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Critical success factors for joint innovation:
Experiences from a New Zealand innovation platform

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ABSTRACT

This paper argues that a government's support for and active involvement in innovation platforms with several independent participants may be in the public interest, as long as the participants have sufficient common interest in the planned innovation, there is sufficient trust between the various parties, and complementary and appropriate resources (both human and financial) are present for joint learning and developments. Finally, output-focused behavior and conduct are essential in order to achieve outstanding results (that is, innovation). Therefore, governments should test for these necessities – in addition to public interest in the corresponding objectives – before providing public support for an innovation platform.

Keywords: Collaborative innovation, public innovation, triple helix innovation, innovation cluster, innovation platform

Introduction

Innovation and division of labor have helped humans steadily upgrade themselves from shivering and starving in caves to lives sweetened by leisure and luxury. The root cause of this development is mankind's ability to collaborate and innovate.[1] These basic insights may have helped start an experimental project in New Zealand known as the Agrobiotech Innovation Academy (or AIA). This two-year innovation project, half of which was funded by the New Zealand Government, links and engages nine different participants: five businesses from the agro-tech industry, one (public) agro-research lab, two universities, and one technical college. New Zealand has two globally competitive industries: tourism and agriculture. The latter (mainly in the form of dairy farms) benefits from the country's climate and specialized national suppliers. This is important since most innovations related to productivity gains in the agricultural sector stem from the sector's suppliers (machinery, chemical fertilizers, etc.) (Pavitt, 1984). While the five private-sector participants in AIA were primarily looking for joint product innovations, the three members from the tertiary sector saw the project more as a liaison platform and a vehicle

[1] Marx's (value) theory claims that technological competition (competition through innovation) is the driving engine of economic development (Marx, 1975).

with which to build ties with the regional agro-tech cluster around the city of Hamilton in the Waikato region of New Zealand. The government's research institute viewed the project primarily as a new competitor for public funds.

This paper seeks to cast new light on critical questions such as what it takes for a collaboration to become successful via empirical input from the AIA project in New Zealand. In 2007, the AIA project received NZ$1 million of funding from the Tertiary Education Commission of NZ (TEC) with the purpose of promoting and further strengthening an agro-tech and biotech industry cluster in the Waikato region via a joint innovation platform. The initiative concluded in 2009 without having achieved any tangible results or returns. A large MNC, three medium-sized companies, one small company, a public research institute, two universities, and one technical college participated in the AIA initiative between 2007 and 2009.[2] The insights discussed in this paper stem mainly from the qualitative, exploratory AIA case study and could be further validated by a quantitative research study, ideally one with a broad sample of successful collaborative innovations.

The results of this research suggest that a collaborative group must be properly representative. This paper presents four key conditions or criteria that participating members of an innovation platform must fulfill. First, there must be sufficient common interest in the planned innovations. Second, there must be sufficient trust between the various parties. Third, complementary and appropriate resources (both human and financial) are required for joint learning and developments. Finally, proper behavior and conduct are essential in order to achieve outstanding results (that is, innovation).

Literature review

At the company level, Schumpeter (1943) proposed cooperative entrepreneurship as a solution for the (innovation) delivery problem. Schumpeter saw clear vision, strong leadership, and close collaboration as components of a possible remedy. Schumpeter anticipated that with broadening fields and integrated products containing all kinds of technology, requests for collaboration would naturally outgrow company borders. Sixty years later, open innovation in tandem with third parties became not only a specific subject but also a hot topic (Chesborough, 2003). Accordingly, a company would require relevant (internal) knowledge (the latest information, specific skills, and expertise) and good (external) partner management in order to become and remain innovative.

In today's global knowledge economy, knowledge of better solutions is often a limiting or deciding factor in obtaining a competitive advantage. Not long ago, economists such as Michael Porter (1980) saw the main cause of competitive advantage as being favorable market structure or weak competitive forces: the market-based view. The opposite approach is known as the

[2] In addition to exploratory information from this project, my research also benefited from the support of two academics from the University of Waikato. Dr. Karyn Rastrick arranged for the interviews and helped finance the assistance of Mark Rodrigues, who was very helpful in compiling a literature overview and assisting in the interviews.

resource-based view, which emphasizes a company's internal strength drawn from valuable and non-imitable resources, resulting in competitive advantage (Wernerfelt, 1984; Barney, 1991). However, both of the above-mentioned theories have their shortfalls and so, in the course of accelerating market dynamics, Teece, Pisano and Shuen (1997) developed the dynamic capabilities view. Thus, the dimension of time entered the success formula. In addition to ownership of knowledge assets, the dynamic capabilities view stresses learning and the accumulation of new knowledge assets that flow into new solutions and secure sustainable competitive advantage. Like the SWOT analysis, the dynamic capability view synthesizes internal resource advantages and external market opportunities. However, aggressive learning and continuous honing of knowledge assets, both of which lie at the center of dynamic capabilities, often also require external collaborations, as Blomqvist and Levy (2006) outlined. In particular, Dyer and Singh's "relational view" emphasizes the potential competitive advantage to be gained from interorganizational collaboration (1998).

Traditional literature claims that companies or other close collaborations can offer greater transactional cost savings than market solutions (e.g., Coase, 1937), while more recent literature has identified better sharing and transfer of knowledge (especially tacit knowledge) as the main advantage of such groups or organizations (Kogut and Zander, 1992). In order to be effective and achieve superior performance, a company must have a relevant, comprehensive, modern, and internally linked knowledge base that is continuously expanding. Nonaka's (1994) seminal paper declared that organizations aiming for innovation must not only process knowledge, but also create new knowledge via learning, and learn to manage knowledge. To facilitate learning, companies must secure certain learning routines. According to Grant (1996), a learning routine is a regular pattern of interaction among individuals that permits the transfer, recombination, or creation of specialized knowledge. As the dynamic capability view emphasizes, organizational and interorganizational learning are viewed as key factors in achieving sustainable competitive advantage (Teece et al, 1997). Therefore, especially in the knowledge economy, a company's main purpose can be to create, manage, and exploit knowledge.

Knowledge creation can often occur more efficiently by engaging with the world outside individual companies.[3] Organizations can buy (existing) knowledge, contract knowledge creation, or learn and build knowledge by collaborating with external partners. However, such learning networks must overcome the obstacles of reluctance to share knowledge for fear of knowledge spillovers to competitors, the risks of freeriding participants, and the problem of identifying and efficiently absorbing interesting knowledge (Dyer and Nobeoka, 2000). Obviously, networks with strongly interrelated organizations (for example, in the same associations) and interdependent organizations (such as supplier-customer relationships) face fewer of these risks. Networks and clusters bring companies closer together so that they can not only reduce transaction costs between partners but also lower partner risks owing to stronger relationships and dependency.

Eventually, basic research and development will result in better solutions, and such research achievements often occur in the tertiary sector. Consequently, there are strong indications of

[3] For an in-depth overview of major trends in inter-firm R&D partnerships since 1960, see Hagedoorn, 2002.

positive causality between government support and innovation (Mansfield and Lee, 1990).[4] Related policies are generally referred to as "industry policy" and more specifically as "national systems of innovation" (Freeman, 1995). While traditional industry policy is a defensive approach that protects companies and industries, national systems of innovation specifically support participants financially and in knowledge creation and sharing. The aim is not to restrict competition, but rather to encourage it by facilitating individual and collaborative knowledge creation (learning) and the knowledge flow (sharing) between different organizations that are able and willing to contribute to innovation processes.[5]This is premised on the idea that even in the strong and border-crossing winds of globalization, companies (and therefore countries) can better succeed by fostering the knowledge flow between various national or international organizations on their territory or even closer within industry clusters (Porter, 2000).

Governments' interest in innovation is threefold. First, governments must not only administer but also design and develop favorable economic, ecological, and social environments. To achieve this, innovative policies and innovative public management are required. The two other factors relate to market failure: positive externalities and excessive profits. Positive externalities of innovation result when the innovator cannot appropriate all of the benefits produced by the innovation; for example, new technologies and newly created knowledge spillover to third parties. Excessive profits may result from quasi-monopolistic or oligopolistic market structure in which a subsidized company earns profits beyond the initial subsidies.[6]

The basis for government support of industries in general, and innovation in particular, is based on high standards in education and public research. The linear innovation model postulates that innovation starts with basic (often public) research, followed by pure applied research and development by private companies, and ends with the same or a different company producing and diffusing the innovation.[7] In this model, science and technology "push" basic new technology forward, and the public R&D system is seen as the primary and essential source of innovations (Freeman, 1995; Godin, 2006). However, increasing international competition and growing complexity in all technical areas have forced research to become more focused and market-oriented. The linear model delivered insufficient transfer of knowledge and technology to adequately drive innovation; instead, politicians and academia have applied more complex models of innovation (Etzkowitz and Leydesdorff, 2000; Godin, 2006). The new perspective suggests that innovation is a nonlinear, dynamic system that consists of a cycle of divergent and convergent activities that may be repeated over time and at different organizational levels. One of the main ideas behind this concept of an innovation system is that innovation is more likely to

[4] However, there is also a school of thought that favors limits to government involvement in innovation support for private companies (see e.g., Cooke, 2001).

[5] Possible examples are networks (emphasizing communication links) or clusters (emphasizing spatial closeness).

[6] For example, Switzerland has promoted its banking sector through several supportive policies, such as tax deductible interests on mortgage, no capital gains tax, and the Swiss bank security law. This gave the banks substantial leeway and extra resources for innovation. This eventually led not only to benefits for the banks, but also for Swiss tax revenues and consumers.

[7] For a broad overview of various ways in which governments can nurture the conditions that promote innovation, see Clark and Guy (1998).

occur at the intersection of economics, politics, and science (Leydesdorff and Fritsch, 2005). There is a growing belief that innovation comes from outside the individual company or even from another institutional player, such as a university, which has a focus on original and groundbreaking developments, whether in science or technology (Etzkowitz, 2002). In this new context, government plays an increasingly important role in encouraging collaborative innovation and providing a stimulating regulatory environment. Furthermore, academia is increasingly linked with industry, not only through consulting and contract research, but in the formation of startups and spinoffs from university-based research (Leydesdorff and Etzkowitz, 2001). This triple helix of university, industry, and government is demonstrated in new organizational mechanisms that promote innovation and new collaborative endeavors (Lissenburgh and Harding, 2000). In order for a triple helix to function, new roles and responsibilities are required. This is especially true for academia, the research focus of which would have to be favorable to private interests (that is, workable and privately marketed solutions) instead of scientific theory and results that are empirical and often generalized.

In addition to the triple helix theory, studies such as Porter's (1990) diamond model or Mansfield's (1991) estimates of universities' impact on innovation have shown that government support, where expressed as infrastructure, education, public research, public purchases, or financial support, can be an important factor that supports collaboration and stimulates private investment in innovation, especially in research-intensive industries. This assertion is based on the insight that high-level technical collaboration, technology diffusion, and personnel mobility clearly improve the innovative capacity of enterprises in terms of products, patents, and productivity.

Incorporating tertiary research into process or management innovation is different in that the initial knowledge of new processes or management techniques often flows from companies into university and government laboratories. Companies experiment with a new management solutions (often with support from consultants), and only after a certain amount of proof of its efficacy from the field will university staff start coding the new solution and integrating it into frameworks, models, and theories and then diffusing it via publication. Large, empirical samples from the business world are used to prove the validity of the new solution that many companies may have already implemented.[8]

The knowledge economy not only requires rapid knowledge exploitation, but also rapid knowledge exploration, a process that can be accelerated by building direct partnerships between universities and private companies. The linear model of innovation (for a critique, see Kline and Rosenberg, 1986) proposed that universities must focus on basic research as a public good and leave applied research and development to industries. The Triple Helix Theory not only rejects this supply push (government to industry), but also the opposite demand pull whereby universities and public research institutes conduct research in response to demand from private companies. Proponents of the Triple Helix Theory promote collaboration on an even footing, where academia, government, and business continuously interact and work jointly towards

[8] In the technical world, this is usually different: laboratory developments are proven and often patented before they get published and implemented by companies.

innovation throughout the life cycle of the original idea. However, such collaborations are difficult to establish and control, for four reasons. First, common and fruitful ambitions and aligned incentives are required. Freeman and Engel (2007) discuss the requirement for proper alignment of creativity and dreams among the partners at the commencement of innovative projects. Second, trust (especially between remote partners coming from business and also from NPOs) has been extensively discussed in current literature examining innovative success. Trust is commonly described as a factor that influences the success of organizational innovation at multiple levels. For instance, Zaheer et al (1998) posited that trust enables more open and honest information sharing. Third, resources –whether financial, knowledge, or learning capabilities – are extensively covered in the literature. The literature imagines innovation as a non-linear function of available resources. There is a positive initial relationship between the two, which later reaches an optimum level before becoming declining due to, e.g., over-investment or extra coordination costs (Nohria and Gulati, 1996 or Weiss, Hoegl and Gibbert, 2013). Fourth, behavior between research and innovation partners plays a decisive role in an innovation project. Many have cited communication and relationship management as important factors of success (e.g., Kaltoft et al, 2006). Freeman and Engel (2007) discussed the coordination and discipline required in innovative processes. Others have warned about myths regarding successful intersectoral collaborative innovation (Geisler, 1997).

Methodological approach

We applied a sequential 5-D research process, comprised of the following steps: (1) Defining the objectives and the research questions; (2) Designing the research; (3) Data collection; (4) Data analysis; and (5) Documentation.

(1) Defining the objectives and the research questions: The objectives of this study are to gain insight into critical conditions for successful partnering in an innovation project or platform, and to provide input to public authorities supporting private innovation endeavors. The concrete research questions are:

-What conditions do partners have to fulfill in order to jointly form a promising research and innovation project?

-What are the critical or necessary conditions that a collaborative project must fulfill in order to qualify for public funding?

(2) Design of the Study: This study uses a case study research design. A case study has been defined as "a research strategy which focuses on understanding the dynamics present within a single setting or case" (Eisenhardt, 1989: 534). A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and its context are not clear. Case studies also address the researchers' desire to understand complex social phenomena (Yin, 2003). Collis and Hussey describe a case study as an "extensive examination of a single instance of a phenomenon of interest" (2003: 68). The purpose of the present study was exploratory and explanatory, rather

than to evaluate and compare this planned innovation platform (AIA) with others. The theory in the literature regarding success factors for collaborative innovation allowed us to focus our work on propositions such as, "Each involved party must pursue non-conflicting objectives vis-à-vis the other parties." These propositions enabled us to formulate questions that were focused and neutral. Before drafting the questionnaire, which contained mostly open questions, we formulated various hypotheses about what critical conditions would probably have to be met in order for such collaborations to be successful in innovation – especially for collaborative innovation endeavors by various legal entities from the public and private sectors.

(3) Data Collection: The present study collected qualitative data via interviews as independent contributions from all parties involved. We wanted to build a deeper understanding of the ways in which different organizations can innovate collaboratively. Researchers visited the participating organizations, which was vital for gaining a good understanding of the organization and its processes. At the various sites, we collected data through semi-structured interviews with key players from the AIA project (mostly senior managers). These face-to-face interviews enabled us to ask follow-up and clarifying questions, to control the discussion, and to record non-verbal clues. Eight face-to-face interviews were conducted, while two others (one with the participating university in the South Island and one with the public research institute) were conducted over the phone. All received data was in the form of statements from these interviews.

(4) Data Analysis: The collected data was structured, compared, and analyzed according to whether responses supported or contradicted the hypotheses about critical conditions for collaborative innovation endeavors. We received broad feedback regarding the individual conditions for innovative success, but feedback regarding the interrelation among the four factors was limited. Also, feedback about behavior between the partners was rather weak and the high number of diplomatic statements meant that we had to intervene during interviews in order to avoid being forced to read between the lines.

(5) Documentation: Finally, the present paper proposes an original framework that was confirmed by all interviews; namely, the critical conditions. Conditions are framed in a logical way starting from the idea through to innovation.
The results presented here would benefit from further research with a large sample of successful collaborative innovation initiatives. If a critical condition postulated here were absent in a successful collaboration, the model proposed here would be falsified. If all researched projects fulfilled the conditions, the proposals from this paper would be validated.

Before drafting the questionnaire and conducting the interviews, we defined components of our collaborative innovation examination object as a new marketplace solution that offers consumers a better cost-benefit-ratio.[9]We retained a broad application of the word *new*, as it can indicate a new procedure, material, functionality, design, costs, etc. The term *new* may be valid for the world, a geographical market, or just an industry. Furthermore, an innovation must be launched commercially before it can be described as an innovation. Innovation can take various forms,

[9] Apart from the better, faster, bigger, etc. (that is, sustainable) innovations, there is also a strong school of thought that stresses disruptive innovations, which are more affordable and easier to use and which outperform competitive products after only a short a period of continuous improvements (Christensen, 2002).

such as new products, new processes, and new business models. While new products are sold to customers (external innovation), new processes primarily benefit a company's internal clients (internal innovation). Some, if not all, of these internal benefits will eventually filter through to external customers as a result of lower prices, better reliability, faster delivery, or greater convenience. New business models illustrate new ways in which companies earn money and can therefore be subordinate to process innovation.

Innovation process versus process innovation

The innovation process starts with dreams and/or ideas (1), which are eventually transformed into an invention (2) that later may appear as an innovation (3) in the market place.[10] The more successful the innovation, the harder competitors try to launch an imitation (4), which can go far beyond a simple copy to become an innovative imitation. The innovation process ends with the disappearance of the initial innovation from the marketplace (5), marking the end of the product lifecycle.

While the innovation process describes how innovation can be achieved (that is, through which steps), process innovations are actual results or improvements, such as a faster or less expensive chain of production or logistics. Management innovations are a special type of process innovation.

Management innovations versus managing innovations

Managing innovations is specifically related to how innovation projects are guided, organized, resourced, etc., while management innovations are innovations in their own right regarding how to manage. Innovations have both administrative and technical components (Van de Ven, 1986). While technical innovations occur in the operating component and affect the technical system of an organization, management innovations occur in the administrative component and affect the social system of an organization (Damanpour, Szabat and Evan, 1989).

Specifically, "[m]anagement innovation changes how managers do what they do" (Hamel, 2006: 3). Management innovation is generally observed at the operational level: that is, in terms of the generation and implementation of new practices, processes, structures, or management techniques. This is the level at which observable changes take place in terms of how work is done, and where the management innovation process can be witnessed (Birkinshaw, Hamel and Mol, 2008). The global car industry provides a good illustration of impressive management innovations. First, Ford Motors gained a competitive edge with its assembly line innovation, then GM took the industry lead with its divisional organization, before Toyota reached the industry's top spot with management innovations like *lean production* and *total quality management* across its entire supply chain. As these examples illustrate, management innovation can be quite broad and may include or integrate various functions, both within and outside an organization. This

[10] This refers to substantial product changes, not just cosmetic changes.

requires a wide variety of skills and knowledge. At the same time, management innovations are less prominent because they are more diffuse, context-dependent, confidential (no patent protection is possible), and less technology-driven than product innovations (Birkinshaw and Mol, 2006). Although AIA aimed for product innovations, its platform can be seen as a management innovation by the participating parties – who reorganized their innovation endeavors.

Innovation from the company perspective

Dynamic global markets for goods and services are characterized by continuous change on the market and/or technical front and value enhancements stemming from innovation.[11] The newly innovated solutions may be cheaper, faster, and/or better, and they allow their producers or providers to capture temporary monopoly rents. These potential benefits have created an underlying current of never-ending pressure to improve. Such dynamic and highly contested markets have increased producers' costs and risks, which has forced many companies to break with traditions and apply new techniques for developing and diffusing more value in a shorter timeframe. For more economical delivery, companies frequently respond with a higher degree of specialization or focus, and outsource the rest of their old value chain. As in the physical supply chain, greater specialization, fragmentation, and collaboration can be observed in development and creation. Individual companies increasingly lack the resources they need, whether financial or in critical knowledge areas.[12] Due to the increasing complexity of the necessary knowledge bases for innovation, knowledge bottlenecks can appear even in large companies (Granstrand, Patel and Pavitt, 1997).[13] Therefore, factors such as simultaneous pressure to innovate (often to create complex solutions in a short timeframe), the growing integration of different technologies (such as modern cars), and alack of required resources have forced many companies to collaborate with other organizations or join corresponding networks.[14] Consequently, the strategic question for many companies is not *whether* to enter close collaboration towards innovation, but *with whom*. Additionally, governments' interest in innovations also enables them to ask what types of collaboration have a good chance of being innovative, thereby enhancing the public good (via positive externalities) and earning a right to public support.

In AIA, most participants were unrelated and independent from each other. Accordingly, the combination of *relations and dependence* that holds learning networks together was absent.

[11] In a static or stable market or world, efficiency would already guarantee success.

[12] In addition to the missing resources, it also becomes increasingly difficult to internalize substantial value from a company's own creations, which is one of the main obstacles to open innovation. See H. Chesbrough, Open Innovation, 2003.

[13] It is interesting to note that large companies enter collaborative innovation projects more frequently than small and medium-sized companies. This could be because large companies invest more in innovation, with the result that they have greater market share as a direct result of their higher innovation budgets.

[14] The saying "if you can't beat 'em, join 'em" applies not only tovalue and supply chains, but also innovation endeavours.

Learning jointly is a process by which partners cooperate aggressively to produce new information, leading to better understanding and further insights.

In order to gain appropriate access to others' knowledge and learning processes, a company must have appropriate partner management. Good partner management helps select, maintain, and extend a partner network, which makes it possible to access and absorb external knowledge as and when required. Cohen and Levinthal (1990) define a company's capacity to absorb as involving, recognizing, assimilating, and applying external knowledge.[15] Access provisioning is often based on reciprocal knowledge flows and joint learning labs. Accordingly, a partner management system must facilitate the creation of close intercompany teams for learning and jointly solving challenges that eventually result in invention and, possibly, in innovation.

In addition to good knowledge and partner management, processes are the dynamic enablers of innovation and change. Changing environments, whether technological or in the marketplace, require adequate and timely responses from companies. Such flexibility can be gained from responsive business processes that Prahalad and Krishnan (2008) claim are critical to support innovation.

Innovation in collaboration

Innovation can occur in many different contexts and organizations. At the extremes, companies can either create inventions internally and commercialize innovations or they can source ideas and inventions externally. In between these two extremes, they can collaborate with other organizations or form a joint venture to work inside a legal entity towards innovation. While joint ventures have diminished in importance, research and development associations have become increasingly prominent and frequent (Hagedoorn, 2002).

Dyer and Singh (1998) recommend searching for competitive advantage, not only at the industry or company level via non-imitable resources from the resource-based view, but also at the level of collaborations among various organizations. They advise companies to create competitive advantage by investing in inter-company relation-specific assets, attaining higher levels of knowledge sharing, building up complementary resources and capabilities, as well as developing more effective governance processes. Related advantages, including more innovations, will be sustainable due to tacit components and, frequently, a lack of complementary partners for competitors.

In addition, the types of participants in interorganizational collaboration have changed overtime. These days, university spinoffs and startups often translate science directly into concrete technology and marketing. With NPOs like academia and public research institutes, governments have also become more active partners in collaborative innovation.

[15] Sources of new knowledge are widely dispersed; in some situations, methods such as Internet crowd-sourcing can be efficient ways of searching for new ideas.

Hybrid solutions can often be observed; for example, those in which universities analyze market needs, while companies use in-house product research and development departments that cooperate not only with internal marketing and manufacturing colleagues, but also with third parties like competitors (coopetition) and again with universities. Here, part of the solution may have been purchased in arm's length (knowledge) transactions. Such open innovations within networks with several partner organizations benefit from having a broader knowledge base, often a shorter time to market, and certain shared risks among the partners. Individual tasks, risks, and appropriation can be allocated in such collaborative innovation endeavors, as long as all involved organizations fulfill their responsibilities and the commercializing partner covers all entrepreneurial risks of selling the new product and paying the partners.

The triple helix model envisions mutual benefits when universities become involved in creating new business, based on the assumption that all participants will adjust their old role and previous procedures. However, among the insights gleaned from the interviews with the five private companies involved in AIA was that the universities were not prepared to adjust their traditional roles.[16] Since this seems critical for cross-sectorial collaboration success, another reason for AIA's failure could be that the interests of universities and the public research institute were contradictory to those of the business.

Proposed model for collaborative innovation and corresponding feedback from the AIA project

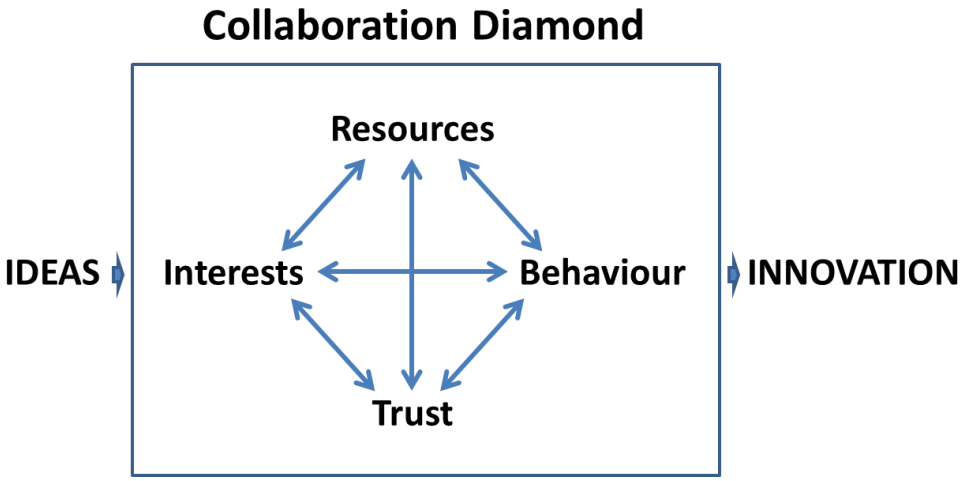
In order to define and structure the possible key factors that influence collaborative innovation in a simple model, we started with a literature overview of the possible factors that influence the success of such collaborations.[17]The interviews then tested the explanatory potential of the various factors, and we collectively refer to the four interrelated phenomena as the Diamond Model for Innovation. This model is not directly related to Porter's original diamond model, which presents key pillars such as state-of-the-art demand or strong suppliers that underpin successful industry clusters (Porter, 2000). Instead, our diamond illustrates the factors that must be in place in order to achieve successful intersectoral and collaborative innovation. Figure 1 shows the factors that all interviewees felt were critical conditions,[18] arranged in chronological order from left to right. The collaboration box (collaboration diamond) in the middle of the figure shows the critical and interrelated collaborative factors that underpin the joint transformation of ideas into innovative actions.

[16] Academics are interested in elegantmodels thatcan be generalized and published – for researchers, publishingis often a career requirement in academia.

[17] The literature review identified approximately 20 different factors that influenced collaborative innovation, either alone or in interaction with other factors.

[18] Since most innovations depend on context and specific skills, the displayed factors cannot represent sufficient conditions for collaborative success in innovation.

Figure 1: Collaboration Diamond for Innovation



Source: Erich Buerkler

The four critical factors that form the collaboration diamond positively influence one other. For example, strong common interests are translated into commitments that help mobilize resources, build trust, and foster innovation-friendly behavior. Trust can be built by, for example, allocating resources (measured in quantity as well as in quality), identifying common interests, and focusing individual behavior on innovation. In the opposite direction, trust helps participants to openly define and communicate interests, fosters more sharing of resources, and encourages behavior in the best interests of all parties involved. Behind the common interests are power factors, such as ambitions, objectives, and commitments. In our display, all of these factors were summarized by the "Interests" of the parties involved, which must at least be non-conflicting.

Before collaboration enters the innovation diamond, the first and most crucial condition is the presence of promising ideas or dreams. The resulting vision (for new products, for example) supports and guides the process of partner selection. Potential partners should share plans regarding the research agenda and should complement each other. Therefore, partners' objectives should be very similar, while their capabilities should be very different (but complementary). Once the innovation platform has been setup, a waterfall of ideas for potential solutions must be put in motion alongside systematic learning processes. Prior to enabling the collaborative idea waterfall, the platform's members must agree on strategic objectives for the project.[19]Individual and joint documents about the project's vision, mission, and concrete objectives should then leave minimal room for ambiguity or opportunistic interpretation. For a product innovation platform like AIA, objectives regarding planned products must be agreed upon before innovation strategies can be discussed.

In AIA, neither the partner selection nor the vision was based on product ideas or product dreams. Based on regional and industry criteria, TEC approached businesses, related government

[19] Ideas may stem from problemsencountered or necessities, but could also stem from recognized new opportunities createdby new technology, markets, or regulations.

agencies, and universities to invite them to join forces within the AIA platform. In this process, little thought was given to the greater capability and financial potency of more ambitious thinking, or to the potential of the participants' heterogeneity to yield greater innovation.[20]In addition, the participants interpreted the AIA objectives differently from the outset. While the companies regularly stressed that new products were the main goal, the universities and the technical college considered their main objective to be networking. Consequently, most of the product innovation projects initiated within AIA did not move beyond the idea phase. Since all parties agreed to search for white space (an area in which no AIA member had core knowledge or a related product in the pipeline), individual contributions were meager. All parties were reluctant to contribute preliminary work drawn from their respective strengths; however, innovation in populated markets requires state-of-the-art insights and contributions. This defensive approach, which all of the AIA participants adopted, may have also been caused by the fact that the AIA platform never reached a proper understanding. This meant that no contracts were signed that would have clarified how the potential benefits of common achievements were to be shared. Consequently, the meager or altogether absent contributions from all participants should have raised red flags at the start of the project.

As one respondent said: "The companies' focus was on wealth creation for the region." One revealing question was: How can elements be harnessed in novel ways to obtain more market opportunities for cross-fertilization, leading to new products on the market? This question indicates a rather naïve opinion regarding existing knowledge that only has to be reallocated in order to yield an innovation. Companies expected that the collaboration group would find solutions by trying new combinations of existing elements, rather than develop them. As one respondent said, "Wealth creation of 100 million dollars was the target mentioned in the MOU." This clearly shows the gap between ambition and commitment.

Common interests

After the preliminary condition of formulating promising ideas, the first actual collaborative step is to streamline the different organizations' interests. Intrinsic motivators, shown in values and attitudes, and extrinsic economic motivators, in the form of incentives, must be brought in line with the ambitions of collaboration. In other words, collaborative objectives must have underpinnings of strong individual and single-company incentives. The streamlining process must penetrate various levels. From the individual to the team, function, and across companies, positive incentives for people, teams, and companies to achieve the given objectives must be based on rational reasons. The resulting interests must be clear, strong, and balanced with those of each of the collaborators. Therefore, the various parties' wants must be clarified, rationalized, and streamlined on an ongoing basis. Freeman and Engel (2007) strongly emphasize the need to align incentives, not only between shareholders and management, but also between venture capitalists and companies or among the various partners in a collaborative innovation project. Streamlined interests are the energetic kernel of collaborations and do not allow for any substantial divergence among the parties. They must be *contracted* in joint objectives. In the case

[20] Also, issues such as necessary complementary assets or appropriability were not considered during the formative stage of AIA; for the corresponding arguments, see Teece (1986).

of diverging interests, objectives cannot be properly and concretely formulated. Therefore, the first stage of collaboration should yield a key document: joint objectives. The more concise, concrete, and rich this document is, the more promising the collaboration will be. However, it is important to mention that innovation outcomes are mostly unknown, which means that the contracts are more about procedures and principles than about a concrete product.

In AIA, the companies' values were perceived as being very similar and uncritical for the collaboration; however, the all-important incentives simply did not exist for the potential contributors and some attitudes diverged. For example, the large MNC was unwilling to allocate its own resources to the AIA project. It wanted to benefit from the potential gains without making a serious contribution. Most of New Zealand's farmers supply the MNC with milk, but within AIA, the MNC seemed to have little interest in reciprocating by becoming the farmers' technology provider. One respondent said,

> There was a big difference between the partners' commitments. The MNC was a disinterested player, while the smaller players were very keen to acquire development contracts. One mid-sized company identified a business opportunity, while another mid-sized company seemed to want to change their business altogether.

Strong interests are often translated into aspirations for taking an entrepreneurial role. Given that no one in the AIA project had strong interests (based on a high likelihood of benefits), no one aspired to this role. Another reason for the lack of commitment and contributions from the participants could be unclear appropriation, which could potentially allow freeriding. For example, it was not foreseen and agreed upon that, for example, the creating companies would bear the delivery risks and that the commercializing company would carry the entrepreneurial/market risk and pay partners/suppliers at arm's length, either fully or partly, independent of market success. In the latter case, supplying partners would be paid variably with a share of sales or profits over time, while intellectual property rights would mainly belong to the commercializing company.

Apart from the wrong incentives (that is, risks of appropriation), AIA started with the implicit promise of shortening the knowledge development and knowledge diffusion processes through the direct participation of universities and a technical college. AIA tried to move the tertiary sector closer to business and product innovation in order to speed up the process; unfortunately, there was no tangible result in this regard. Universities are used to producing for the public good and know the internal incentive structures that rely on the production of publications, not on productive participation in innovation projects. In that sense, AIA's participating universities fully lived up to traditional expectations. They neither allocated dedicated resources nor incentivized part-time participants from their ranks. As a result, individuals were not properly incentivized, which means they may not have had the common interests or goals of the participating organizations in mind.

Sufficient and complementary resources

After the initiating idea lays the foundation for a strong consortium, which also derives its fortitude from the agreed-upon collaboration objectives, the next step is to define the necessary resources. The relevant question here is: What total capacities and capabilities are needed to reach the agreed-upon objectives? This is often hard to define and justify since innovation's unknown outcome and often long payback period requires risky and frequently expensive financial investments, especially for complex endeavors. As such, an innovation can be understood as a rush up to the next (unknown) knowledge summit, during which flexibility, learning skills, and participants' passion to deliver are sometimes even more crucial than financial support.[21]Furthermore, the participants' various skills must complement and create synergetic combinations of knowledge. Individuals, teams, and organizations must stimulate each other.

In AIA, financial resources mainly came from TEC. While this removed the initial hurdles to participation, it also removed some of the usual resource-linked commitment from the participating partners. Hence, many of the organizations participated only half-heartedly, which diminished even further over time in tandem with the lack of project results. Some interviewees even dismissed some of the later AIA sessions as "talk fests" or "watering holes" where people just met to chat.

Because the individual companies had not allocated appropriate incentives for their own employees participating in AIA and had not built extra labor capacity for AIA participation, there was clearly a shortage of manpower, commitment,[22] and quality. As one CEO put it: "AIA was on top of the other busy jobs for everyone. My attitude was that I could not have my top managers do this, spread out the resources too thin." The AIA project manager's comment about the contribution of the participating research institute was: "The public research institute had no budget for the project, no budget code; so without it they could only contribute about an hour or two [per week]." The companies also graded the universities' contributions very badly. One example was: "I don't think he [the project manager] had a good understanding of how universities work and the level of constraint or inertia given the type of institution." With regard to resources, all interviewees agreed that there was a mismatch between budgets and ambitions and a lack of buy-in (financial commitment) from all parties involved. Low levels of commitment became visible over time to the partners and jeopardized trust in others' objectives and future contributions. However, the quantification of necessary resources is highly dependent on context and research ambitions, so empirical tests must use relative measures for this aspect of the innovation diamond.

[21] Generally the literature refers to an optimum of resources for an aspired innovation. A reversed U-shaped function shows an initially positive relationship between resources and development that becomes optimal at a certain point before overly high budgets raise coordination costs and endanger motivations (Nohria and Gulati, 1996).

[22] Commitment is manifested by contributions and results in trust, but is driven by interests.

Trust

Trust is generally seen as a forceful tool for conflict management, as Kanter outlined in her book *When Giants learn to Dance* (1989). Kanter viewed change as the main cause of conflict, but interorganizational innovation projects can bring even more change and resultant uncertainty for the stakeholders. Innovation outcomes can often affect a company's destiny. The strategic importance of innovation explains why companies are careful when choosing with whom to share insights and future intentions, as this could decide a company's fate. Trust in each other's intentions and skills are a precondition for open and efficient collaboration between departments, and especially between different organizations. Furthermore, trust can be built over time, is a function of collaborative success, and is strongly influenced by participants' values and visions.

In AIA, trust seemed to be the least of the problems. Statements like the following confirmed the relatively high level of trust: "New Zealand culture is based on trust," "high knowledge and ethics of companies involved," "too small a city to breach trust," "know each other, went in open and stayed open." This high level of trust, which is based both on geography and industry, can also be seen as a disadvantage. One complaint referred to partner selection:

> It would have been better to introduce more heterogeneous partners from other industry, such as fisheries, wineries. This would have reduced the amount of trust at the start of the AIA project, but relationship building and especially preliminary project success could have grown trust over time and the chances of innovation by learning from a truly different market would have been larger.

However, the circle of trust seems to have been restricted to the commercial players. As two academics said, there was a complete lack of trust from beginning to end. Here, the trust in each other's capabilities and intentions seemed to be absent.

Behavior

Finally, focused and disciplined behavior supports joint innovation if interests are streamlined, trust among the parties is sufficient, and allocated resources complement each other and enable strong learning. Individual curiosity, personal commitment, a challenging and competitive mentality, open internal and external communication, and an eagerness to experiment and take risks increase the likelihood of collaborative innovation. If the previous three factors are sufficiently strong (especially trust), focused on the task at hand (especially the resources), and appropriately balanced among the partners (particularly the individual interests), the resulting behavior should encourage a high propensity to innovate jointly.

But behavior suffered from various organizational deficits. While processes normally show the intended conduct of specific tasks, the *behavior* criterion looks at the actual actions. It is unsurprising that behavior in the AIA project was not oriented towards innovation success. AIA was not based on project ideas, but on an existing industry cluster[23] and geographical proximity

[23] One of the functions of a cluster is to foster interactions, knowledge flow, and exchange amongmember organizations within the spatial concentration of different but interconnected companies.

(tertiary institutes). Partner selection and company interests were not properly examined (for example, appropriation), no common objectives existed, and allocated resources were insufficient in quality and especially in quantity. Consequently, behavior was far too passive and unfocused.

The project director who was appointed after the first director was promoted out of the project was junior to all involved decision-makers and had no human resources of his own. Although he attempted to bridge business, government, and academia, he confessed that from his position it was an impossible task. The lack of common objectives made it impossible for him to motivate and coordinate people who did not report to him. The breadth of involved interests as opposed to the few active resources in the initiating infant projects made it impossible to define focused and well-resourced sub-projects.

The external moment of truth appears at delivery time. Successful projects get the preliminary factors right, which they prove with successful innovations. The internal moment of truth of innovation appears when people have to deliver and perform. Their behavior in research, collaboration, cooperation, communication, their commitment, and their people's passion internal confirm that the three preliminary factors (interests, resources, and trust) have been managed appropriately. In a promising collaboration, people behave as if they own part of the company, treat individuals from partner organizations as preferred team members, and treat the actual collaborative project as a now-or-never opportunity in their business lives to make a real difference. Not one single interview partner saw AIA as such an opportunity. In AIA, the two participating universities and the technical college identified the opportunity to get closer to the national agro-business, which is one of two (absolute) competitive advantage industries in New Zealand, the other being tourism. Therefore, universities expected not only to provide some knowledge, but also to receive knowledge and gain access to real-life projects. However, the combination of a relatively mechanical- and electrical-technology-oriented industry with the more life science- and business-oriented universities with little technical research of their own led to a mismatch in interests and resources and, consequently, to a disturbing lack of collaborative behavior.

Triple Helix would actually provide a dynamic framework for promising interactions among the different sectors. Triple Helix asks collaborating participants from the public and private sectors, such as government, universities, and businesses, to move closer together to create overlapping areas, and to partly take on other partners' roles and responsibilities. For example, universities should become more entrepreneurial and the government should more actively influence the innovation process. In AIA, the universities did not aspire to greater entrepreneurship, the partners from the business sector did not adjust and become more research-oriented, and government remained only a nominal partner rather than becoming more actively involved. The government (TEC) may have been afraid of a conflict of interests when resuming the simultaneous roles of regulator and active investor, or it may have seen the risk of not having sufficient knowledge about future markets and technology. As a result, TEC fulfilled the classical governmental role of a convener and an enabler. In general, governments must be fair;

that is, careful about selecting the correct projects to promote the common good while not mismanaging same.[24]

There are two main counterarguments for entrepreneurial universities. First, on the creation or technical side of innovation, closely incorporated universities would encapsulate their findings in patents and private firms, at the expense of the common good. Second, on commercial and policy grounds, universities that are heavily invested in private projects could lose their independence as policy advisors. Since the leading universities in the United States are already privately funded, such conflicts may already exist. Hence, especially after storms such as the dot-com bubble or the subprime mortgage crisis, people legitimately ask why the academic experts were not ringing alarm bells long before these economic disasters occurred. One answer could be that certain events cannot be predicted, while another might be that you don't bite the hand that feeds you.

The participating public research lab, as well as the universities, may also have feared a potential future competitor (innovation academy) and, more importantly, was not prepared to actively participate in outside endeavors. Its provision of a loosely structured platform for public (often individual) research and graduate studies was a clear mismatch for the much more focused business partners (excluding the MNC).

Conclusions

AIA could be seen as an attempt for an institutional innovation that tried to push for closer relationships between faculty and firms. For the purposes of the present research, the project's failure opened up fruitful discussions with the various parties involved about what is required for such collaborations to succeed. The open interviews made it possible to pre-test the four critical spheres of our model. The framework, with the four critical spheres for successful joint collaboration, has been pre-tested with the help of all interviewees. However, empirical validation would require a test with a sample of at least 30 joint collaborative innovation successes. For all four components of the diamond, measurable instrumental variables would have to be defined. The 30-plus projects would then have to be tested in order to determine whether they all fulfill the four critical conditions of streamlined interests, sufficient trust, complementary and sufficient resources, and innovation-focused and disciplined behavior. If certain projects within the sample were successful but did not meet all critical conditions, the model proposed above would be falsified.

An innovation platform consisting of several different legal parties must be based on a shared vision and shared objectives. Effective collaboration requires trust and openness, especially in critical areas like tacit knowledge sharing and/or specific weaknesses. Therefore, if the participants have contradictory objectives, this can hinder the process.

[24] Patent laws secure against both these risks. Government is not involved in creating and sponsoring innovation projects and only true innovations are publicly rewarded by exclusive temporary appropriation that motivates businesses and their partners for future research and development.

Incentives in an innovation platform are important and should be streamlined and rationalized, not only for individuals, but also for groups and individual organizations. Incentives guide individuals and institutions when they split or structure their work portfolios. Therefore, expected appreciation, bonuses, and profits from innovation activities are crucial to generate necessary enthusiasm and energy. In order to motivate all partners, incentives must also be fair and based on delivered inputs.

An innovation platform must be created by parties that are strong in their own fields, and all parties must bring to bear their specific strengths. AIA was the opposite of this requirement in that it was an accumulation of white space and general questions.

In a single-innovation project, capabilities and capacities must be appropriate *vis-à-vis* ambitions and challenges. New research (Weiss, Hoegl and Gibbert, 2013) claims that adequate financial support also depends on the resource elasticity of the research team; for some research teams, less (resources) is more at the end. In other words, available resources must be effective at finding new solutions. However, this does not necessarily mean they require a high level of efficiency, which is mostly based on repetition and standardization.

Trust within a collaborative innovation platform is essential and must be continuously strengthened. While it is necessary to have a certain level of trust in order to start a joint innovation platform, trust also grows with common successes and demonstrated discipline. Therefore, a project with a low level of trust either indicates early-stage development or a lack of success. Although AIA started with a relatively high level of trust, the absence of project successes meant this trust could not be substantially strengthened.

The four requirements defined in this paper as critical conditions are difficult to achieve in combination. Therefore, we may not see many platforms in which parties from different sectors interact dynamically on an even footing. Master-slave relations via consulting, contract research or technology and non-business-driven research still seem to suit actual incentives and cultures in business, and especially in academia. Perhaps a sharper distinction in regular universities and universities of applied sciences could help. The mandate of the former could be to perform general research and to act as a (financially) independent voice in policy making, while the latter could focus more on consulting, technology transfer, and most importantly on joint innovation projects with the private sector.

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Dr. Erich Buerkler, PhD, received his doctorate in international economics at Berne University, Switzerland, having researched Switzerland's international trade flows. In 2000, after a business career in telecommunications with management positions in countries including the Netherlands and India, he joined the University of Applied Sciences in Basel where he specialized in innovation and international competitiveness. As a full-time professor, he teaches economics and innovation management at the University of Applied Sciences in Basel. The author can be reached at erich.buerkler@fhnw.ch.

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