

# Conceptualizing Success Factors in Collaborative Technology Innovation

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**Abstract:** - Technology Innovation has been identified as a key factor that is increasingly influencing the success and competitiveness of modern enterprises in their selected market niche. Traditionally, innovation viewed a company's internal responsibility but this has gradually changed to a model where many enterprises are increasingly pursuing collaborative innovation. Globally, many successful collaborative innovations have been reported but there are also cases where the ventures were unsuccessfully. The study reviewed literature on successful and unsuccessful innovation venture and identify key common factors that defined success in collaborative technology innovation ventures. These factors included; deliberate efforts by the collaborating entities to develop human resources in terms of skills and expertise in their areas of strength, Designing and streamlining of processes and programmes that would play a key role in the collaboration and building of custom collaborative infrastructural platforms that support the collaborative venture. Using the factors, the study proposes a conceptual model of factors that influence successful collaborative technology innovation.

**Key Words:** — *Innovation, Technology, Technology Innovation, Collaboration-Innovation Model, Innovation Ecosystem.*

## I. INTRODUCTION

### 1.1 Background

Technology has an influence on our life's daily activities. We wake up with the noise made possible by semi-conductors from Korea which are built into plastic shells from Germany. Globalization fast-tracks accessibility of new technology, such that, each day, there is a new discovery or invention (Joensuu-Salo, Sorama, Viljamaa, & Varamäki, 2018; Oladimeji, Ebodaghe, & Shobayo, 2017). Traditionally, innovation initiatives in software of Information Technology intensive companies are viewed as either internal innovation if the ideas are generated within a company, as collaborative innovation when a number of stakeholders co-create value, or as external innovation in which companies adopt strategies to capture and expand on ideas created by other stakeholders opines Robertson (1997).

According to Yoon (2017) changes in demands for products and services at the market place occur rapidly, and many entrepreneurs are left wondering whether to update or replace their old strategies. Innovation, defined in the European Commission document (2005) as "the application of better solutions, new products and services that meet new requirements and associated market needs", is seen as the key solution. Innovation primarily involves creating new methods of production, supply and distribution, changes in management, work organization, working conditions and qualification. Van Criekingen et al., (2021) suggest that Information communication technology (ICT) is a new avenue for modern employment creation, with networking sites enabling people to interact through innovations.

Innovation can be viewed as either internal or external responsibility. In traditional innovation setup, innovation initiatives are viewed as internal responsibility, where the innovative ideas are generated and validated within the company then brought to the market by the company itself. In the second approach, it may be viewed as external affair, where companies adopt strategies, approaches and innovative products or solutions created by other firms (Aggerwal 2012).

Traditional approaches, based on the assumption that the creation and pursuit of new ideas is best accomplished by a centralized and collocated R&D team, are rapidly becoming out-dated (Adner & Kapoor, 2010). The downside of traditional Innovative approach is that being highly interactive, it is usually expensive. Some companies do not have sufficient capital to finance their internal research and innovations (Lendel 2013). This means that they have to look for other sources of capital.

Innovation conceptualization is accomplished within defined *Innovation ecosystems*. It is argued that in order to accelerate innovation, and to benefit from ideas and resources that reside outside the boundaries of a firm, companies increasingly engage in innovation ecosystems which are about generating ideas, hypothesizing about future differentiating functionality and experimenting with new concepts to identify whether they add new value to customers. Typically, an innovation ecosystem involves networks of stakeholders (Roztocki et al., 2011).

The key stages in innovation conceptualization process are;

- *Innovation activities Ideation*: The first activity in the innovation process is the idea generation phase. Successful idea generation is fuelled both by the pressure to compete and by the freedom to explore. Typically, a balance between playfulness and need characterizes successful idea generation. In this phase, companies brainstorm, look at ideas in other industries, gather customer insights, perform market research and develop innovation competencies. This phase aims to develop core innovation competencies, and generate new and creative ideas ( Roztocki et al., 2011).
- *Concept creation*: This is where potential ideas are turned into more concrete concepts with the intention to evaluate the concepts to identify those that prove more promising and feasible than others (Roztocki et al., 2011).
- *Customer validation*: This is where the idea is validated with potential customers. The development stage can include alternate versions of the original idea, along with enhanced features as opines Govindarajan et al., (2001).

## 1.2 Open and Closed Innovation Models

### 1.2.1 Closed Innovation

The question is, what are the forces that have made it so difficult for leading enterprises to sustain their innovation forefront? Within the last decade we are witness to a paradigm shift on how enterprises approach and conduct innovation (Basadur & Gelade 2006). The old paradigm is often referred to as a “Closed Innovation Model”. In this model, enterprises must generate most of their own ideas, develop them, as well as build, finance, distribute, service and evolve them within the enterprise to ultimately reach the market. Central to this strategy is an over-arching philosophy that the enterprise must be self-reliant, essentially because of a lack in faith in the quality, availability, capabilities, reliability and intentions of others (Schumpeter 2014).

Ideas are screened and refined during the R&D process, and those surviving ultimately emerge into the market place, which judges financial viability. This linear and sequential approach to operating concept-to-market processes is designed to refine innovation alternatives, with those surviving having a greater chance of success potential in the market because their progression has been better managed and controlled (Chesbrough 2003). Several factors have combined to erode the underpinnings of closed innovation strategies. One factor has been the growing mobility of highly experienced and skilled personnel. When people left a company after working there for in some cases multiple decades, they took a good deal of that valuable knowledge with them to their new employer. A related erosion factor was the amount of company-funded college and post-graduate training that many people obtained (Government of Kenya vision 2030, 2017).

Ultimately, this growing number of all such people allowed the capabilities to perform innovation to spill out of the knowledge silos of corporate research labs to companies of all sizes in many industries and geographies. Other than that was the growing presence of private venture capital, which specialized in creating new companies that commercialized external research and converting these start-ups into fast growth, highly-valuable companies. Often, these highly capable start-up companies became formidable competitors for the large, established firms that had formerly financed most of the R&D in their industries (Davis & Pallister 2012).

### 1.2.2 Open Innovation

For these core reasons then, a new approach, often called “Open Innovation” has emerged. The Open Innovation Model is a strategy that assumes enterprises can use both internal and external ideas, as well as internal and external paths to markets, which can and should include the creation of new markets. Open innovation combines internal and external ideas into innovations whose requirements are defined by a business model that utilizes both internal and external ideas to create value, while defining internal controls to ensure some portion of that value is captured. Open innovation assumes that internal ideas can also be taken to market through external channels, outside the current businesses of the enterprise, to generate additional value (Hienerth et al., 2006).

An excellent example of the relevance of open innovation comes from Procter & Gamble (P & G), who in the late 1990s decided to change its approach to innovation. The firm extended its internal R&D to the outside world through an initiative called “Connect and Develop.”

This initiative emphasized the need for P&G to reach out to external parties for innovation ideas opines ESW, Enterprise for a Sustainable World (2013). The company’s rationale was simple – Inside P&G there are roughly 9,000+ scientists advancing the industrial knowledge that enables new P&G offerings, but outside there are 1.6 million! So why try to invent everything internally? “P&G’s strategy of open innovation now produces more than 35% of the company’s innovations and billions of dollars in revenue.” (Haluk et al., 2011).

## II. EMERGING PARADIGM: COLLABORATIVE TECHNOLOGY INNOVATION

In the past, internal research and development was universally viewed as a strategic asset, as well as a barrier to competitive entry into most industries. Only large and financially strong enterprises with significant staff resources and long-term research programs could compete (Bosch 2016). Companies such as Westinghouse, P-fizer and AT&T conducted the majority of research in their respective industries internally and in turn gained most of the related revenues from their inventions and creativity which translated to innovations.

However, these same former leading industrial enterprises are finding remarkably strong competition from numerous newer

companies such as Intel, Google, Genentech, and many others who conduct comparatively little primary research on their own. Although these upstarts have been very innovative, they have pursued a strategy of innovating with the research discoveries of others (Siegwart & Hess 2013).

The innovation process is non-linear which means that it is stimulated and influenced by many internal and external aspects and sources of information (Kaufmann et al., 2002). According to Crieckingen et al., (2011) although presented as three different approaches to innovation, most innovation initiatives involve a mix of internal, collaborative and external elements. At some point, an internal innovation needs to be validated with external customers in order to verify that the predicted value is indeed realized. In similar criteria, a purely external innovation needs to be successfully integrated in the internal product or system before it can be fully validated and used by customers.

Yoon et al., (2017) has observed that management of innovation is changing and this echoed by Oladimeji, Ebodaghe, & Shobayo, (2017) who suggested that there is the need to rethink the way we manage innovation. MacCormack et al., (2007) and Boutellier et al., (2014) have pointed out that there is a growing trend where innovations are increasingly brought to the market by networks of firms, selected for their unique capabilities, comparative advantages and operating in a coordinated manner (MacCormack et al. 2007).

This new model presents a paradigm shift has forced firms to re-think traditional approaches to innovation; First, the growing complexity of the products and/or services demanded in the market. No longer is it possible for one firm to master all these skills and locate them under one roof (Boutellier et al., 2014; Schumpeter 2014). Second, a supply of cheap skilled labor has emerged in developing countries, creating incentives to substitute these resources (Uwer Meyer 2014; Iansiti 2004). Third, different regions of the world have developed unique skills and capabilities, which leading firms are now exploiting for advantage suggests Yoon et al. (2017) And finally, advances in development tools and technology combined with the rise of open architectures and standards have driven down the costs of coordinating distributed work (Yoon 2017; Chesbrough et al., 2003).

In the emerging collaborative innovation model, a network consisting of a variety of firms that are largely autonomous, geographically distributed, and heterogeneous in terms of their operating environment, culture, social capital and goals, come

together to collaborate to better achieve common or compatible goals, access greater resources, recognition and rewards when facing competition for finite resources (Fichman 2004, August). In such partnerships, the intention is to establish close relationships to external innovation partners and have continuity in joint innovation activities to develop differentiated functionality as part of the core product (Adner & Levinthal 2001). Firms increasingly seek superior performance in innovation through collaborations (Uwer Meyer 2014), where mutually beneficial relationships are established to develop new products and services (MacCormack et al., 2007) for sustainable growth (Yoon et al., 2017; Swink 2006).

In its applied sense, "collaboration is a purposeful relationship in which all parties strategically choose to cooperate in order to accomplish a shared outcome" (Hansen et al., 2015). In sum, collaboration is no longer a "nice to have", but a competitive necessity (Alexandra & Kassim, 2013; Yunis, Tarhini, & Kassar, 2018).

### III. CONCEPTUALIZING INNOVATION SUCCESS FACTORS IN COLLABORATIVE INNOVATION

Over the two decades, the manufacturing and IT related sector has been under enormous and constant pressure to not only maintain, but to increase its competitiveness (Teece 2009 ). Prompted by macroeconomic trends such as global expansion, more virtualized business models, sharp rises in energy costs and the need for collaborative process integration, firms have been able to radically transform their products (Farok J. et.al., 2010).

However, for those firms who want to consistently excel in such a challenging environment, excellence with collaborative innovation has become a mission imperative (Archibugi et al., 2002). Successful innovation addresses the broader strategic dimensions of enterprises' strategies that focus on objectives such as branding image, desire to become more customer focused, compressing concept-to-market cycle time, success with exploiting and creating more collaborative value chains, information availability and knowledge sharing that yields value. Critical to implementing such strategies, effective collaboration must become a core competency of the enterprise and its partners (Boschma & Frenken 2010).

In the collaborative innovation model, enterprises decompose the innovation chain and source partners that possess critical

advantages that include specialized skills, agility and flexibility, lower cost structures, access to emerging markets and many other characteristics that can provide a source of tactical differentiation. The aim of these emerging business models is to establish mutually beneficial relationships through which new products and services can be developed and brought to market (Barnett 2003).

#### 3.1 Success, failures in collaborative innovation with case examples and lessons.

Innovation is also highly interactive and it is usually expensive. Some companies do not have sufficient capital to finance their research and innovations (Lendel 2013). This means that they have to look for other sources of capital. The growing trend is such that successful firms invest in developing explicit strategies for collaboration and even make organizational changes to aid in these efforts.

Ultimately, these actions allow them to identify and exploit new business opportunities. Collaborative innovations have thus become commonplace across most areas of the technology and manufacturing industry (Soosay, Hyland & Ferrer 2008). Collaboration facilitates access to contextual knowledge and expertise, which has been the focus an growing numbers of successful firms that partner in an innovative venture. The benefits, successes and positive outcomes from such partnerships are based upon the unique knowledge, experience and expertise that come from a local presence, which are underestimated by firms that ignore the power of collaboration (Uwer Meyer 2014). In sum, collaboration is becoming a new and important source of competitive advantage (Olsson & Bosch 2016).

Collaboration in the Korean IT Service Industry Information technology (IT) services started to be recognized as a new business in Korea when companies began to establish computing divisions and teams mainly dedicated to installing and operating mainframe-based hardware. Understanding the hardware was considered more important than software development, which was little recognized or implemented at that time. Companies were offered business opportunities through the spread of computers in the workplace, and software became more important. Korean conglomerates seized these opportunities and gathered human resources in their computing divisions to establish new affiliated companies (Olsson et al., 2016). Successful firms went beyond simple wage arbitrage, asking global partners to contribute knowledge and skills to

projects, with a focus on improving their top-line. And they re-designed their organizations, to increase the effectiveness of these efforts. Born global firms recorded dynamic growth in the competitive marketplace and achieved substantial international sales from an early stage in their development despite economic and technological constraints. The successes of these projects were based in integrating people's skills through collaborative innovation ideation.

Consider SemCo, a leader in the contract manufacturing industry, which designs and develops electronic components and systems for own-equipment manufacturers (OEMs). When SemCo built a semiconductor plant in China, it did not replicate the design of its US facilities. While substituting US staff with Chinese staff would yield lower costs, SemCo saw a bigger opportunity in revisiting how the facility would operate. So it recruited a huge engineering staff – an order of magnitude greater than the US – and devoted them to process and product innovation and further improvement.

The result: a facility with the highest productivity of any in their network, independent of wage levels. Semco, by contrast, built the capability to lower costs systematically over time (Hienerth et al., 2006). Successful firms sought partners with a blend of both abilities, giving them instant access to a repertoire of skills not available in-house hence ability to access unique competencies, technical know-how and/or process expertise that firms did not possess internally (Kristof et al., 2021). This success was attributed to process and product innovation through collaboration.

Microsoft used the capabilities of a partner to dramatically improve agility and quality in one business unit that provides periodic updates to customers – billions of downloads every quarter. Testing for these updates includes operating system, hardware, chipset and 3rd party application testing. Microsoft's partner helped apply "Lean" manufacturing techniques to this process, streamlining and prioritizing tests and re-designing tasks to allow staff to work in parallel. For one of the projects, the team improved time to test by 90%, lowered costs by 70% and reduced "failure" rates to near zero (Limassol 2016).

Consider NewCo, a firm that designs enterprise servers sold to OEMs like HP and Sun. To complement its US staff, NewCo established an Owned Development Center (ODC) in Taiwan and teamed with a partner in India. In one recent project, the firm was having difficulty in meeting the target cost due to the

high price of one particular component. So NewCo asked its ODC to leverage its knowledge of different local manufacturer's costs and capabilities to solve the problem. The organization eventually located a new supplier that could source an equivalent component at lower cost. In this case, the value of the ODC was not in providing better capability; it came from superior local knowledge. Thinking Strategically-Viewing collaboration through this broader lens highlights how it can be used to support a firm's strategy. It forces managers to understand the competitive implications of partner selection, by assessing their merits along multiple dimensions, instead of only one. And it helps firms understand where to use collaboration, in terms of the parts of the innovation value chain where a focus on cost versus differentiation is most appropriate. In essence, collaboration has the potential to move firm A to the "frontier". (Caloghirou, Hondroyiannis, and Vonortas 2003; Oxley and Sampson 2004; Atallah 2005).

The levels of capital investment requirements and the depth and breadth of technologies in the Boeing's development of its 787 "Dreamliner" aircraft forced Boeing to look at new forms of organization, the aim being to share risk with partners while exploiting the unique technical expertise that each brings to development. Boeing's approach to the 787 was the epitome of global collaboration. The project included over 50 partners from over 130 locations working together for more than four years. From the start, the aim was to leverage advanced capabilities from this network. For example, in technologies like composite materials, which are being used for the first time for large sections of the airplane, smaller more focused firms had developed expertise that was unique. Rather than replicate this expertise, the firm sought to tap into it, blending it with skills from other partners developing complementary technologies (Kilelu, Klerkx, Leeuwis & Hall 2011).

Furthermore, the relationships it established were not the traditional "build-to-print" contracts of past years. Instead, partners designed the components they were to make, ensuring a seamless integration with the outputs of other partners.

In this view, Boeing's source of competitive advantage was shifting; it is less and less related to the possession of deep individual technical skills in hundreds of diverse disciplines. While the firm still possesses such knowledge, this is no longer what differentiates it from competitors such as Airbus, who can access similar capabilities.

Rather, Boeing's unique assets and skills were increasingly tied to the way the firm orchestrates, manages and coordinates its network of hundreds of global partners. Boeing's experience is increasingly common across the industries: Building on infrastructure and platforms the firm's success factor in innovative collaboration is now becoming a new and important source of competitive advantage

TransCo, a leading transportation firm which undertook a multi-year project involving engineering work by over 50 global partners needed a platform that ensured the output from different partners was compatible, enabled the frequent integration of components, and facilitated testing of the entire system. Developing the platform was a multi-year undertaking, involving hundreds of staff from the firm and its partners. This effort focused on minimizing the constraints on each partner. Where this was not possible, significant up-front effort was devoted to defining how platform integration through innovative collaboration would be made possible (Lee et al., 2012).

Consider an unheard-of collaboration between Biotherm and Renault. The skin-care company Biotherm, part of the Luxury Products Division of the L'Oreal Group and the automobile manufacturer Renault devised a new concept in cars: the Spa Car, designed to simultaneously care for the health of its occupants and to protect the environment. Experts from each company contributed their know-how to develop features that are novel for a vehicle's interior. Biotherm contributed its knowledge on cellular mechanisms in the skin and on the benefits of aromatherapy, from work dating back to 1952. Renault provided its expertise in designing and testing equipment for vehicle comfort, fruit of its more than 110 years of experience as opines Michael (3rd September 2008 12:34 pm).

The ZOE Spa Car, slated for launch in autumn 2012, is a 100%-electric car. It features advanced air filtration and purification systems to protect passengers' health and improve their sense of well-being while inside the vehicle: Unlike traditional air-conditioning systems, which are optimized for temperature control but often have a dehydrating effect, especially during long trips, the system used in the ZOE exploits a totally new design to provide intelligent climate control that avoids loss of humidity inside the cabin so that passengers' skin stays hydrated (MacCormack et al., 2007). Passengers will travel in a clean environment, thanks to a toxicity sensor and various

particle filters installed in the cabin that open and close the air vents as needed.

An electric scent dispenser, to provide aromatherapy using essential oils in function of the driver's needs: stimulation for the morning, relaxation when returning from work, alertness for nightdriving. The ZOE is also equipped with an ambient music system developed in conjunction with Creative Diffusion (associated with Quartz, International Electronic and New Music Awards), to provide relaxing or stimulating music as needed. The vehicle also includes a light-therapy system developed in collaboration with Philips, whereby a screen emits light to improve passengers' sense of wellbeing. In some advanced technology industries products are developed collaboratively across networks of firms (HomeworkLib 26<sup>th</sup> June, 2021).

Collaborative innovation ventures have failed in a number of cases, where the collaborating partners have failed to leverage on designing process, not focusing on technical knowhow of people and developing platforms that were inferior. Consider the premier industrial research laboratory of the last century, Bell Labs. At that time, Bell Labs represented an unquestionable strategic advantage in Lucent's (now part of Alcatel-Lucent) competition against Cisco in the telecommunications hardware market. Despite Lucent's advantages in many critical areas, including R&D, Cisco consistently grew market share against Lucent. Cisco seemed to introduce many new products and services, despite its lack of comparable research capabilities. Though they were direct competitors in a very technologically complex and fast paced industry, Lucent and Cisco were not accomplishing innovation using the same strategies.

While Lucent committed enormous economic and personnel resources to exploring new materials and state-of-the-art components, Cisco conducted very little internal primary research, choosing instead to pursue a much different strategy in its struggle for innovation leadership opines Kristof & Mark Freel (2021). Cisco's strategy was to scan the world of small start-up companies that were springing up all around it and that were commercializing new products and services, which the market would ultimately judge to be successful or not. In executing this strategy Cisco would occasionally invest in these start-ups by providing needed capitalization and other times it would simply partner with them.

In many cases, Cisco ultimately acquired the startups and assimilated them into their growing enterprise. This strategy permitted Cisco to keep up with the innovation output of its industry, without performing significant internal research departments or committing substantial capital to new technologies, the majority of which ultimately failed to survive in the marketplace as opines Michael (3 rd September 2008 12:34 pm).

The outcome of these contrasting strategies can be best measured by Alcatel-Lucent's February 8, 2008 posting of a \$3.74 billion fourth-quarter 2007 loss and cancellation its 2007 dividend, after taking a write-down of more than \$3 billion on its U.S. wireless business. In contrast, Cisco Systems reported fiscal year 2007 net sales of \$34.9 billion (an increase of 23% over the prior year) and an annual 2007 net income of \$7.3 billion.

This example leads to a fundamental paradox that confronts virtually all innovating firms. That being, while there is no dearth of good ideas generated within high-powered and talent-rich R&D centers, internal industrial research is often far less effective at generating innovation output to the marketplace as compared to collaborative innovations with skilled talents outside the firms' research departments.

Many firms mistakenly applied an "outsourcing" mindset to collaboration efforts which, in turn, led to three critical errors: First, they focused solely on lower costs, failing to consider the broader strategic role of collaboration by not leveraging on people, process, product and platforms.

They didn't organize effectively for collaboration, believing that innovation could be managed much like production and partners treated like "suppliers." They didn't invest in building collaborative capabilities, assuming that their existing people and processes were already equipped for the challenge opines Florida (1997).

In addition, outsourcing and collaboration have very different objectives. Outsourcing involves procuring a commodity asset or resource at the cheapest price. Collaboration, by contrast, entails accessing globally dispersed knowledge, leveraging new capabilities and sharing risk with partners. It is a much more sophisticated skill as explains Noorani (2014).

Looking at likelihood of project failure through collaboration we also consider the flagship A380 aircraft. Airbus' German

and French partners who chose to work with different versions of Dassault Systems' CATIA design software. But design information in the older system was not translated accurately into the new one, which held the "master" version. Without a physical mock-up, these problems remained hidden throughout the project.

The result: 300 miles of wiring, 100,000 wires and 40,000 connectors that did not fit, leading to a 2-year production delay at a cost of \$6bn.7 Yet the cause of Airbus's problems was not in choosing different software versions; rather it lay in the lack of an effective collaboration process for dealing with the problems this created opines Olsson Holmström & Bosch (2016).

Failure in innovation projects may induce the firm to collaborate in order to overcome the problems that determined the failure of innovation projects (induced collaboration). Therefore, the decision to collaborate may be the result of two different reasons. In the first case, the firm is expected to identify and forecast both advantages and problems associated with the development of innovation projects and deciding whether the collaboration with other partners may be a solution to these problems. We label this case as proactive collaboration which is the most important reason for collaboration.

In the second case, collaboration is induced by the occurrence of failure and the recognition that the firm may overcome such failures collaborating with other partners (Freund et al., June 1996).

### *3.2 Collaborative Innovation: Lessons learnt & factors for Successful Collaborative technology Innovation*

Successful collaboration doesn't just happen – it is a skill that must be learned. Rarely do firms get it "right first time." Leading firms recognized this reality, and made investments to enhance their performance over time. Successful firms target investments in four areas: people, process, platforms and programs. The "Four Pillars" of collaborative capability. Collaborative Capabilities which is an area separating leading firms from others was their willingness to invest in developing "collaborative capabilities." All too often, firms assumed that their existing employees, processes and infrastructure were capable of meeting the challenge of collaboration. The table 1 highlights the factors and lessons learnt.

**Table 1:** Lessons Learnt and Identified Success Factors

KEY PILLAR	DESCRIPTION (WHAT IT IS)	HOW IT IMPACT ON SUCCESS	SOURCE (CITATION)	LESSON LEARNT
Developing People	<ul style="list-style-type: none"> <li>➤ Collaboration entails accessing globally dispersed knowledge, leveraging new capabilities and sharing risk with partners.</li> <li>➤ Superior performance in collaboration requires people with different skills, given team members often lie outside the boundaries of the firm, are located in far-flung countries and have vastly different cultures.</li> <li>➤ Broader skill set, associated with the need to orchestrate and coordinate the work of distributed teams.</li> <li>➤ The emphasis was on “softer” skills, such as communication and motivation, as opposed to discipline-based content.</li> <li>➤ The emphasis on developing new people skills reinforced by a firm’s evaluation and reward systems.</li> </ul>	<ul style="list-style-type: none"> <li>➤ Organizations de-construct the innovation value chain and source pieces from partners that possess lower costs, better skills and/or access to knowledge that can provide a source of differentiation.</li> <li>➤ The aim is to establish mutually beneficial relationships through which new products and services are developed.</li> <li>➤ Firms increasingly seek superior performance in innovation through collaboration</li> <li>➤ Weekly and monthly “builds” can be used to synchronize the work of both teams.</li> </ul>	<p>Chesbrough(2003) Open Innovation, HBS Press, Boston MA.</p> <p>Cooper (2014).Stage Gate Systems: A New Tool for Managing New Products, Business Horizons 33.</p> <p>A MacCormack (2007) A Lieberman (1990)</p>	<ul style="list-style-type: none"> <li>➤ Successful firms tackled this challenge through changes to their recruitment, training, evaluation and reward systems</li> <li>➤ An internal innovation needs to be validated with external customers in order to verify that the predicted value is indeed realized.</li> <li>➤ Purely external innovation needs to be successfully integrated in the internal product or system before it can be fully validated and used by customers</li> <li>➤ Complexity of products is increasing. No longer is it possible for one firm to master all these skills and locate them under one roof.</li> <li>➤ Different regions of the world have developed unique skills and capabilities, which leading firms are now exploiting for advantage</li> <li>➤ Collaboration could improve through increased product differentiation. Successful organizations achieved this in two ways: <ul style="list-style-type: none"> <li>➤ Leveraging a partner’s superior capabilities (i.e., know-how that the firm did not possess internally)</li> <li>➤ By accessing a partner’s contextual knowledge (i.e., knowledge that the partner possessed by virtue of its local position).</li> </ul> </li> </ul>
				<ul style="list-style-type: none"> <li>➤ In combination, these benefits comprise the “3C’s” of a global collaboration strategy</li> </ul>
Designing Processes	<ul style="list-style-type: none"> <li>➤ Projects employ a formal product development methodology based upon a modified “stage-gate” or “waterfall” type process.</li> <li>➤ These processes are increasingly popular ways to ensure greater control and consistency in the execution of projects, related to the division of tasks, the sharing of artifacts, the coordination of handoffs, and the integration of components.</li> <li>➤ One team can use a rigid “stage-gate” process to set the core technology, and another an “agile” process for the user-interface.</li> </ul>	<ul style="list-style-type: none"> <li>➤ This collaboration “infrastructure” was then leveraged across multiple projects over time, with the goal being to promote a long-term view of continuous improvement in effective innovative collaboration.</li> <li>➤ The importance of each of the four areas (people, process, platforms and programs), as well as their interdependencies cannot be understated in terms of driving end results or outcomes</li> </ul>	<p>Eppinger&amp; Chitkara, (2006). The New Practice of Global Product Development, SMR, Summer</p> <p>Hansen, M. and Nohria, N.(2004). How to Build Collaborative Advantage, SMR, Fall.</p> <p>Jansiti, M.(2004). The Keystone Advantage, HBS Press, Boston, MA.</p> <p>Porter, M.(2016). Competitive Strategy, Free Press, New York, NY. 1980. Santos, D., Doz, Y. and Williamson, P. Is Your Innovation Process Global?, SMR, Summer 2004.</p>	<ul style="list-style-type: none"> <li>➤ But these techniques, and others that share their roots, are often predicated on the assumption of single-site development. There is a need to re-think how they should operate when managing the distribution of work among a team of global partners.</li> <li>➤ Distributed development requires a variety of additional activities as compared to single site projects</li> <li>➤ Leading firms designed processes to address these activities, taking into account the experiences and preferences of partners.</li> <li>➤ This did not mean that each partner used the same process; rather the aim was to decide how much standardization was needed</li> </ul>

<p>Building Platforms</p>	<ul style="list-style-type: none"> <li>➤ Leading firms developed technology “platforms” to improve the coordination of work.</li> <li>➤ These platforms comprised four main parts:</li> <li>➤ First, development tools and technologies to improve the efficiency of distributed work;</li> <li>➤ Second, technical standards and interfaces to ensure the seamless integration of partner outputs;</li> <li>➤ Third, rules to govern the sharing of intellectual property among partners</li> <li>➤ Fourth, knowledge management systems to capture the firm’s experience on how distributed work is best performed.</li> <li>➤</li> </ul>	<ul style="list-style-type: none"> <li>➤ Leading enterprises developed technology “platforms” to improve the coordination of work. These platforms comprised;</li> <li>➤ (a) Collaboration tools and technologies to improve the effectiveness of distributed work,</li> <li>➤ (b) Technical standards and interfaces to ensure the seamless and secure integration of partner inputs and outputs,</li> <li>➤ (c) Rules to govern the sharing of intellectual property among partners and</li> <li>➤ (d) Knowledge management systems to capture the enterprise’s experience on how distributed work is best performed.</li> </ul>	<p>Tece, D.(2010) Profiting from Technological Innovation: Implications for Integration, Licensing, Collaboration and Public Policy, Research Policy 15.</p> <p>Williamson, O.(2013). The Economic Institutions of Capitalism, Free Press, New York, NY.</p>	<ul style="list-style-type: none"> <li>➤ Many firms mistakenly applied a “production outsourcing” <del>mindset</del> to collaboration, viewing the use of partners only as a means to achieve lower costs through “wage arbitrage”</li> <li>➤ These firms saw little need to change the way they organized their innovation efforts to facilitate collaboration.</li> <li>➤ Advances in development tools and technology combined with the rise of open architectures and standards have driven down the costs of coordinating distributed work</li> <li>➤ The constantly changing business environment requires dynamic adoption by firms.</li> <li>➤ Successful firms went beyond simple wage arbitrage, asking global partners to contribute knowledge and skills to projects, with a focus on improving their top-line.</li> <li>➤ In addition, they re-designed their organizations, to increase the effectiveness of these efforts.</li> <li>➤ This collaboration “infrastructure” was leveraged across multiple projects over time. The goal is to promote a long-term view of the assets needed for effective collaboration.</li> </ul>
<p>Building Programmes</p>	<ul style="list-style-type: none"> <li>➤ We need to often apply different tools and techniques to different types of innovation.</li> <li>➤ A lack of clarity of purpose and design. We often see weak front ends in how ideas are captured, then enriched without referencing back to need or intent and developed in independent silo’s so</li> </ul>	<ul style="list-style-type: none"> <li>➤ We need to encourage top leadership sponsorship of unique ideas that need to be separated out.</li> <li>➤ Knowledge management systems to capture the enterprise’s experience on how distributed work is best performed.</li> </ul>	<p><b>Open Development: Networked Innovations in International Development</b></p> <p><a href="https://www.hbs.edu/faculty/Pages/download">https://www.hbs.edu/faculty/Pages/download</a></p>	<ul style="list-style-type: none"> <li>➤ We need to go outside far more and access our networks and collaborative environment and enable ‘them’ to assist or drive the innovation as inside it might get caught up in traditional thinking and narrow metrics.</li> <li>➤ Collaboration, by contrast, entails accessing globally dispersed</li> </ul>
	<p>the end result comes out a misfit of what is needed or initially thought.</p> <ul style="list-style-type: none"> <li>➤ How often do you squeeze all your product development through the same evaluation process, because it is policy?</li> <li>➤</li> </ul>		<p>A MacCormack (2007). Innovation through Global Collaboration - Harvard Business.</p> <p><u><a href="https://unctad.org/PublicationsLibrary/der2019_en_10_Mar_2019">Digital Economy Report - UNCTAD</a></u></p> <p><u><a href="https://www.oecd.org/education/ceri/The_Nat...">https://www.oecd.org/education/ceri/The Nat...</a></u></p> <p><u><a href="https://www.oecd.org/education/ceri/The_Nat...">L. Cerna (2021)The Nature of Policy Change and Implementation: A ... - OECD</a></u></p>	<p>knowledge, leveraging new capabilities and sharing risk with partners. It is a much more sophisticated skill.</p> <ul style="list-style-type: none"> <li>➤ Consider the strategic role of collaboration, by not looking at it only as a tactic for reducing cost. Efforts will be misaligned with business strategy. –</li> <li>➤ Organize effectively for collaboration. Not to treat partners like suppliers of parts or raw materials,</li> <li>➤ However, make long-term investments to develop collaborative capabilities.</li> </ul>

#### IV. CONCEPTUALIZING COLLABORATIVE INNOVATION SUCCESS DRIVERS

Here, we'll propose and present a conceptual model which shows the success factors and how each influences the success of collaborative technology innovation. We also suggest the moderator variables as shown in figure.1.

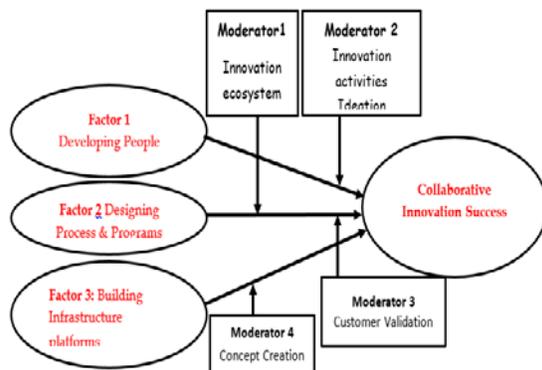


Fig.1. Conceptual framework

#### V. METHODOLOGY (PROCESS AND CRITERIA FOR SELECTING REVIEWED ARTICLES)

In carrying out this study, we followed the principles outlined in inductive categorization method (Dube & Pare, 2003). More specifically, we did the following: (1) carefully selected relevant journals, and those that are pertinent to the context of our study, (2) identified the articles published in those journals which are relevant to our study by using carefully selected keywords, (3) categorized the selected (and short-listed) articles by drawing on different theoretically grounded categorization schemes, (4) assessed (and calculated) the number of articles in different categories and sub-categories, (5) analysed the trends and identified gaps.

We had to select journals based on their reputation in the Information Technology discipline and also based on their relevance to our study topic. To decide on these journals, we reviewed 12 internationally recognized peer-reviewed journals owing to their topical relevance to the study that is collaborative innovations. Our assessment of journal articles thus allowed us to ensure that most high-quality papers on the topic were considered, and thus, each journal contained articles on collaborative innovation citing case examples of global success and failures.

#### VI. CONCLUSION

This study identified success and failure case studies of collaborative innovation among leading firms globally. As collaboration always begins with a bilateral relationship, the opinions of all parties should be gathered in order to analyze their similarities and differences. A more in-depth study involving Company A and its collaboration partners would produce a more detailed list of success factors. Most IT firms are at a crossroads of change and are seeking to collaborate with other firms through methods that differ from those they have used in the past. The study reveals the importance of focusing on partner diversity in foreign markets to compensate for insufficient capabilities is an important strategy. It is hoped that this study will help firms seek the appropriate collaborative approaches in the future.

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