Strategies for Value Creation from Collaborative Innovation

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Abstract

This paper focuses on "how to create value from collaborative innovation", which is a core question concerned when companies plan open innovation initiatives. We provide a spiral four-stage model, named *SWIM*, with each stage a decision guided by a 2x2 matrix. These stages, named *scope, weave, identify* and *modularize*, try to balance resource allocation towards a foreseeable value, though it might be long term. We take China's Huawei Technologies as our main case study, with other companies' practices as further examples to elaborate and validate this new, yet practical model.

Keywords: business value, innovation strategy, collaborative innovation, case study

Introduction

In today's highly competitive and open environment, companies face a world of exponential technological change and increasing uncertainty—caused by global competition, technical progress, challenges from disruptive innovators, and the like. One solution for coping with the change and uncertainty is to increase a company's capabilities through collaborative or open innovation (Chesbrough, 2003). Collaborative innovation can reduce uncertainty and enhance success with complementary knowledge and abilities.

However, collaboration does not lead automatically to success and business value. Some of the collaboration initiator's concerns are: When to collaborate instead of innovating in-house? Who to collaborate with? How to transform external knowledge into a company's competitiveness through collaboration? We provide here need a new integrated model to cope with those questions all at a time, that is, how to generate value through collaboration?

This paper provides a new circular process model for success, drawing on our longitudinal case study on the inspiring experience of how China's Huawei Technologies used collaborative innovation to help become, at lightning speed from a standing start, the world's largest telecommunications technology company with revenues just below $100 billion in 2017. Huawei operates in over 170 countries, and employs over 180,000 employees worldwide of which 80,000 work in R&D. We also draw on other company examples and research to provide a new, yet practical, model. The model has been applied and validated over more than five years' practical implementation at Huawei. It will be useful for business managers who would like to seek outside talent for innovation while keeping a high level of innovation performance.

Research Methodology

In addition to literature review, this paper is based on the direct experience over many years of two Huawei technology executives--then Head of Technology Cooperation Deapartment and the Manager of the same unit—who are co-authors of this paper along with two British academics active in innovation research. As such, this paper is a rare example of practitioner and academic co-production in management research.

A Value Oriented Collaborative Innovation Model

We show a spiral four-stage process model for collaborative innovation in our account of successful technology development at Huawei Technologies, which set up in 2007 a dedicated department to collaborate globally. This department, Technology Cooperation, Huawei Technologies (henceforth HW-TCD), looks after joint technology development or research partnership as projects, and promotes the result into product design. Huawei found it is hard to evaluate this kind of effort by conventional tools to judge the performance of an investment project, because business value was realized only in the long term. Therefore, HW-TCD developed a behavioral model that generalized collaboration as a four-stage process, with the

output results fed into further collaboration decisions. Each stage is itself a decision concerning different aspects of value generation. We call this the SWIM model: **S**cope, **W**eave, **I**dentity, and **M**odularize (Figure 1).

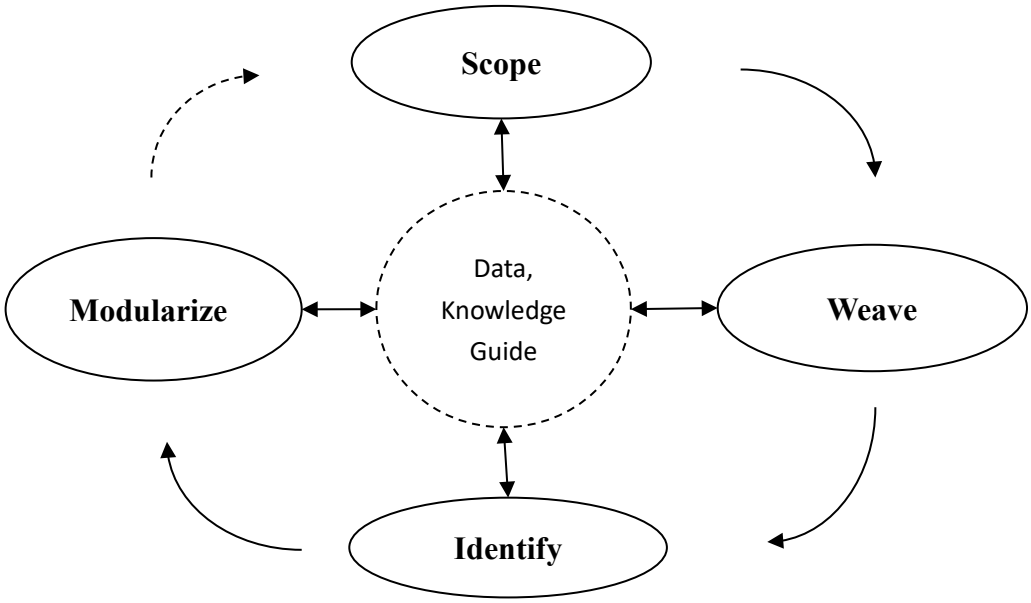

Figure 1: The SWIM model

SCOPE out the right type of question

In the first stage, Scope, HW-TCD scopes out the right type of questions to ask before embarking on collaborative innovation. These questions vary by whether the technology challenge is known to the industry and to the firm (Matrix 1 in Figure 2). The four combinations correspond to Rogers' "take-off" innovations ("Consensus") (Rogers 2010), March's "old certainties" ("Focus") and "new possibilities" ("Blind Spot") (March, 1991), as well as Taleb's "black swan" ("Unknown") (Taleb, 2007). This mindset enables firms not only to deal with foreseeable problems but to also prepare for black swan challenges. Huawei established a multi-tiered innovation organization, with R&D departments in business units focusing on "Consensus" and "Focus" questions, and a Central Research department focusing on "Blind Spot" and "Unknown".

Internal awareness about the challenges in this field	Technology challenges' exposure: Known to industry	Technology challenges' exposure: Not known to industry
Known to the firm	**Consensus：** clear grand challenges, benefit for the whole society (e.g. Rogers: "take-off" innovations)	**Focus:** obstacles for the specific technical route chosen, local know-how involved (e.g. March: "old certainties")
Not known to the firm	**Blind Spot:** research agenda set yet un-known in the firm, reinvent the wheel if unknown (e.g. March: "new possibilities")	**Unknown:** under-discovered topics which might cause disruptive change for industry (e.g. Taleb: "black swan")

Figure 2 Matrix 1: Scope out the right type of questions

Consensus. In the ICT world, the evolution of wireless communication is well defined by the community as generations, as 2G, 3G, and 4G. When the latest generation technology is well defined, the industry or community begins to seek what technologies are to be included in the next generation. Therefore, to prepare for the next 5G wireless communication, Huawei held a series of workshops to define the necessary technologies to focus on, and to actively recommend and participate in integrated testing organized by an authorized third party. Other companies took similar steps to help create 5G.

Focus. Each company has its own focus, which is either its core competitive capability or specific problems in its technical path. To pursue its innovation focus, Huawei has invested more 10 percent of its revenue each year into R&D and has accumulated tens of thousands of patents. Most of these patents are for its main product suites.. The CEO specified that various innovation activities should set a boundary, aimed at enhancing core value, and deemed as a "main channel". These policies guide major innovation efforts to focus on business and develop better products to meet customer needs.

Blind-spot. Not seeing potential changes can cost a firm even up to its entire business. To prevent blind-spots, Huawei set up a department, internally called the Blue Army, whose main aim is to find alternatives for current technology routes. The Blue Army acts as potential disrupters, often with alternative ways such as collaboration and external investment.

Unknown. To plan for the unknown, Huawei has a task force, within the strategic planning unit, to research mechanisms for dealing with major uncertainties. For unknown problems, Huawei uses open calls to the external community, via its Huawei Innovation Research Program (HIRP),to keep aware of newly developing technologies. Academics can also submit their new ideas via HIRP and get funding. After some research time, the idea may become clear and a

further collaboration type may apply. In general, most activities in this quadrant are carried outside of the firm, which may not be affected by the *main channel* culture.

WEAVE internal and external innovation activities

Next, in Matrix 2 (Figure 3, our model weaves together internal and external innovation activities. Strategies are devised based on the business outlook and internal resource readiness, considering the types of problems. For example, where there was a clear market outlook, General Electric adopted an innovation approach to support its strategic objective of being number 1 or number 2 in core businesses ("Fully Cover"). Where GE had deficiencies, it would seek external help (**"Integrate"**) such as from GrabCAD, an Estonian startup now based in Cambridge, Massachusetts, that acts as marketplace to connect engineers with computer-aided design (CAD) jobs(Power, 2014). With an unclear market outlook, Microsoft built a strong research system internally ("Reserve"), while Samsung engaged with academia through its Global Research Outreach (GRO) Program ("Aware").

Huawei, even with 80,000 R&D staff, focuses on a few innovation themes, aiming to "Fully cover" them. Its Central Research department plays an important role in its "Reserve" capabilities for the future market. HW-TCD uses project collaboration and HIRP (Huawei Innovation Research Program) funding either to "Integrate" or be "Aware" of technology beyond its organization boundary.

Internal knowledge ready or capable to have it	Market outlook for this technology/knowledge: **Clear**	**Opaque**
Capable	**Fully Cover:** Devote resources to cover all aspects to support core competitiveness (e.g. GE: no. 1 or no.2 strategy)	**Reserve:** optimize and exploit, make technology ready when market appears (e.g. Microsoft's research)
Deficient	**Integrate:** complement own capability with outer ones, to form a strong and quick solution for customers (e.g. GE's seeking help from GrabCAD)	**Aware:** keep exploring the potential technology and partners, find and evaluate for future potential (e.g. Samsung's GRO program)

Figure 3 Matrix 2: Weave internal and external innovation activities

IDENTIFY the right collaborators

With the map setting the goals, the next step is to identify a pool of external talent as candidates for collaboration, based on their characteristics such as current academic achievements and potential. Matrix 3 helps to identify the right type of collaborators from the academic and scientific communities.. In HW-TCD, scientometrics as well as group decisions identifies external researchers as one of "Leader" ,"Dignitary", "Potential" and "Maturer", with local managers frequently contacting these scholars and reporting on their technical advancement. This classification system helps Huawei to assign different types of research challenges to collaborating scholars.

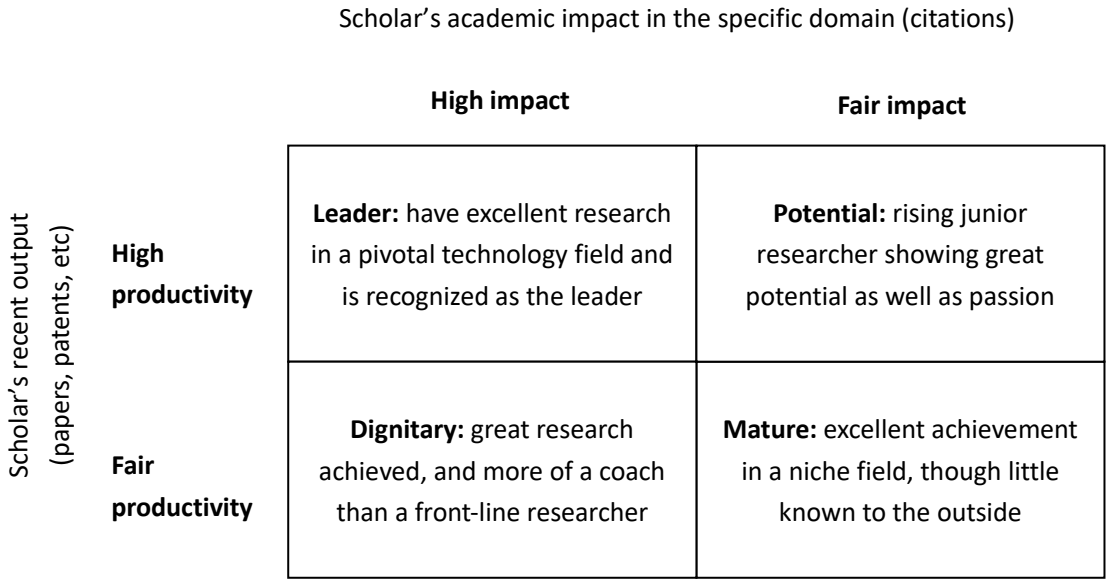

Figure 4 Matrix 3: Identify the right collaborators

After classifying the scholars to these four type of characters, HW-TCD try to justify their preferences accordingly and design and recommend collaboration modes. The "Leader" type scholars are usually busy and at their height of academic achievement and community impact. They have rich sources of funding and what they care about is how to have their knowledge benefit society and reach scale. They are seldom interested to develop a certain technology according to Huawei's specifications. Therefore, HW-TCD would seek direct licensing or fund junior scholars in the Leader's team, under the supervision of the Leader, to leverage and customize the Leader's research program for Huawei requirements. HW-TCD also organizes workshops to have the Leader introduce leading-edge ideas to Huawei, so that company staffcan get the core of the Leader's new ideas directly and concisely.

Some junior scholars are "Potentials" (rising-stars) but lack enough research resources. For

these, HW-TCD would organize a workshop to have them show their ideas to Huawei's technical staff. This would give Potentials access to industry needs and allow them to plan their research to be better aligned with real world needs. The fore-mentioned HIRP would show Huawei's interest, and these young scholars can start with answering the call to show their potential. After a successful project, they may arrange more and other types of collaboration projects. There is a case of a now full professor who started his collaboration with Huawei when he was a Ph.D student and this partnership has lasted more than ten years.

Some senior scholars would be more useful providing guidance rather than being an active researcher in their own right. This is especially in the case of China where some senior scholars gain great fame after a successful career. They are regarded as a Dignitary as they have large research teams to do the detailed work and to extend their original research to various applications. They would maintain a high-level oversight of the field. They usually chave rich sources of funds, but they have too little time to focus on detailed research. If a Dignitary is of interest, HW-TCD would make contact and perhaps set up a consulting project. Such a project is usually more flexible on deliverables but providing insight and a holistic view of a field.

"Mature" scholars are those who have excellent achievement in a niche field, though little known to the outside. Maybe this field is not so hot, maybe their research is quite different from that of main stream researchers, maybe their research is too focused, or their impact is not so high compared with a Leader and or Dignitary. This does not mean their research is not important for industry. HW-TCD maintains a list of such researchers and funds their research for certain applications. As they have a long time experience in a certain field, when some so-called big innovations in this area are reported by the media, HW-TCD would try to seek their professional review of the development.

MODULARIZE various collaboration projects

The firm needs an infrastructure to support collaborative innovation that is flexible enough to modularize for each specific activity, as shown in Matrix 4 (Figure 5). A tailored system would enable the necessary freedom for innovation while keeping a universal eye on performance for all the activities, and offer successive improvements. For example, when technical requirements are definite, firms can either find the matched partners, or seek solutions from the crowd, as "Elite Circle" ("Match") and "Innovation Mall" ("Open"), according to Pisano and Verganti (2008). However, with indefinite questions, firms can learn from DARPA to seed funding from known collaborators ("Orient") (Fuchs, 2009), or act in an alert way as GE does ("Explore") (Vanderbilt, 2015). Such a system also emphasizes non-intervention of innovation activity by the management team which allows researchers the freedom to decide the direction of research. In HW-TCD's practice, it begins with "Open" calls to attract and actively "Explore" the innovative ideas and partners. The initial funding may be a small amount. When both the firm and its partner learn about the technology ideas and get to know each other further, the next stage may be a larger collaboration via either a "Match" with a certain collaborator to solve a definite requirement, or "Orient" to set an indefinite requirement to a dedicated network of collaborators.

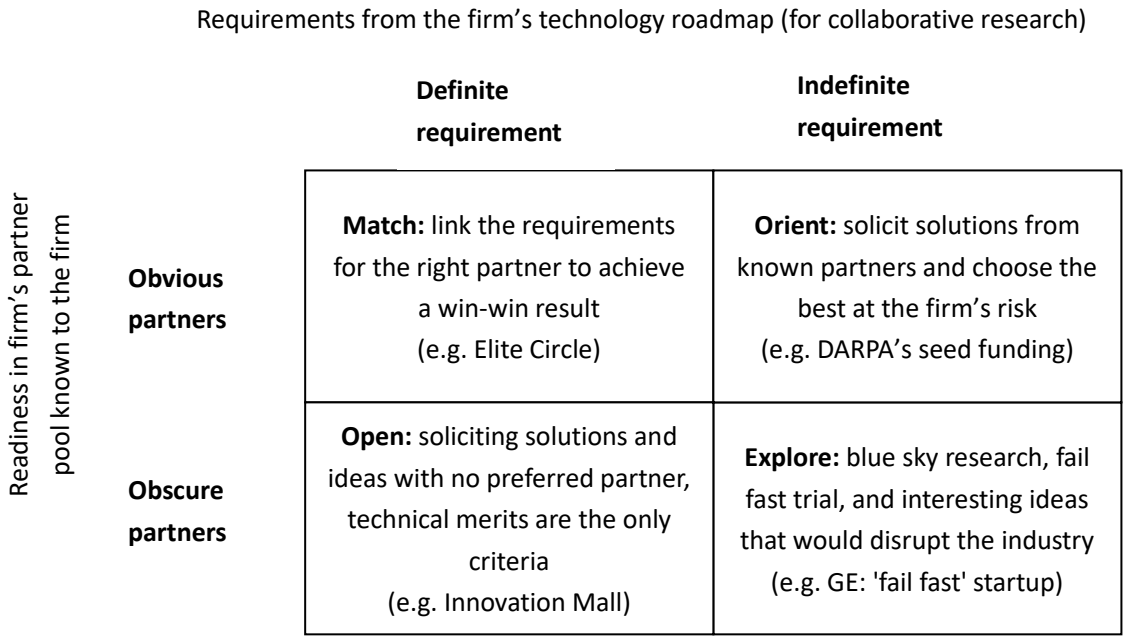

Figure 5 Matrix 4: Modularize various collaboration projects

HW-TCD has designed many collaboration models that can be summarized by the four types in Matrix 4 (Figure 5), each related to the partner's characteristics. HW-TCD maintains a list of possible partners by technology. Thus, when there is a definite requirement from a business unit, and HW-TCD knows exactly which partner can best provide the needed technology, it would "Match" such a resource provider. The agreement with the partner would be through ways such as a collaboration project with detailed specifications, or a license agreement with minor services. If these technologies and requirements are specific and ready, HW-TCD would make a quick bridge to get the two sides to meet.

Sometimes, the requirements from the business unit technical staff are quite vague as these derive from customer needs and have some uncertainties, even though the technical domain is quite certain. In this scenario, HW-TCD would provide the business unit with the partner name list, and let the business unit technical staff select and contact potential partners. HW-TCD would also listen to the business unit opinions about the problem, and then build a new research project or a series of projects with the best suited partner on mutually agreed features. These projects may define a quite relaxed goal or continuously updated goals that "Orient" to the ultimate customer needs. HW-TCD updates its partner name list continually to keep ahead of the advancement of the firm's technology strategy.

HW-TCD believes that it is critical to the firm's technology strategy to maintain a vibrant and flexible potential partner name list to embrace the latest technologies . Each year, the HIRP Open, an "Open" call program for proposals at the technology frontier, solicits proposals via a guide prepared by HW-TCD. This guide collects the interests from various business units. HW-

TCD would, together with the reviewers from business units, select proposed ideas and fund as research projects. HW-TCD would then ask a person from the business unit to trace and monitor the technical advancement of each project. Therefore, knowledge can be absorbed as the research progresses, keeping Huawei at the forefront of leading edge research. At the same time, HW-TCD would update its name list to reflect changing capabilities and other aspects

Lastly, HW-TCD offers an "Explore" mode in order to work with those academics who prefer free research that may bring unexpected inspiration and accidental but great inventions. This, HW-TCD would sometimes invest without pre-defined specifications. But how? HIRP Open accepts some proposals for research ideas outside the scope of interest list. HW-TCD would seek a sponsor throughout the business units as well as in the Blue Army. If someone is interested and would like to act as a technology sponsor, HW-TCD can invest on such an Explore research project. If the idea is at very early stage, an explorative project can be set up to let the scholar try their idea and show the result as a Proof of Concept. HW-TCD also encourages its personnel to scout ideas outside actively, and if both sides are interested, set up an exploratory project. This approach helps the firm explore some new ideas and avoid pitfalls through external trials without heavy cost.

Data, Knowledge and Guide

The decision at each stage cannot be made without the necessary data, knowledge and guide. These three elements are central to the SWIM Model (see Figure 1). HW-TCD maintains a digital platform to accumulate project data and relevant knowledge about collaborations. The data are managed centrally and can be accessed according to different security levels. Some tools are provided to give a statistical insight on all aspects of collaborations.

The knowledge from collaboration management is difficult to record. This knowledge includes not only technology information but also that of the people, the policy and culture when conducting collaration. HW-TCD encourages the managers to write case studies to share on the platform, as most managers are geographically scattered and are often absent visiting different collaboraters. HW-TCD has built an electronic discussion group to let managers ask and answer any questions. These discussions happen in real time, so that the information seeker can keep asking questions and getting answers from different persons.

When some practices become common, they can be formulated as guides, which support an organization routine. The guides are created from both top-down and bottom-up. The top-down guides seek to embed policies from various sources to the activities of collaboration work, may these be government laws, the firm's requirements, liaisons from financial and law department, etc. Assigned staff design and monitor the execution process of these guides. These guides are often mandatory.

The bottom-up guides come, however, from field practice. Each year, HW-TCD organizes a two-day meeting to let collaboration managers introduce their best practices dealing with collaboration. The presenters prepare a presentation and answer questions. In the

forementioned electronic discussion group, HW-TCD assigns someone to regulalry generate reports on the most discussed topics. The collaboration managers can refer to such reports before asking questions. The case study work is conducted now and then, to reflect the issues of the dynamic circumstances in which collaboration operates. HW-TCD also seeks help from outside consulting firms and academics, who would recommend some practices of the industry and give the ratonale. Overall, these various knds of guidance help the process to run smoothly in a dynamic and economic way.

Conclusions

This paper builds a framework for the process of collaborative innovation management, drawing on both research and real practice. It focuses on the whole process, especially the strategic planning activities, such as project and team selection, that take place before innovation collaboration starts. It argues that the leverage effect of collaborative innovation can be achieved with three conditions: a holistic map to guide internal and external activities, a committed resource pool to execute the activities, and a flexible infrastructure to support the process.

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