture now, which generally demands improvement of process (Senior Manager, Company B).

The evidence suggested that implementation issues, high cost, and increasing product delivery time were the major concerns of the dominant cultures of these firms that supported the adoption of process innovation at the growth stage. Process innovations supported them in delivering higher value to customers. The application of advanced technology to support

standardizing products is critical because of the increasing demand and competition which forces the firms to innovate in process terms, and increase their output while differentiating their offerings.

In the early days, we gave priority for developing new applications but now we try to improve the agility of applications, delivery time and meet increasing demand. So the focus is on the technical aspects rather than experimenting with new applications and the main concern is on innovating process elements. Although it is mainly used in manufacturing industries, “Platforming” is the method that we use to develop our applications (Project Manager, Company A).

At the growth stage, four firms attempted to enhance their resource base and expertise to explore ways to differentiate their products from competitors through enhanced process efficiencies. One noticeable observation was, at the early stages, a lack of resources, particularly advanced technologies and capabilities had appeared as consistent barriers for adopting process innovations. This suggested that innovating

process was a more complex and difficult task in comparison to innovating products, presumably as it required different expertise and the deployment of advanced processing technologies which often developed and externally sourced.

Fifteen years ago, we all were new to the field. So we tried out the things that we could do better and did not try more complex projects since we didn't have experts like we do now. Providing the best solutions to clients' basic needs with basic technologies was the challenge that we had. Now we have good demand for our products and need to improve the quality and standards to match with new technologies. Providing products in a flexible, cost-effective, and timely manner is the key to our success now. That is why we focus on improving our development process and invest in deepening our technology-specific knowledge to meet the specific needs of clients in our present markets (Senior Manager, Company A).

The case analysis revealed that different types of innovation coexisted and were related, but one type became dominant over other types in a certain time when the strategic priorities of firms changed. In the early period, breakthrough software solutions became the key focus, which changed later when the firms focused on advanced technologies to introduce incremental innovations. The analysis of residual and dominant innovation foci revealed how process innovations affected product innovation, illustrating an association and interdependency between them—although process innovation became the dominant focus at the growth phase.

We have introduced a number of breakthrough software solutions and they have well established in the market. Now it is not the right time to try out completely new solutions but to do some incremental changes to the existing solutions using new technologies because software innovation is always transformational (Senior Consultant, Company D)

When the four firms reached the growth stage, the acquisition of advanced technologies became a key priority. This was because they believed that process innovation could be

achieved only through technology-specific knowledge acquisition. The leadership of the four firms believed that many of their competitors had a greater knowledge in improving organizational efficiencies, reducing cost, and were equipped with more advanced technologies than them. Hence, investing in enhancing their resource base and expertise, particularly obtaining advanced technological capabilities were viewed as a strategic priority. Here, Cohen and Levinthal (1990) found that individual firms were expected to invest in acquiring scientific capabilities, and this was a principal competitive factor in contributing to the firm's success. This was observed within the four businesses, where include technical expertise and deep industry knowledge were sought at the growth phase.

Control Oriented Hierarchical Organization and Organizational Innovation as Emergent

The analysis of emerging organizations revealed that a great deal of emphasis on work-place organization, which involved the implementation of new methods for distributing responsibilities and decision making, appeared within the four case companies. In the early period, employees enjoyed greater autonomy in decision-making, which facilitated new ideas, but this situation changed later on when the firms grew in size and new external relationships were sought. A strong emphasis on organizational innovations gradually emerged at this stage, consequently emphasis for product and process innovations gradually declined.

We expect to make some changes to the structure. Now we have 4 levels and it will increase to 5. Management will get more power, responsibilities and autonomy than now, but lower organisational employees will get less autonomy because giving more power and autonomy to management is really essential if we want to increase efficiency, and strengthen external partnerships (Senior Manager, Company A)

The cross-case analysis showed, the emergent organization was characterized by increasing efficiency focused, professionalism, and business expansion, which eventually appeared to support the adoption of organizational innovation (Table 3). The emergence of new managerial controls and additional layers to their

Table 3
Characteristics of Emergent Organization Life

Characteristics	Company			
	A	B	C	D
Professionalism demanded in, and across, activities, and functions	√		√	√
Emphasis on business expansion and developing strategic partnerships	√	√	√	
Enforcement of strong managerial controls	√		√	√
Focus on adding new layers to existing organization structure(s)	√	√	√	√
Increasing emphasis on internal efficiency improvements	√	√		√
Higher employee turnover, standardization, and monitoring performance increasingly feature.	√	√		√

organization structures were observed when all the four firms highlighted the importance of implementing new organizational methods and business practices. The analysis of emergent organization practice indicted that the four firms planned to introduce new structures to effectively connect all sections of the organizations, with the aim of enhancing coordination and effective communication. This revealed that coordination and communication became an important issue when firms grew in size and when they were looking for new and stronger external relationships—with customers, suppliers, trade organizations, etc.

We have a performance-oriented working culture. People, who perform, excel here, but still we need to find innovative ways to get the best out of them as we plan to develop partnerships with key players in the industry. So several structural changes and professional practices are expected to be introduced (Senior Business Executive, Company B).

A respondent of Company A, a senior-level executive, stated:

We plan to introduce some changes to our business structure. It will be completely different from what we have now. We want to introduce these changes to the business structure to improve the coordination of centres and reduce operational costs. When coordination is weaker

it delays implementation and increases cost.

A similar situation was reported at Company D.

We have daily team meetings but the company wants to have regular meetings with other teams like sales and products so we plan to introduce a matrix type structure.

The emergent organization supported the adoption of organizational innovation over other types as there was a strong tendency to improve internal communication efficiency and productivity by adopting new organizational practices. These new systems were seen as the key to enabling them to evolve into big corporations. One reason identified for such a control focus was the increasing tension among employees as team sizes increased, which appeared to create personality clashes and poor working relationships. This environment appeared to inhibit idea generation.

Before we had small development teams and it worked well for us. We now have large development teams. If I tell you the truth, people now do not share their views freely like they did before. Because they have all got different backgrounds and they show a little tolerance for others' view. This may be more adverse in the future as the company plans to increase team size and implement new systems and procedures to minimise conflicts and issues of project teams (Senior Manager, Company B).

Increasing managerial controls appeared to be a contributory factor to higher employee turnover as growth accelerated. This was compounded by a shortage of qualified labor in the LDCs which required companies to recruit less qualified employees despite often articulated reservations by existing employees. The case data revealed that existing staff disliked this decision because they believed that this strategy could affect the quality of software solutions and their working life.

Every day people are leaving because no one likes too much control. They are going to recruit diploma holders. It will really affect the quality of developments and our work (Software Engineer, Company A).

A senior manager from Company A explained the labor issues they faced.

We need more people to meet our current demand but recruiting graduates is a big issue now since we do not have enough talent in the labour market. The industry has grown very fast. So we have to look for alternative talents and solutions.

Changes to organizational structure were inevitable with an increasing size when the emergent organization was expected to be more formal. As noted by Cameron and Quinn (1999), this is not uncommon as firms often tend to introduce rigid systems and procedures in similar scenarios, to enable them to control their operations, people, and resources more effectively. As a result, the emerging organizations appear to enable the organizational innovations over other three types to exploit the external opportunities and internal capabilities.

Discussion

Theoretical Implications

As this research was conducted in the software industry in Sri Lanka, with organizations that had a similar age—growing and maturing—the domain in which this theory applies is of course limited to similar organizations. Nonetheless, the study shows how technology-based small firms evolve and adopt innovations to achieve their business objectives over time. As concerns the first contribution, the study established that the residual and the emergent

organization have a significant impact on the firms' innovation focus—the dominant form. The use of the RDE framework permitted us to uncover the tension between past, present and emerging organizational dynamics and the changing innovation focus of these firms.

The research conducted under the antecedent approach blindly assumes that the factors influencing innovation are not changed, and ignore the effect of time, thus the limitation of predictability of future innovation performance is inherent in these models. Floricel and Dougherty (2007) noted that life cycle theories applied to investigate innovation have limited predictive power due to too restrictive and unrealistic assumptions. By applying the RDE framework, we found that the dynamic nature of static models can be enhanced as considerations of the RDE provides a picture of the organization's past, present, and future at a certain time, thus facilitating the understanding of the changing nature of innovation and influencing factors over time. The use of RDE framework facilitated in this study to understand both static and dynamic perspectives within organizations as well as evolving nature of technology and organization while revealing the interrelatedness of innovations. As for the next contribution, we found that the innovation focus of software firms follows a pattern of product-process-organizational innovation, by which we confirm and extend the findings of Utterback and Abernathy (1975). We also acknowledge, as discussed by Linton and Walsh (2003), product and process innovations are interrelated, and a change in process can lead to a change in product. This is because, as we found, although different types of innovations coexist, and are correlated to each other, one becomes dominant over other types at a particular time when the firms' strategic priorities change. We observed, at the start-up phase, the firms focused on introducing various types of product innovations to selected market segments—some of these innovations fail and others establish in the market. At this stage, the firms use cheaper technologies, more readily available capabilities and well-known approaches in the industry to develop software solutions that are configured to be new into the market. In the early period, technology change is relatively limited and does not feature capital-intensive or high-quality technologies.

The desire to preserve the entrepreneurial type working environment and product

innovation was seen as a strong theme and this was found to have a negative effect on process innovation activities as organization members tend to appreciate residual organizational practices and the previous product innovation focus. For example, the informal working environment, which has a favorable effect on product innovation in the early stages of organizational development, was observed to have a negative effect on innovation activities in the later stages. Moreover, with the growing maturity of firms, a hierarchical control-oriented organization emerges as discussed by Lester, Parnell, and Carraher (2003), and has a negative impact on employee propensity to innovate due to reduced risk-taking and an increasing reluctance to endure failure. We found that when the firms were small in size, it enabled a working climate of very strong professional and personal ties; these were consistently open and encouraging relationships which encouraged innovation efforts. However, when the firms grew in size, more formal working environments and managerial controls were introduced and consequently these types of relationships were weakened—despite attempts to moderate this. We further noted that when the firms were small in size, it assisted more effective feedback and communication. In particular, instant feedback and the direct involvement of the senior leadership team in supporting the implementation of innovation appeared to reduce lead times in comparison to more emergent practice as the firms grew in size. Delayed feedback and less direct involvement of the senior leadership team with innovation activities at the later stages appeared to contribute to more protracted innovation outcomes and poorer employee engagement in the process. Our findings suggest, at the later stages, the firms pay less attention to introducing breakthrough product innovations as the emphasis switches from product to process, and later on to organizational innovation. Here, the organization's environment is reshaped from an entrepreneurial to a hierarchical type over time. As a result, there appeared to be a constant struggle among dominant, residual, and emergent practices that lead to a tension among old and new employees. First, these findings are important as they indicate the varying effect of innovation influencing factors at different stages of the corporate life cycle. Second, this reveals the effect of static and dynamic elements on innovation activities. Third, such findings emphasize the importance of analyzing

central-dominant practices as well as emergent and residual practices in developing innovation friendly working environments.

As Kopylay, Chillingworth, and Mitchell (2013) discuss, at the growth stage, the software firms also continuously invest in adopting different type of process innovations including new technologies, methodologies, and skills. These, for example, included agile software development, which has a direct influence on process efficiency—reducing the time to market and development costs. As Pyka (2000) argues, the willingness to invest in product innovation is more influenced by the market conditions or types of demand at the early stages of the firm's development. Later, sectoral technology advancements within the industry appear to require new skills and knowledge to reduce costs and the time to market of later versions of applications etc. Interestingly, this shows the interdependent nature of market pull and technology push perspectives, which may have implications for the switching from product to process innovation. At the growth stage, the firms do not attempt to introduce breakthrough software solutions as they focus on improving and upgrading established software products in the market, and the management of projects. When the focus shifts to the process innovations, the firms invest in acquiring new process specific technological capabilities, process specific R&D activities, new project management skills, and advanced technologies. The organization environment constantly stimulates new ideas related to process innovations, possibly at the expense of other types of innovations. Analysis here shows the process focused innovation emphasis appears to change in the next phase as the businesses evolves into streamlining the work process and strengthening the power of managerial positions emerges as a necessary condition when the firms further grow in size. At the next level of their development, the span of control and the management of external relationships becomes as key issue whereby the organizational innovation emerges as a key strategic priority. To achieve this, new organizational methods in the firm's business practices, workplace and external relations are sought, increasing operational efficiencies and further exploiting existing capabilities by reconfiguring the organizational structure and administrative systems are given significant priority. As a result, further explorations of product and process innovations starts to decline.

This study also demonstrates how firms in LDCs manage and develop technological capabilities over time and overcome the resource barriers. As other studies (e.g., Bessant 2003; Simmons and Sower 2012; Williams and Woodson 2012) revealed, we also found that the lack of resources became a key barrier to adopting innovations. In the early period of their development, the four software firms had acquired technological capabilities by networking with the organizations in developed countries through individuals in the firms or through joint venture partnerships. The study uncovered that at the start-up phase, founders with international experience or international connections became the main innovation source or protagonist for the firms in LDCs. Later, they develop their technology capabilities, integrating external knowledge with in-house efforts, and investing in R&D activities and human capital development. As the mature they gradually upgrade their knowledge through technology suppliers, clients, and local research institutions such as universities, which particularly support the process innovation activities at the mid-stage. This shows, although the external sources of knowledge play an important role, the firm's ability to create and develop their own innovation capabilities is a key factor that contributes innovation success in LDCs. We noted, the lack of advanced technological capabilities influenced the firms in focusing on a narrow subset of products within their sector to satisfy current and future clients by introducing product innovations with the minimum technology capabilities they possess in the early stages. Within a LDC, this strategy seems to have worked well as the users of technology are ready to accept the new technology products, which satisfy the minimum performance threshold as they also do not have the ability to use advanced technological solutions either. Later, this situation changes when both groups—the users and the firms enhance technological capabilities resulting in buyers expecting improvements in technologies, product performances, the time to market, and all this at lower cost. Firms at the growth stages consequently focus on adopting process innovation and enhancing their technological capabilities through external and internal sources. The findings of this assist in understand how technology innovation evolves in an industry over time in a LDC context. In addition, tensions between the longest serving newest employees and the emerging hierarchical organization

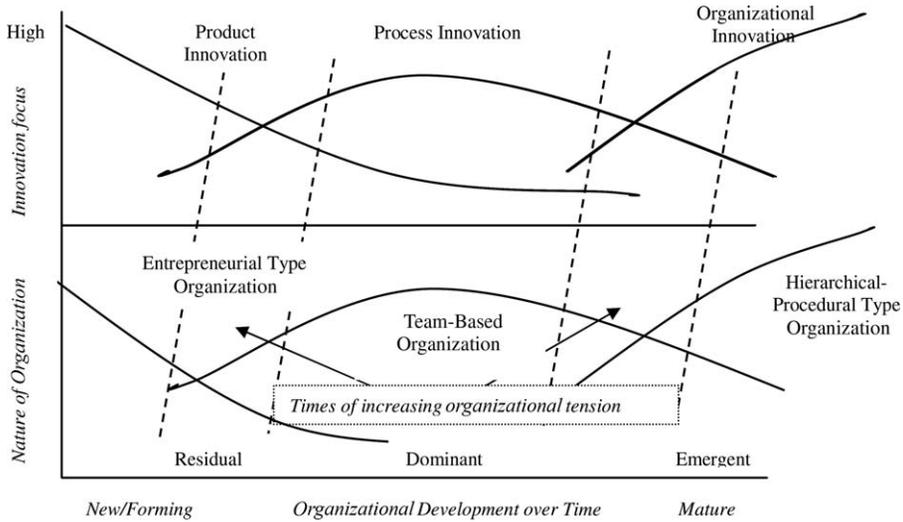
contribute to increasing employee turnover. At the same time, these firms struggle to recruit new employees, particularly process and organizational innovation champions to support the businesses growing needs. In an LDC, this human resource issue appears to become a key challenge that knowledge-intensive industries face due to the resource constrains and the increasing competitive nature of the sector.

In this study, we have adopted Van de Ven's (1986) definition as it stresses the importance of inputs as well as outputs of the innovation process. As a result, we revealed how the organizational environment supports three innovation foci over the organization life cycle. Figure 1 shows that the start-up phases of these firms are characterized by an entrepreneurial type organizational environment, which encourages and embraces informality and uncertainty, this appears to provide the necessary conditions for producing innovative products. The organization then enters a transition phase, where the strategic organizational focus shifts to process innovation investments, which requires increasing formality and more defined team-based working. At the cross-over point there appears to be an increasing tension within the organization working environment. As the team- and people-focused working environment becomes dominant, the organization changes to support perceived organizational forms that accommodate process innovations, and in particular process efficiency. Over time, the firms move toward identifying competitive gains through organizational efficiency. This shift or transition again appears to create organizational tension. What emerges is a more hierarchical organization that focuses resources for organizational innovation. Our findings therefore extend the views of Utterback and Abernathy (1975) and Damanpour and Gopalakrishnan (2001) who identified the product-process innovation pattern evolution of the firm. Utterback and Abernathy also argued, at the third stage, firms attempt to have a balance between product and process innovation. However, as we found, organizational innovation becomes a key strategic priority and incremental adjustments in products and process innovations are focused on over this period.

Practical Implications

In terms of practical implications, this research illustrates to organizations the hard and soft

Figure 1
Organizational Dynamics and Innovation Focus



challenges they face around technology and systems, and organizational climate and form. Resultantly, our proposed theory accommodates residual, dominant, and emergent organizational working environments, and crucially product-process-organizational innovation foci. This approach has revealed two interweaved challenges for managers of organizations. First, initial organizational forms, described as entrepreneurial type, support product innovation strategies, but appear that they may not necessarily support process or organizational innovation. Consequently, senior executives have to consider a number of complex and interrelated components, such as new knowledge, skills, resources, organizational form, rewards, and cohesion, often in the context of growth—including generating new sales, new market territories, and new staff. Our findings also guide the small businesses as the analysis of RDE framework uncover the business life cycle of entrepreneurial firms which generally start as a small firm and draw the attention to the need for awareness of the changing role of innovation and management when the firms grow. Practitioners can therefore use the RDE framework to better anticipate the future innovation characteristics and organizational forms that can best support innovation, while being mindful of periods of tension that they can experience when organizations transit from one stage to another stage.

This study emphasizes the importance of different types of innovation at different stages of the organization's development to achieve corporate objectives. Moreover, bringing the organization into being, building a credible product, was the primary performance objectives at the start-up phase. Process innovation supported the achievement of market-related performance objectives such as decreasing delivery time and increasing product quality which were in evidence at the growth stage. As we observed, undesirable residuals and less innovative friendly emerging factors coexisted with the dominant innovation influencing factors. As a result of this, practitioners should scan the residual, dominant, and emergent innovation influencing factors to develop more innovative friendly working environments—particularly as the organization shifts from one focus to another. In this case, the analysis of RDE organizations, when combined with the identified characteristics of this study (Tables 1–3), can therefore be used to better understand the environmental context that can facilitate innovation.

Conclusion

The study introduces a novel theoretical framework for innovation management that

supports better understanding of the organizational dynamics and innovation foci. This study has shown that innovation models, which are based on the static life cycle theories, can be improved by accommodating dynamic perspectives. In this study, this was demonstrated by applying the RDE theoretical framework. The RDE framework provided a picture of the organization's past, present, and the future while enabling a necessary theoretical foundation for analyzing both the changing nature of innovation focus and the organization over time. More importantly, this study demonstrated the varying effect of innovation influencing characteristics at different stages of the organization development in a LDC—the characteristics favorable for innovation at the start-up phase appear not to necessarily support innovation at later organizational stages. Hence, the RDE framework provides an appropriate lens for both academics and practitioners, in identifying the enablers and barriers of innovation, and the future innovation challenges. This study has shown that the different types of innovation coexist, and are related to each other but the innovation focus takes the form of a product-process-organizational pattern over time as the dominant innovation focus changes in line with the strategic priorities of firms. This was coupled with an organizational form that transformed from an entrepreneurial type to a hierarchical-control oriented firm. The study also demonstrated that the achievement of corporate performance objectives is supported by different types of innovation when the appropriate working environment is developed, and when the organizations' leadership facilitates innovation efforts of employees by providing the opportunities for acquiring technological capabilities. We found that the firms acquire the necessary technological capabilities through international networks, which showcase the knowledge acquisition strategy of the firms within a LDC. The study also revealed that the success of technology-based start-up in an LDC appears to be greatly determined by the owner's education background and the ability to access the global networks. This obviously has implications for policy makers in LDCs that are looking to cultivate particular industries.

This study was mainly based on the foundation of the antecedent approach to innovation research. Generally, this approach is criticized for its static orientation and neglecting the varying effects of innovation influencing factors over

time. In this research, this issue was addressed by analyzing both static and dynamic factors through the RDE framework. We acknowledge that determinants of innovation may interact, and while the exact nature of interaction cannot be fully revealed, the analysis of the case studies and the application of the RDE framework helped in this study to identify the interaction of determinants to a greater extent. However, further empirical investigations are necessary to validate the findings of this study as the identified characteristics and results of this study are limited to the software industry in Sri Lanka; therefore, further research in other industries and similar LDCs are suggested. Although the present study acknowledges the effect of environmental factors on innovation, these factors were not investigated as the aim of the research was to identify the effect of organizational level dynamics on innovation focus. We, therefore, suggest the use of RDE framework to develop a more holistic model including both firm level factors and macro level factors to examine the evolution of small firms and innovation. Moreover, further research can be conducted to examine the relationship between innovation types and the RDE factors identified in this study using a quantitative research approach.

References

- Abernathy, W. J., and J. M. Utterback (1978). "Pattern of Industrial Innovations," *Technology Review* 80(7), 40–47.
- Adner, R., and D. Levinthal (2001). "Demand Heterogeneity and Technology Evolution: Implications for Product and Process Innovation," *Management Science* 47, 611–628.
- Aghion, P., P. A. David, and D. Foray (2009). "Science, Technology and Innovation for Economic Growth: Linking Policy Research and Practice in STIG Systems," *Research Policy* 38(4), 681–693.
- Akhavan, P., and S. M. Hosseini (2016). "Social Capital, Knowledge Sharing, and Innovation Capability: An Empirical Study of R&D Teams in Iran," *Technology Analysis and Strategic Management* 28(1), 96–113.
- Altenburg, T. (2006). "Governance Patterns in Value Chains and Their Development Impact," *The European Journal of Development Research* 18, 498–521.
- Anderson, A., and M. L. Tushman (1990). "Technological Discontinuities and Dominant Designs: A Cyclical Model of

- Technological Change," *Administrative Science Quarterly* 35(6), 604–633.
- Barba Navaretti, G., and A. J. Venables (2004). *Multinational Firms in the World Economy*. Princeton, NJ: Princeton University Press.
- Barras, R. (1990). "Interactive Innovation in Financial and Business Services: The Vanguard of the Service Revolution," *Research Policy* 19, 215–237.
- Bell, M., and K. Pavitt (1993). "Technological Accumulation and Industrial Growth: Contrasts Between Developed and Developing Countries," *Industrial and Corporate Change* 2(2), 157–209.
- Bessant, J. (2003). *High Involvement Innovation*. Chichester: Wiley.
- Birch, D. L. (1979). "The Job Generation Process," Unpublished Report Prepared by the Massachusetts Institute of Technology Program on Neighborhood and Regional Change for the Economic Development Administration. Washington, DC: U.S. Department of Commerce.
- (1987). *Job Creation in America: How Our Smallest Companies Put the Most People to Work*. New York: The Free Press.
- Bower, J. L., and C. M. Christensen (1995). "Disruptive Technologies: Catching the Wave," *Harvard Business Review* 73(1), 43–53.
- Brem, A., and K. Voigt (2009). "Integration of Market Pull and Technology Push in the Corporate Front End and Innovation Management—Insights from the German Software Industry," *Technovation* 29(2009), 351–367.
- Bryson, J. (2008). "Dominant, Emergent, and Residual Culture: The Dynamics of Organizational Change," *Journal of Organizational Change Management* 21(6), 743–757.
- Burgelman, R. A., and L. R. Sayles (2004). "Transforming Invention into Innovation: The Conceptualization Stage," in *Strategic Management of Technology and Innovation*. Eds. C. M. Christensen and S. C. Wheelwright. Boston, MA: McGraw-Hill, 682–690.
- Camelo-Ordaz, C. J., Garcia-Cruz, E. Sousa-Ginel, and R. Valle-Cabrera (2011). "The Influence of Human Resource Management on Knowledge Sharing and Innovation in Spain: The Mediating Role of Affective Commitment," *The International Journal of Human Resource Management* 22, 1442–1463.
- Cameron, K., and R. E. Quinn (1999). *Diagnosing and Changing Organizational Culture: Based on the Competing Values Framework*. Reading, MA: Addison-Wesley Publishing Co.
- Chiaroni, D., V. Chiesa, and F. Frattini (2010). "Unravelling the Process from Closed to Open Innovation: Evidence from Mature, Asset-Intensive Industries," *R&D Management* 40(3), 222–245.
- Christensen, C. M. (1997). *The Innovator's Dilemma. When New Technologies Cause Great Firms to Fail*. Boston, MA: Harvard Business School Press.
- Churchill, N., and V. Lewis (1983). "The Five Stages of Small Business Growth," *Harvard Business Review* 61(3), 30–50.
- Cohen, W. M., and D. A. Levinthal (1990). "Absorptive-Capacity—A New Perspective on Learning and Innovation," *Administrative Science Quarterly* 35(1), 128–152.
- Colvin, G. (1999). "The Year of the Megamerger," *Fortune* 139(1), 62–72.
- Damanpour, F. (1992). "Organizational Size and Innovation," *Organization Studies* 13, 375–402.
- Damanpour, F., and S. Gopalakrishnan (2001). "The Dynamics of the Adoption of Product and Process Innovations in Organizations," *Journal of Management Studies* 38(1), 45–65.
- Dantas, E., and M. Bell (2011). "The Co-Evolution of Firm-Centered Knowledge Networks and Capabilities in Late Industrializing Countries: The Case of Petrobras in the Offshore Oil Innovation System in Brazil," *World Development* 39(9), 1570–1591.
- Dao, V., and R. Zmud (2013). "Innovating Firms' Strategic Signaling Along the Innovation Life Cycle: The Standards War Context," *Journal of Engineering and Technology Management* 30, 288–308.
- Daugherty, P. J., H. Chen, and B. G. Ferrin (2011). "Organizational Structure and Logistics Service Innovation," *International Journal of Logistics Management* 22(1), 26–51.
- Denzin, N. (1978). *The Research Act: A Theoretical Introduction to Research Methods*. New York: McGraw-Hill.
- Devlin, P. J. (2010). "Exploring Efficiency's Dominance: The Wholeness of the Process," *Qualitative Research in Accounting and Management* 7(2), 141–162.
- Doms, M., T. Dunne, and M. Roberts (1995). "The Role of Technology Use in the Survival

- and Growth of Manufacturing Plants," *International Journal of Industrial Organization* 13, 523–542.
- Dosi, G. (1982). "Technological Paradigms and Technological Trajectories: A Suggested Interpretation of the Determinants and Directions of Technical Change," *Research Policy* 11(3), 147–162.
- Drejer, I., and B. H. Jorgensen (2005). "The Dynamic Creation of Knowledge: Analysing Public–Private Collaborations," *Technovation* 25, 83–94.
- Dutz, M. A., and S. D. O'Connell (2013). "Productivity, Innovation and Growth in Sri Lanka: An Empirical Investigation," Policy Research Working Paper 6354, The World Bank. Available from: <http://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-6354>
- Eisenhardt, K. M. (1989). "Building Theories from Case Study Research," *Academy of Management Review* 14(4), 532–550.
- Eisenhardt, K. M., and M. E. Graebner (2007). "Theory Building from Cases: Opportunities and Challenges," *Academy of Management Journal* 50(1), 25–32.
- Florice, S., and D. Dougherty (2007). "Where Do Games of Innovation Come From? Explaining the Persistence of Dynamic Innovation Patterns," *International Journal of Innovation Management* 11, 65–91.
- Foster, R. N. (1986). *Innovation: The Attacker's Advantage*. London: Guild Publishing.
- Fu, X., and Y. Gong (2011). "Indigenous and Foreign Innovation Efforts and Drivers of Technological Upgrading: Evidence from China," *World Development* 39, 1213–1225.
- Gereffi, G., and R. Kaplinsky (2001). "The value of value chains, special issue," *IDS Bulletin* 32.
- Gilbert, C. G. (2005). "Unbundling the Structure of Inertia: Resource versus Routine Rigidity," *Academy of Management Journal* 48, 741–763.
- Gilder, G. (1988). "The Revitalization of Everything: The Law of the Microcosm," *Harvard Business Review* 66(2), 49–61.
- Gort, M., and S. Klepper (1982). "Time Paths in the Diffusion of Product Innovations," *Economic Journal* 92, 630–653.
- Govindarajan, V., and P. K. Kopalle (2006). "Disruptiveness of Innovations: Measurement and an Assessment of Reliability and Validity," *Strategic Management Journal* 27(2), 189–199.
- Graebner, M. E. (2004). "Momentum and Serendipity: How Acquired Leaders Create Value in the Integration of Technology Firms," *Strategic Management Journal* 25, 751–777.
- Greiner, L. (1972). "Evolution and Revolution as Organizations Grow," *Harvard Business Review* 50(4), 37–46.
- Griliches, Z. (1957). "Hybrid Corn: An Exploration in the Economics of Technological Change," *Journal of the Econometric Society* 25(4), 501–522.
- Herath, H. M. U. N., and S. D. Silva (2011). "Strategies for Competitive Advantage in Value Added Tea Marketing," *Tropical Agricultural Research* 22(3), 251–262.
- Herrmann, P. (2005). "Evolution of Strategic Management: The Need for New Dominant Designs," *International Journal of Management Reviews* 7(2), 111–130.
- Justis, R. T. (1981). *Managing Your Small Business*. Englewood Cliffs, NJ: Prentice-Hall.
- Kamien, M. I., and N. L. Schwartz (1982). *Market Structure and Innovation*. Cambridge: Cambridge University Press.
- Kassiech, S., S. Walsh, S. Cummings, J. McWhorter, P. Romig, and D. Williams (2002). "Commercialization of Disruptive Technologies: Moving Discontinuous Innovations into Products," *IEEE Transactions on Engineering Management* 49(4), 375–387.
- Kearney, A. T. (2009). *Global Service Index*. Available from <http://www.atkearney.com/index.php/Publication/global-service-index-gsli-2009-report.html> (accessed 10 February 2010).
- Keller, W. (1996). "Absorptive Capacity: On the Creation and Acquisition of Technology in Development," *Journal of Development Economics* 49, 199–227.
- (2004). "International Technology Diffusion," *Journal of Economic Literature* 42, 752–782.
- Kijkuit, B., and J. V. D. Ende (2010). "With a Little Help from Our Colleagues: A Longitudinal Study of Social Networks for Innovation," *Organization Studies* 31, 451–479.
- Kim, Y., K. Song, and J. Lee (1993). "Determinants of Technological Innovation in the Small Firms of Korea," *R&D Management* 23(3), 215–226.

- Kirchhoff, B. A. (1994). *Entrepreneurship and Dynamic Capitalism: The Economics of Business Firm Formation and Growth*. Westport, CT: Praeger.
- Kirchhoff, B. A., J. D. Linton, and T. S. Walsh (2013). "Neo-Marshellian Equilibrium versus Schumpeterian Creative Destruction: Its Impact on Business Research and Economic Policy," *Journal of Small Business Management* 51(2), 159–166.
- Klepper, S. (1996). "Entry, Exit, Growth and Innovation over the Product Life Cycle," *American Economic Review* 86, 560–565, 81.
- Kondratieff, N. D. (1937). "Long Waves in Economic Life," *Lolyds Bank Review*, July 1978.
- Koplyay, T. L., Chillingworth, and B. Mitchell (2013). "Corporate Lifecycles: Modelling the Dynamics of Innovation and Its Support Infrastructure," *Technology Innovation Management Review* 2, 22–29.
- Kupfer, A. (1998). "MCI WorldCom: It's the Biggest Merger Ever," *Fortune* 137(8), 118–128.
- Lall, S. (1992). "Technological Capabilities and Industrialization," *World Development* 20, 165–186.
- Lee, C. Y. (2003). "A Simple Theory and Evidence on the Determinants for Firm R&D," *Economics of Innovation and New Technology* 12(5), 385–396.
- Lester, D., and J. Parnell (1999). "A Strategic Interpretation of Organization Life Cycle," *Journal of Applied Management and Entrepreneurship* 5(1), 14–32.
- Lester, D., J. Parnell, and S. Carraher (2003). "Organizational Life Cycle: A Five-Stage Empirical Scale," *International Journal of Organizational Analysis* 11(4), 339–354.
- Lester, D. L., J. A. Parnell, W. R. Crandall, and M. L. Menefee (2008). "Organizational Life Cycle and Performance among SMEs: Generic Strategies for High and Low Performers," *International Journal of Commerce and Management* 18(4), 313–330.
- Linton, J., and S. Walsh (2003). "From Bench to Business," *Nature of Materials* 2, 287–289.
- (2008). "A Theory of Innovation for Process-Based Innovations Such as Nanotechnology," *Technological Forecasting and Social Change* 75(5), 583–594.
- Lippitt, G., and W. Schmidt (1967). "Crises in Developing Organizations," *Harvard Business Review* 45(6), 102–112.
- Lovea, J. H., and S. Roper (2009). "Organizing Innovation: Complementarities Between Cross-Functional Teams," *Technovation* 29, 192–203.
- Madhani, P. M. (2010). "Realigning Fixed and Variable Pay in Sales Organizations: An Organizational Life Cycle Approach," *Compensation and Benefits Review* 42(6), 488–498.
- Mansfield, E. (1968). *The Economics of Technological Change*. New York: W. W. Norton.
- Marquis, D. G. (1969). "The Anatomy of Successful Innovations," in *Readings in the Management of Innovation*, 2nd ed. Eds. M. L. Tushman and W. Moore. Cambridge, MA: Ballinger, 79–87.
- Miles, R., and C. Snow (1978). *Organizational Strategy, Structure, and Process*. New York: McGraw-Hill.
- Miller, D. (1987). "Strategy-Making and Structure: Analysis and Implications for Performance," *Academy of Management Journal* 30, 7–32.
- Miller, D., and P. H. Friesen (1984). "A Longitudinal Study of the Corporate Life Cycle," *Management Science* 30, 1161–1183.
- Mintzberg, H. (1973). *The Nature of Managerial Work*. New York: Harper and Row.
- Moore, G. A. (2000). *Crossing the Chasm*. Oxford: Capstone.
- Morrison, A., C. Pietrobelli, and R. Rabellotti (2008). "Global Value Chains and Technological Capabilities: A Framework to Study Learning and Innovation in Developing Countries," *Oxford Development Studies* 36(1), 39–58.
- Mowery, D. C. (1983). "Economic-Theory and Government Technology Policy," *Policy Sciences* 16(1), 27–43.
- Myers, S., and D. Marquis (1969). "Successful Industrial Innovation: A Study of Factors Underlying Innovation in Selected Firms," Report to the NSF, Washington, DC.
- Nelson, R. R., and S. G. Winter (1982). *An Evolutionary Theory of Economic Change*. Cambridge, MA: Harvard University Press.
- OECD (2005). *The Measurement of Scientific and Technological Activities: Guidelines for Collecting and Interpreting Innovation Data: Oslo Manual*, 3rd ed. Paris: OECD.
- Parnell, J., and S. Carraher (2002). "The Role of Effective Resource Utilization in Strategy's Impact on Performance,"

- International Journal of Commerce and Management* 13(3), 1–34.
- Phillips, B. D., and B. A. Kirchoff (1989). "Formation, Growth and Survival: Small Firm Dynamics in the U.S. Economy," *Small Business Economics* 1, 65–74.
- Pietrobelli, C., and R. Rabellotti (2007). *Upgrading to Compete. Global Value Chains, Clusters and SMEs in Latin America*. Cambridge, MA: Harvard University Press.
- (2011). "Global Value Chains Meet Innovation Systems: Are There Learning Opportunities for Developing Countries?," *World Development* 39(7), 1261–1269.
- Prahalad, C., and G. Hamel (1991). "Corporate Imagination and Expeditionary Marketing," *Harvard Business Review* 69(4), 81–92.
- Pyka, A. (2000). "Informal Networking and Industrial Life Cycles," *Technovation* 20, 25–35.
- Quinn, J. B., and K. Cameron (1983). "Organizational Life Cycles and Shifting Criteria of Effectiveness: Some Preliminary Evidence," *Management Science* 29, 33–51.
- Rogers, E. (1983). *Diffusion of Innovations*. New York: Free Press.
- Rosenberg, N. (1969). "Direction of Technological Change—Inducement Mechanisms and Focusing Devices," *Economic Development and Cultural Change* 18(1), 1–24.
- Schmookler, J. (1962). "Economic Sources of Inventive Activity," *Journal of Economic History* 22(1), 1–20.
- Schollhammer, H., and A. Kuriloff (1979). *Entrepreneurship and Small Business Management*. New York: Wiley.
- Schroeder, R. G., A. Van de Ven, G. D. Scudder, and D. Polley (1989). "The Development of Innovation Ideas," in *Research on the Management of Innovation: The Minnesota Studies*. Eds. A. Van de Ven, H. L. Angle, and M. Poole. New York: Harper and Row, 107–134.
- Schumpeter, J. A. (1934). *The Theory of Economic Development*. Cambridge, MA: Harvard University Press.
- (1947). *Capitalism, Socialism, and Democracy*, 2nd ed. New York: Harper and Row.
- Scott, B. (1972). *Stages of Corporate Development – Part 1, Case No. 9–371-294*. Boston, MA: Boston Intercollegiate Cases Clearing House.
- Scott, M., and R. Bruce (1987). "Five Stages of Growth in Small Business," *Long Range Planning* 20(3), 45–52.
- Sethi, R., and Z. Iqbal (2008). "Stage-Gate Controls, Learning Failure, and Adverse Effect on Novel New Products," *Journal of Marketing* 72(1), 118–134.
- Silver, L. (2009). "Perspectives on Organizational Change: The Struggle between Dominating and Residual Cultures in Savings Banks," *Corporate Communications: An International Journal* 14(4), 369–388.
- Simmons, A. L., and V. E. Sower (2012). "Leadership Sagacity and Its Relationship with Individual Creative Performance and Innovation," *European Journal of Innovation Management* 15(3), 298–309.
- Sirmon, D., G. Hitt, M. A. R. D. Ireland, and B. A. Gilbert (2011). "Resource Orchestration to Create Competitive Advantage: Breadth, Depth, and Life Cycle Effects," *Journal of Management* 37(5), 1390–1412.
- Smith, K. G., T. R. Mitchell, and C. E. Summer (1985). "Top Level Management Priorities in Different Stages of the Organizational Life Cycle," *Academy of Management Journal* 28, 799–820.
- Solow, R. (1956). "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics* 70(1), 65–94.
- Stolwijk, C. C. M., W. P. M. Vanhaverbeke, J. R. Orta, M. W. Pieterse, E. Hartigha, and C. Beers (2012). "The Effect of Internal and External Technology Sourcing on Firm Performance throughout the Technology Life Cycle," *Technology Analysis and Strategic Management* 24, 1013–1028.
- Tavassoli, S. (2015). "Innovation Determinants over Industry Life Cycle," *Technological Forecasting and Social Change* 91, 18–32.
- Tavassoli, S., and C. Karlsson (2015). "Persistence of Various Types of Innovation Analyzed and Explained," *Research Policy* 44, 1887–1901.
- Tidd, J., and J. Bessant (2011). *Managing Innovation: Integrating Technological Market and Organizational Change*. Chichester: Wiley.
- Tiwari, R., and C. Herstatt (2012). "Assessing India's Lead Market Potential for Cost-Effective Innovations," *Journal of Indian Business Research* 4(2), 97–115.
- United Nations Conference on Trade and Development (2012). *Information Economy Report*. New York: Geneva United Nations. Available from: http://unctad.org/en/PublicationsLibrary/ier2012_en.pdf (accessed October 21, 2012).

- Utterback, J. M. (1994). *Mastering the Dynamics of Innovation: How Companies Can Seize Opportunities in the Face of Technological Change*. Boston, MA: Harvard School Press.
- Utterback, J. M., and W. J. Abernathy (1975). "A Dynamic Model of Process and Product Innovation," *Omega* 3(6), 639–656.
- Van de Ven, A. H. (1980). "Early Planning, Implementation and Performance of New Organizations," in *The Jossey-Bass Social and Behavioral Science Series. The Organizational Life Cycle. Issues in the Creation, Transformation, and Decline of Organizations*. Eds. J. R. Kimberly and R. H. Miles. San Francisco, CA: Jossey-Bass, 83–134.
- (1986). "Central Problems in the Management of Innovation," *Management Science* 32(5), 590–607.
- Varis, M., and H. Littunen (2010). "Types of Innovation, Sources of Information and Performance in Entrepreneurial SMEs," *European Journal of Innovation Management* 13(2), 128–154.
- Vernon, R. (1966). "International Investment and International Trade in Product Cycle," *Quarterly Journal of Economics* 80(2), 190–207.
- Wagner, S. M. (2013). "Partners for Business-to-Business Service Innovation," *IEEE Transactions on Engineering Management* 60(1), 113–123.
- Walsh, S. T., B. A. Kirchhoff, and S. Newbert (2002). "Differentiating Market Strategies for Disruptive Technologies," *IEEE Transactions on Engineering Management* 49(4), 341–351.
- Walsh, T. (2004). "Road Mapping a Disruptive Technology: A Case Study the Emerging Microsystems and Top-down Nano Systems Industry," *Technological Forecasting and Social Change* 71, 161–185.
- West, G. P. III., and T. W. Noel (2009). "The Impact of Knowledge Resources on New Venture Performance," *Journal of Small Business Management* 47(1), 1–22.
- Wheelwright, S. C., and K. B. Clark (1992). *Revolutionizing Product Development - Quantum Leaps in Speed, Efficiency, and Quality*. New York: The Free Press.
- Williams, L. D. A., and T. S. Woodson (2012). "The Future of Innovation Studies in Less Economically Developed Countries," *Minerva* 50, 221–237.
- Williams, R. (1980). *Problems in Materialism and Culture*. London: Verso.
- Williamson, I. O. (2000). "Employer Legitimacy and Recruitment Success in Small Business," *Entrepreneurship: Theory and Practice* 25(1), 27–43.
- Winter, S. G. (1984). "Schumpeterian Competition in Alternative Technological Regimes," *Journal of Economic Behavior and Organization* 5, 287–320.
- Wolfe, R. (1994). "Organisational Innovation: Review, Critique and Suggested Research Directions," *Journal of Management Studies* 405–431.
- Yanez, M. T. M., Khalil, and S. T. Walsh (2010). "IAMOT and Education: Defining a Technology and Innovation Management (TIM) Body-of-Knowledge (BoK) for Graduate Education (TIM BoK)," *Technovation* 30(7–8), 389–400.
- Yin, R. K. (2003). *Applications of Case Study Research*. Thousand Oaks, CA: Sage.
- (2009). *Case Study Research: Design and Methods*. Thousand Oaks, CA: Sage.
- Yu, D., and C. C. Hang (2009). "A Reflective Review of Disruptive Innovation Theory," *International Journal of Management Reviews* 12(4), 435–452.
- Zaltman, J., R. Duncan, and J. Holbek (1973). *Innovation and Organizations*. New York: Wiley.
- Zanello, G., X. Fu, and P. Mohnen (2015). "The Creation and Diffusion of Innovation in Developing Countries," *Journal of Economic Surveys* 30, 884–912.
- Zeschky, M., B. Widenmayer, and G. Gassmann (2011). "Frugal Innovation in Emerging Markets," *Research-Technology Management* 54(4), 38–45.