Coping with Open Innovation:

RESPONDING TO THE CHALLENGES OF EXTERNAL ENGAGEMENT IN R&D

Ammon Salter
Paola Criscuolo
Anne L.J. Ter Wal

Open innovation often requires wholesale changes to the nature of R&D. However, academic research and managerial practice have paid little attention to the challenges that individuals face in the daily pursuit of open innovation. As a result, there is little understanding of how individuals cope with open innovation, and which organizational practices can support them in this role. Drawing on the experiences of R&D professionals, this article identifies four specific challenges and coping strategies of individuals engaged in open innovation. It proposes a range of open innovation practices that organizations can implement to better equip their staff to undertake effective external engagement. (Keywords: Open Innovation, Innovation, Individual-Level Openness, Intellectual Property, External Engagement, Practices)

O ver the past few years, many organizations have encouraged their employees to be more active "open innovators" and to interact with external parties to find new ideas in a bid to improve existing products, processes, and services, and to create new ones.[1] The rationale for this is that if organizations become more effective users of external knowledge, this renders internal R&D efforts more productive for developing innovations and finding new pathways to market for existing technologies.[2] However, this new orientation requires significant organizational change and a redefinition of the tasks and boundaries inside the organization.[3] In order to realize the benefits from openness, as much attention is required to the firm's "internal face" as to its "external face."[4] Many firms have found that their open innovation efforts have

Ammon Salter is a Professor of Innovation at the School of Management at the University of Bath.

Paola Criscuolo is an Assistant Professor of Innovation Management at Imperial College Business School.

Anne L. J. Ter Wal is an Assistant Professor of Innovation and Entrepreneurship at Imperial College Business School.

stalled due to internal barriers.[5] Thus, for many organizations, the promise of open innovation has not been realized.

Although there is an awareness of the role of individuals in open innovation, most of the literature focuses on the organizational rather than the individual- or project-level.[6] Little attention has been paid to the "micro-foundations" of open innovation, the choices and behaviors of individuals involved in the successful exploitation of external ideas, and how these individual actions shape aggregate strategic and managerial outcomes.[7] As a result, we know relatively little about the challenges that R&D professionals face in the daily pursuit of open innovation, the ways individuals cope with these challenges and the practices that organizations can introduce to help them become more effective open innovators.

Fundamentally, open innovation represents a significant change to the work practices of R&D professionals, who in the past were typically rewarded for "discovering new nylons" rather than for successful external engagement.[8] Some individuals may welcome the shift to openness, whereas other may resist it.[9] Rather than hostility to the idea of open innovation itself, such resistance may manifest itself in conflicts between the informal working practices of individuals and the formal organizational rules and procedures they have to operate under. These conflicts may leave individuals in uncertain and difficult situations, without sufficient training or organizational support.

To enrich our understanding of the individual-level aspects of open innovation, this article identifies the challenges faced by R&D professionals in open innovation activities in large, multinational organizations and the coping strategies that individuals adopt to surmount these challenges. We then use these informal "bottom-up" practices of individuals to help to enrich our understanding of the organizational practices that can promote open innovation. To this end, our research draws on information derived from interviews in a range of companies, and a detailed case study of R&D professionals working in a leading firm strongly oriented to open innovation.

Open Innovation at the Individual Level

Much of the literature on open innovation focuses on the organizational practices that enable firms to find new ways to capture and exploit external knowledge.[10] This work provides insights into a range of practices such as out-licensing and in-licensing,[11] corporate venturing,[12] use of innovation intermediaries,[13] dealing with unsolicited ideas,[14] innovation tournaments,[15] and open source software development.[16] Although the literature provides an understanding of how organizations can manage open innovation successfully, it does not explore the micro-foundations of open innovation. The efforts of individuals at accessing knowledge that is outside the firm's boundary need deeper examination. These individuals are operating on the front lines of open innovation, preparing ideas to cross the

boundary of the organization, either bringing knowledge into the firm (inbound open innovation), or transferring knowledge outside (outbound open innovation).[17] This study focuses on inbound open innovation and the way that it has changed the work contexts of R&D professionals.

First, the norms and expectations related to R&D work have changed with the advent of more open models of innovation. Although individuals are expected to stay informed about external developments, the primary focus in the closed R&D model is on the development of new products, processes, and services internally. In the open innovation model, individuals are tasked with scouting for external ideas, shepherding external ideas through internal processes, and facilitating their exploitation in the firm.[18] These efforts require individuals to engage directly with external parties, to participate in external communities, and sometimes to be seconded to some other organization.

Second, open innovation often requires significant changes to working routines and job functions. For example, Alexy et al. find that the use of open source software in a large firm led to changes in job roles, the introduction of new tasks and redundancy of others.[19] Open innovation also requires a different mindset, and a supportive environment. Henkel, for example, shows that managers are often skeptical about employees' involvement in open source software development, despite a lack of evidence of confidential information being revealed.[20] Salge et al. demonstrate that new product development teams in UK healthcare are more likely to benefit from openness if the local environment is supportive of creativity.[21]

Thus, in the context of open innovation, R&D professionals may find that the requirements for open innovation are incompatible with existing operating routines, such as the expectation that they develop IP. This might mean employees develop coping strategies to allow them to work towards the wider organizational goal while still being effective in their individual work roles. This may require deviation from formal procedures, which may be incomplete or inflexible, and the development of personal approaches to problems, or of "workarounds" that break with conventions and expectations. These changes to the work setting introduce several challenges in R&D professionals' daily open innovation work, yet we lack an understanding of how individuals cope with them and of the help provided by organizations.

What are the main challenges faced by individuals working in R&D when engaging in open innovation? How do R&D professionals resolve these challenges in their day-to-day work? And what managerial practices might help individuals to more successfully undertake their open innovation activities?

Research Method

Our research involved a multistage study that spanned several organizations and covered a broad range of individual experience in open innovation. The research was conducted in four steps. First, exploratory interviews were conducted with R&D technologists and managers at leading innovators (including IBM, Nokia, GlaxoSmithKline, General Mills, Pfizer, Arup, ARM, Tesco, BP, Syngenta, QinetiQ) to understand the nature of their open innovation efforts. This stage

focuses on the organization's current open innovation practices, the challenges faced by individuals in their open innovation efforts, and the mechanisms used to support these efforts. The results of these interviews suggest that open innovation efforts often conflict with acquiring and defending formal IP.[22]

Second, we performed an in-depth case study of individuals working in R&D in a large multinational corporation.[23] This organization, which we will call "Neptune," has a strong open innovation program. It operates in very competitive markets, and alongside its R&D base it has strong expertise in marketing, manufacturing, and distribution. We conducted semi-structured interviews with 35 members of Neptune's staff from management and technical career paths of its R&D organization, covering different locations, job roles, and business units. We interviewed six people several times to gather additional evidence and discuss our interpretation of the information gained from previous interviews. Our interviews focused on individuals' direct experience with external engagement in recent years. We asked interviewees to describe a specific project—successful or unsuccessful—in which they had been involved recently. We did not prompt them to talk about external engagement, although generally the topic emerged in the conversation. When it did not, we asked why external engagement had not been part of the approach in that project. When discussing external engagement, we encouraged interviewees to talk about the problems involved, and to describe whether and how they had been overcome. We also asked them to reflect on the training and skills they saw as critical for effective open innovation. The interviews lasted between 45 and 90 minutes, and were recorded and transcribed.

Third, the interview transcripts were coded using NVivo, allowing us to identify barriers to external engagement, and the coping strategies employed by individuals, and to make suggestions about organizational solutions. We grouped the codes in higher-order categories of similar barriers and similar coping strategies. To illustrate the coping strategies used, we wrote vignettes of individuals' actions. These vignettes build directly on the interview transcripts. We anonymized them by using fictional names and protecting company- and industry-specific information. These vignettes combine material from multiple interviewees.

The fourth stage of the study involved discussing our findings with a range of stakeholders in Neptune and other corporations to validate our thinking. A group of Neptune's most accomplished technologists provided detailed feedback in an online meeting. We next made a face-to-face presentation of our work to a panel of senior R&D managers for their feedback on our findings and validation of our categorizations. Finally, we participated in an informal meeting with senior R&D technologists from 20 leading multinational corporations, in which we presented our findings, and through discussion, tested the generalizability of the challenges identified and the feasibility of the solutions documented in this article.

From Individual-Level Challenges and Coping Strategies to New Open Innovation Practices

Our field study of Neptune and interviews in other organizations brought four challenges to the fore that individuals face at different stages of external

TABLE 1. Individual-Level Challenges of Open Innovation at Various Stages of External Engagement

Stage of Engagement	Company Stance	Individual-Level Challenge
Getting the Right Mindset	All scientists and engineers are expected to embrace open innovation.	Perception of external engagement as second best.
Building Partnerships	Established procedures have to be followed when building collaborations with new parties.	Preference for the safety of comfortable partners with whom they worked in the past.
Starting the Conversation	No disclosure of internal knowledge to third parties without confidentiality agreement in place.	Difficulty to overcome the paradox of disclosure when starting new collaborations.
Taking Advantage	Managerial pressure to increase the number of R&D projects that involve external parties.	Difficult to make external knowledge digestible in terms of alignment with internal knowledge, procedures and objectives.

engagement: getting the right mindset, building partnerships, starting the conversation, and taking advantage. Table 1 summarizes these challenges alongside the stances that Neptune takes in enabling and promoting open innovation at these different stages.[24]

Some individuals may not have the right mindset and fail to see the value of open innovation in their own work. Despite the fact that all staff members in Neptune are expected to engage with external parties, many perceive external engagement as "second best," largely due to the demanding nature of working with external partners. Those individuals that *do* engage with external partners may prefer to do so with a limited number of vetted partners and thus limit their exposure to the full potential of ideas outside the organization. Although Neptune and many other organizations that have embraced open innovation have put procedures in place to enable individuals to build partnerships with new companies, individuals may exhibit a strong preference for the "safety of comfortable partners." Subsequently, when R&D staff have built new partnerships, they may find it difficult to get conversations started, overcoming the paradox of disclosure.[25] On the one hand, they need to comply with the organization's need to capture valuable and enforceable IP and thus cannot disclose any internal knowledge to third parties before having a confidentiality agreement in place. On the other hand, they feel the need to disclose some information early on to get a meaningful conversation started.[26] Finally, individuals face substantial barriers when attempting to put external knowledge to effective use and relate it to the firm's ongoing innovation efforts. Despite growing managerial pressure to increase the number of projects that involve external engagement, individuals struggle to make external knowledge digestible and to align it with internal knowledge, procedures, and objectives.

Challenge 1: External Engagement as "Second-Best"

Despite frequent protestations of commitment to open innovation, among even the most progressive "open innovators," the dominant culture of R&D scientists and engineers remains largely inward-facing. Although it is common to ascribe

these views to a "not-invented-here-syndrome,"[27] our interviews with R&D staff revealed that there are other factors contributing to this orientation. Interviewees identified the demanding nature of working with external parties as the primary reason for their preference for using internal knowledge sources. Although R&D professionals may be well motivated—and, in principle, are all expected to look beyond the firm to obtain knowledge—a significant share of them will only work with external parties when there is no alternative and see external search as secondary to internal search. In doing so, individuals may overlook new insights and perspectives that external knowledge may provide to internal knowledge.

Local, in-house knowledge, although perhaps less advanced than knowledge from external sources, is aligned to organizational categories and objectives and compatible in format and language.[28] This makes it easily accessible and transferable, allowing rapid incorporation into new ideas, product concepts, or technology proposals. Interaction with external parties to access knowledge may require effort to translate and integrate it, and it may be less immediately obvious how it fits with the organization's objectives and expertise. It may require manipulation so that its format fits the requirements of internal selection processes. An interviewee commented that:

> "Now, from my point of view, it's not as easy, because obviously if you're working with internal people, then they know how you normally do the work. Whereas if you go and use external people all of the time then you've got far more work to do to really . . . and learn something about what the problem is and all of this stuff."

The second reason for individuals' tendency to see external knowledge as second best is the nature of corporate reward systems. In most R&D organizations, reward systems remain designed around relatively closed models of innovation. In particular, individuals are largely rewarded for the number and quality of inventions and patents they develop. Even, in organizations with ambitious open innovation goals, there are weak structures in place to reward successful external engagement. Individuals often find that their engagements with externals are not valued by the wider organization. As one interview commented:

> "Every year we have a performance review. And as part of that we get feedback from people that work with us as to how good we're doing, where we need to improve, etc. And I got a couple of senior professors to give us a feedback and they were really quite willing to do that. And they were very open about it. And, so I put that on my report and my management dismissed it; they said it's totally irrelevant, it's got nothing to do with the company. So I think they're wrong but maybe things will change in the next few years, who knows."

Moreover, external recognition may also not be fully understood by internal managers, who are often unaware of the corporate value of an individual's external affiliations or memberships. An interview stated:

> "There are a number of us who have been recognized by outside bodies so I'm a Fellow of [a significant scientific body]. That counts for nothing in the company . . . But we don't have a way of understanding its value and its potential impact inside the company because we haven't been there before, this is all new territory."

Even in firms that put open innovation as a priority, there may be a lack of incentives and rewards for creating and delivering on open innovation opportunities. The lack of attention to external engagement in rewards systems means that individuals often feel that open innovation efforts are of limited value to them personally. Although an organization may encourage its staff to be more open, individuals shy away from these efforts.

Coping Strategies and Organizational Practices for "Second-Best"

> *Vignette 1*: Sven only works with external partners when there is no alternative. "It is not the most efficient way of doing the work, because you do have this education phase to go through." However, when Neptune does not have the competence in house, external engagement may be the only option. Sven tries to make the most of it through intensive coaching of the collaborator. "So we've done some coaching on site to see if they think they've got a good idea, and then let's see how we can test it out to see how good it really is." An important element of that approach is site visits. "We will discuss their equipment and understand their processes, and then on the basis of that we'll do a judgment of whether or not we think they have the capability and maybe some of the new ideas that we're looking for." Without such coaching and deep understanding what they can do "they come back with a lot of ideas and most of them you've looked at before."

Despite the fact that Sven sees external engagement as "second best," he tries to overcome his skepticism through deeper immersion into the partner organization and points towards an important practice that firms may implement on a more systematic basis to reduce negative perceptions of external engagement. Regular site visits to (potential) external partners are an important way in which open innovation R&D professionals are able to better appreciate the value of external partners and thus reduce the perception of external engagement as "second-best." Organizations may introduce formal practices to enable their R&D staff to become more deeply immersed in the partner organization. For example, IBM assigns its Distinguished Engineers to spend part of their working week in another organization, which exposes them to market and technological opportunities that might otherwise remain hidden and provides deeper insight in the capabilities of collaborators. Encouraging R&D staff to allocate time to external relations on a systematic basis would raise their awareness of the potential benefits of connections with external organizations, and ultimately create a more positive mindset towards the value of open innovation.

In addition, organizations need to build more flexible reward and promotion systems that enable and support openness. Reward systems could be expanded to incorporate acknowledgements and rewards for individuals that successfully initiate, manage and implement external engagements. This could include rewards for the identification of new external partners, the transfer of an external idea across the boundary of the firm, or the utilization of an external resource on internal projects. Other examples of incentives that could be part of modified reward systems include awards or prizes for those that excel in external engagement—"open innovator of the year."

Challenge 2: The Safety of Comfortable Partners

A more subtle form of skepticism regarding the use of external engagement is the safety of comfortable partners. In our interviews, we found that there is a tendency for individuals involved in open innovation to focus on interactions with the firm's key partners, the so-called "usual suspects." R&D staff are more comfortable with and trust external parties with whom the company has collaborated previously and may have a long tradition of knowledge exchange. These collaborations often are covered by long-term agreements making them a "safe space" for the exchange of ideas and knowledge across the firm's boundaries, based on mutual understanding that has developed over time.[29] An interviewee told us that:

> "We have the top tier ones, like the big four that we work with, and then what I have found is once you find somebody you work well with, and you kind of have that connection, I end up staying with them, because it's kind of like, I guess, it's kind of like dating. You know, once you find that right partner, you work well with them, so then to start dating again, it's a difficult process, so you don't want to go through it again."

Thus, although acknowledging the potential advantages of openness to external sources of knowledge, individuals may perceive such interaction as burdensome, and they lack the preparedness required to build partnerships with new outside sources. Individuals who rely mainly on long-term, existing partnerships may miss opportunities to work with more innovative external partners. Although long-term engagements undoubtedly have advantages related to the ease of knowledge exchange and collaboration, an exclusive focus on vetted partners may reduce the organization's ability to develop novel solutions that break with existing perspectives and ways of working.

One of the main reasons that individuals stick to known partners is the complexity of setting new firm and binding IP arrangements with new parties. Existing partners covered by long-term agreements provide a safe space for exchanges of ideas and knowledge. Although most firms have put procedures in place that guide individuals in setting up new partnerships, it is perceived as complex and time consuming to set up binding IP arrangements. The time involved in setting up new partnership agreements was reported as prohibitive (3-6 months), typically involving exchanges between the legal departments of the respective organizations. For example, collaborative research involving universities and firms increasingly require legal agreements about backward and forward IP ownership.[30] Universities may have unrealistic expectations about the value of their knowledge, which delays potential collaboration.[31] It is often the individuals instigating the collaboration process who are obliged to invest time and effort in negotiating the complex legal process. This makes many individuals reluctant to engage with external partners unless the expected payoffs are very high, with the result that many potentially useful external interactions do not materialize:

> "Often, setting up all the confidentiality agreements, determining the ownership of any IP, can be fairly lengthy, time consuming, and, you know, often can lead to us going down to a point where we don't actually then move forward because we've found sufficient reasons why we wouldn't want to or the vendor wouldn't want to."

Given the inherent uncertainties and incomplete nature of the exchanges in the early stages of collaborations for innovation, these approval costs can be a strong deterrent, and latent opportunities for new collaborations are often shelved.[32]

Coping Strategies and Organizational Practices for "The Safety of Comfortable Partners"

> *Vignette 2*: Roberta is a senior technologist in one of the biggest divisions of Neptune. She finds it very troublesome to go through the process of setting up IP agreements. To circumvent or at least postpone those problems, she often engages in "transaction-light partnerships" that are exploratory in nature. "We just do a little project, where we don't even need to worry about IP. And if that works; if the people like each other, feel good together, and something seems to emerge, then we go. Then it'll evolve into something bigger." Only when the value of working together starts to become more tangible, does she begin to worry about formal agreements. "It's difficult and risky . . . Inexperienced people couldn't do it, in fact, because they wouldn't know how far they could allow themselves to engage."

To break the cycle of an over-reliance on existing partners, some R&D professionals form "transaction-light" partnerships with new partners on their own initiative. Before making strong commitments to new engagements that are formally covered by complex contracts, both parties can get to know each other and find out where and how expertise and capabilities may complement. To facilitate their staff to initiate new engagements, firms may implement more formal practices to start "transaction-light" explorative partnerships. Hewlett-Packard's (HP) Innovation Research Program is an example of a structured approach to such partnerships. It advertises its areas of technology to university scientists and engineers to encourage proposals for research projects to HP. Within this program, projects are covered by a standard contract, which protects the background IP of each party and provides HP non-exclusive rights to downstream developments from the research project.[33] This type of "speed-dating" partnership typically focuses on interesting but non-essential development areas, and it does not require deep commitment on either side. However, in the course of working together on the project, the company's R&D staff and its external partners learn about each other, helping to establish the common ground necessary for deeper and more fruitful exchanges and relationships.

Challenge 3: Overcoming the Paradox of Disclosure

The literature on the markets for technology highlights what Arrow calls the "paradox of disclosure."[34] This refers to the situation where a party in a technology exchange discloses too much information and the other party is not willing to pay for it. The paradox is that, if too little information is disclosed, the other party may not be willing to engage in the exchange.[35] Despite their positive stance towards open innovation, Neptune and many other "open innovators" stick to the policy that no internal knowledge can be disclosed to third parties before a confidentiality agreement is in place. To start the conversation with a potential external collaboration, however, an individual often feels the need to

give up some information to establish some common ground and understanding. An interviewee commented that:

> "The issue that we have in all of this is just the confidentiality side. Some of the questions tend to be quite guarded if we're not under a confidentiality agreement or whatever. So, you know, you can only get so much back if you only give so much into the conversation in the first place. . . . I mean, we can approach somebody like at conferences even without having a confidentiality agreement in place, but you just have to keep the conversations quite general. Then we can decide whether we wanted to go through the effort of getting a confidentiality agreement in place. And that can take some time."

Our interviewees suggested that they, as individuals, often find it difficult to know how much information to disclose to an external party. Even those with experience in open innovation are often unsure about what to reveal and what to keep confidential. Interactions with external parties can involve several potentially risky situations such as informal exchanges at conferences. An interviewee told us that:

> "It's really difficult, you know, I mean, my legal people understandably would get really [upset] if I kind of just went off willy-nilly on my own. So, it's always finding this balance point between saying enough so that you actually get something out of it, but you don't say too much that you don't destroy your IP position later on."

This uncertainty and worry about disclosing information often results in individuals choosing to disclose too little:

> "Well, during your initial contact with a supplier, you try and minimize the amount of information you give to them and just the certain amount of information they need to know. Because at that point, you know, Neptune hasn't protected the idea, or at least the application of their material into our product, so you have to really be careful of the information you disclose at that point and then as you develop, as you prove feasibility and you start to protect with IP, then you can start to be a bit more open to the supplier."

Our interviews highlighted significant concern about IP and legal departments' views about how much should be revealed to potential external parties before the formal agreement. Interviewees appeared to be more worried about leaking knowledge than weighing the potential upsides of a new organizational engagement. This situation is similar to myopic loss aversion in prospect theory, which suggests that individuals are twice as likely to be concerned about potential losses than potential gains.[36] As a result, individuals may avoid external engagement because of the perceived personal and professional risks of unplanned disclosures.

Interviewees pointed also to problems related to disclosure by potential collaborators. Often they found individuals working for small firms and individual inventors to be concerned about fair treatment, and having their ideas "stolen." For many small firms, their ideas are their most precious asset and they are often wary of large firms and their aggressive stance toward IP.[37] At the same time, many inventors have unrealistic expectations about the financial value of their ideas, and they do not take account of the costs to a large firm of developing them.

These imbalances in expectations can make it difficult to go beyond the stage of initial exploration.

Coping Strategies and Organizational Practices for the "Paradox of Disclosure"

> *Vignette 3*: Brian is a dedicated gatekeeper. It is his task is to go out and find external partners that may hold technologies that can address Neptune's needs. Getting conversations started is often very difficult. Although Neptune's managers and colleagues from the legal department would expect him to keep conversations as general as possible, Brian is convinced "you can only get so much back if you only give so much into the conversation in the first place." He takes a modular approach to IP disclosure: "I'm telling about A, but not B, C, D, E. The partner doesn't know the whole thing." Brian is aware, though, that he is taking a risk. "If I would send all these emails to my director, or if he would be the mouse in the ear, he may say: Brian, are you sure?" Selectively disclosing bits of sensitive information is key to getting meaningful conversations started and developing a trusted relationship. Yet, in an attempt to get ideas picked up in Neptune, Brian would go a step further. He would "pretend" to be on the side of the external: "I can help them judge what to share with Neptune, what to hold back, what's critical to the argument, and what's a nice-to-have. So there will be occasions where I would advise people: don't share your patents."

R&D professionals frequently involved in open innovation have developed ways to circumvent the paradox of disclosure. As the above vignette illustrates, experienced open innovators may know which parts of the firm's IP can be revealed and discussed in negotiating a new partnership. Interviewees implied that they adopted a "buddy" model of engaging with external parties, which helps to personalize and deepen the engagement, resulting in a trusting relationship in which sensitive information can be exchanged.

These skills derive from experience. Most staff would need more guidance to allow them to overcome the paradox of disclosure and start conversations with prospective partners. Two types of organizational practices can provide such guidance. First, many organizations are paying increasing attention to establishing modular IP systems.[38] These provide clarity for R&D staff about the critical components of the IP to which strong disclosure rules apply; they allow staff to differentiate between the "crown jewels" and other types of IP not subject to such strict rules. A system of labeling (red, amber, and green "lights") of different parts of the firm's knowledge base can shape clarity as to which knowledge can be disclosed in early conversations ("green") and which cannot ("red"), but also delegates some of the responsibility to judge whether to disclose to individuals (in case of "amber"). Opening up to this possibility may strengthen individuals in the view that it may sometimes be justified to disclose to facilitate initial conversations with external parties.

Second, organizations can design IP training programs for staff that clearly differentiate the challenges and opportunities of open innovation. Existing programs tend to take a defensive, legalistic approach to IP management.[39] They tend to stress the risk of unplanned disclosures and highlight the potential sanctions applied to individuals who do not follow procedures, but provide very few examples how to exploit the opportunities of open innovation. In order to overcome hostility and nervousness in external parties, R&D professionals from large organizations must

project an image of being open and friendly, of understanding the position of a small firm relative to their own large organization. R&D professionals need to learn how to "give something to get something." Role-playing with trusted external partners might provide insights into how to conduct productive conversations with external parties that do not disclose too much or too little information. Organizations could set up "phone-a-friend" support where experienced staff can offer advice in real-time to less experienced individuals engaging with externals.

Challenge 4: Making External Ideas "Digestible"

Identifying useful external knowledge is just the start of successful open innovation. Individuals need to be able to take advantage of the knowledge they obtain from external sources. They must thus ensure that the external technologies, product concepts, or systems can be absorbed and incorporated into the organization's ongoing R&D activities.[40] External ideas may have poor overlap with internal categories and expertise, and they may be formulated so that they appear very "foreign" to the firm.[41] External ideas can rarely be plugged straight into the existing knowledge, and effort may be required to align external and internal knowledge and to find out how external knowledge can be exploited to meet the company's objectives. As an interviewee commented:

> "For example, at the very beginning when we started [to work] with those doctors, they would come up with some very complex stuff which to me was absolutely mind-blowing and exciting. I absolutely loved it, but as soon as I was trying to use it with anyone, I was losing them after 30 seconds because it was too academic, right. So it took us, like, months and months of working before they really understood it was really critical for them if they wanted the organization to buy into what they were proposing, to make sure that they could show what it meant to us as a business."

In our interviews with open innovation managers, it became clear that firms' open innovation programs often pay little attention to the process of assimilation of the external ideas identified. Many organizations see open innovation as an opportunity to "leapfrog" the process of discovery of novel ideas rather than as a laborious process of assimilation. Few organizations recognize the value of training to produce individuals that know how to apply external ideas as well as find them. For example, open innovation programs commonly invest in "knowledge scouting," using dedicated staff to search the external environment for potentially valuable ideas, but do not appoint "assimilators" with expertise in transforming external ideas into forms that can be used internally. It was clear from the interviews that many R&D professionals lack support to transform external ideas into a format a firm can use when incorporating them in its wider innovative efforts.

Coping Strategies and Organizational Practices for "Making Knowledge Digestible"

> *Vignette 4*: Chandraraj works extensively with top research institutes and small technology companies around the world to get access to the latest advances in production technologies. He finds that the potential of external ideas often does not become apparent to internal stakeholders because crucial bits of information are lacking

and it may be unclear how it may help Neptune to reach its objectives. "I tend to do joint programs, rather than saying, you know, this is the scope, go away and come back after three months. Because when I've tried to do that in the past, I've found that most of the time the output is just not useable." On the one hand, Chandraraj tries to make sure that those suppliers he works with are "able to customize their message to whoever is going to receive it at the other end [in Neptune]." It's a role that he has to play all the time. "You need to stay close to what they are doing and then you need to help them deliver a message which is going to be understandable by the organization." On the other hand, there is a bit of translation work that needs to be done internally within Neptune. "You have to talk about it [external idea] in terms of value to people within Neptune, so you know, we would want to translate whatever we thought of it into either performance improvements for us or cost performance improvements for us."

This vignette illustrates that making external knowledge digestible for internal application requires translation skills. Individuals have to invest considerable time and effort in honing external ideas and knowledge to allow them to be spliced into the firm's R&D efforts or processes. To facilitate this process, the ideas need to be translated into a form that will allow their assessment against existing internal knowledge. The imported knowledge must stand up to scrutiny by internal allocation decision processes, such as stage-gates, and the individual involved must ensure that the external and internal ideas are comparable in terms of such things as documentation, evidence of benefits, and IP position. The process may require the individual involved making the external idea more attractive to internal managers by aligning it with the firm's needs and orientations. This assimilation effort may involve the creation of a compelling story about the utility of the external idea to the organization, its alignment with the firm's overall strategy and assets, and its potential for scalability across the organization.

It appears that our interviewees receive little guidance on how to tackle these tasks. Organizations should train staff to build "translation-in" skills to clarify where precisely the value of external technology lies within the company. Alongside dedicated gatekeepers tasked to harness new knowledge, organizations may need to create a dedicated assimilator role that involves aligning external knowledge to internal knowledge, objectives, and procedures. Individuals with a comprehensive knowledge of both the organization's routines, habits, and capabilities and the technology and expertise held by external partners will be well equipped to re-package external ideas into a form that will appeal to the firm's constituents. Making the "assimilation" role more concrete and prominent in the organization would facilitate the process of validating external ideas against internal requirements and aligning them with the organization's overall needs.

Vignette 5: Chandraraj (see Vignette 4) also emphasizes the importance of broadcasting Neptune's needs more widely. "We have to identify the problem we're trying to solve in a way that the outside world can really understand what it is." In addition to mixed success in using Neptune's ideas submission website and innovation intermediaries, he relies extensively on his own network to make clear what kind of solutions he's looking for. "I would blast out: we're looking for a [specific technology]. That [message] would go to university departments; it could go the big suppliers. It would go everywhere, and it would say what we are looking for.

Because what's the big deal? It's obvious why we're looking for it. We haven't got it yet, and we want to fill that space as fast as possible."

Alongside the "translation-in" activities described in Vignette 4, the internal "translation experts," tasked with making external knowledge more easily integrated, must get involved with "translation-out" activities. Broadcasting the organization's needs to external parties signals the focus of the organization's R&D efforts.[42] Organizations that choose to selectively reveal knowledge to externals may facilitate a better alignment of external partners (and their knowledge) with the organization, which can then promote opportunities for collaboration with these external sources.[43] This "selective-revealing" can be achieved through the publication of technology "road maps" or information related to internal decision-making processes. This information would allow external parties keen to collaborate to align their knowledge development efforts with those of the focal organization. It should enable more successful engagement with innovation intermediaries and the re-packaging of problems into forms that externals can deal with.[44]
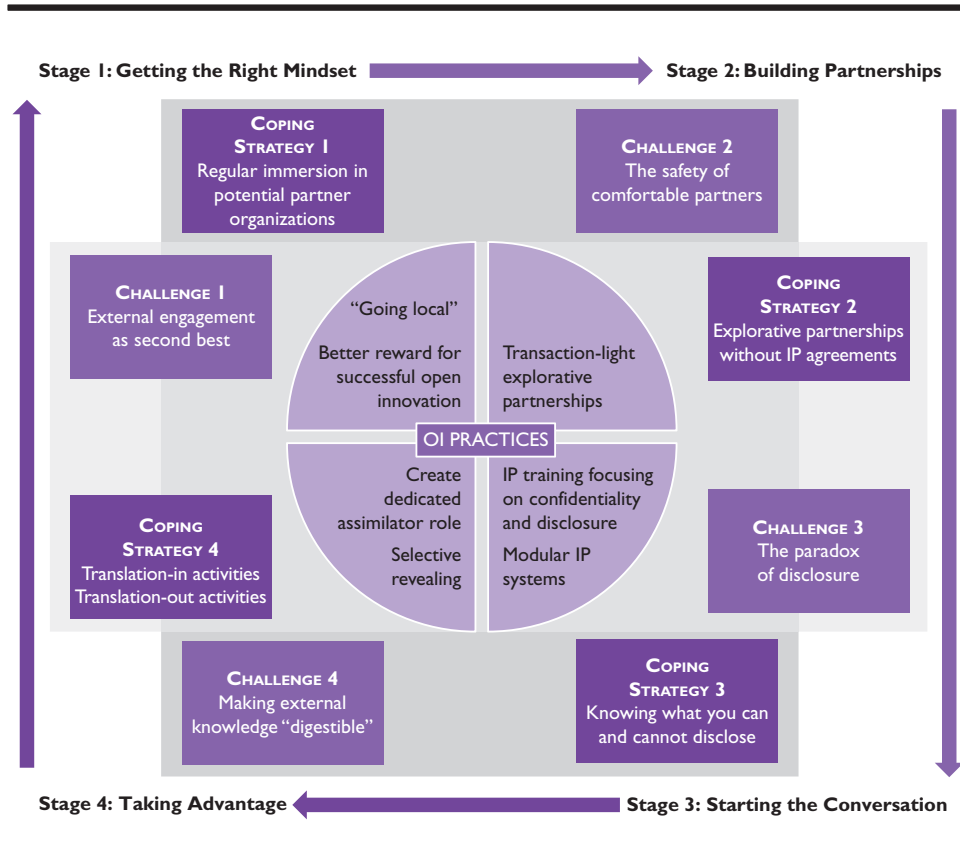
Discussion and Implications

By exploring the challenges confronting individuals at various stages of external engagement, we have attempted to enrich our understanding of the micro-foundations of open innovation. We described several coping strategies adopted by individuals and used these as a base from which we suggested managerial practices that prepare staff to tackle the tasks of external engagement in R&D. The challenges, coping strategies, and organizational open innovation practices at various stages of external engagement are summarized in Figure 1.

The managerial implications of our findings are three-fold. First, failed open innovation efforts are often ascribed to the "not-invented-here" syndrome. The transfer of external ideas into large firms in the context of R&D is not straightforward. Even when firms have a supportive stance towards open innovation at most stages of external engagement, individuals face difficulties in building new partnerships, transferring knowledge across firm boundaries, and finding a good fit between the external knowledge and the capabilities, know-how, and objectives of the focal organization. The only stage where firms' stance towards open innovation is constraining rather than supportive for individuals may relate to the predominantly conservative views on non-disclosure of IP even in firms that have enthusiastically embraced open innovation. In our case study organization, individuals face problems related to revelation and ownership of IP, due to restrictions on what they can say to external parties. In light of these challenges, individuals may reject the potential of external collaboration and engage in less open innovation. This mirrors the finding in Henkel,[45] which, in the context of open source developers in commercial firms found that middle managers were often reluctant to allow junior staff to be open to the external environment, resulting in missed opportunities to exploit open innovation. Our results indicate that open innovation efforts often fail when individuals confront challenges they are unable to overcome on their own.

Second, new managerial practices are required to enable individuals to succeed in open innovation. Our study shows that the coping strategies that individuals

FIGURE 1. Organizational Open Innovation (OI) Practices Emerging from Individual-Level Challenges and Coping Strategies

Stage 1: Getting the Right Mindset → Stage 2: Building Partnerships

COPING STRATEGY 1
Regular immersion in potential partner organizations

CHALLENGE 2
The safety of comfortable partners

CHALLENGE 1
External engagement as second best

"Going local"

Better reward for successful open innovation

Transaction-light explorative partnerships

COPING STRATEGY 2
Explorative partnerships without IP agreements

OI PRACTICES

Create dedicated assimilator role

Selective revealing

IP training focusing on confidentiality and disclosure

Modular IP systems

COPING STRATEGY 4
Translation-in activities
Translation-out activities

CHALLENGE 3
The paradox of disclosure

CHALLENGE 4
Making external knowledge "digestible"

COPING STRATEGY 3
Knowing what you can and cannot disclose

Stage 4: Taking Advantage ← Stage 3: Starting the Conversation

adopt to surmount these challenges form a starting point from which to derive new organizational practices designed to render open innovation more effective. These include creating training and development programs to allow individuals to learn how to be effective in open innovation, which at present is left largely to the individuals to figure out. It is critical to develop organizational practices that will lower the personal and professional costs of openness to the individual introducing "transaction-light" engagements and procedures as well as modular IP systems that clarify what can and cannot be shared with external parties. Organizations also need to pay more attention to the internal face of open innovation by creating a new formal role and set of responsibilities for "assimilators" who can work alongside "information scouts" and "gatekeepers" to help in the reformulation and integration of novel external ideas to allow their absorption across the wider organization.

Third, our study has implications for R&D career models and pathways, which traditionally have been characterized by long-term continuous employment and have focused on the creation of new, valuable IP. Under open innovation, R&D professionals are expected to take on new responsibilities related to supporting external communities, spending time in external organizations, supporting external inventors in their engagement with large organizations, and

preparing internal problems for resolution by external parties. Our study shows that few organizations have put systems in place to support the transition to new models of externally oriented R&D staff. Even in leading open innovators, R&D professionals tend to be rewarded and promoted based on the number and quality of their inventions and patents. This approach provides only modest incentives for individuals to exploit and deliver on open innovation opportunities. This may further reinforce the perception that seeking knowledge externally is the "second best" option to using internal knowledge, closing the cycle of challenges portrayed in Figure 1. New and better balanced internally and externally oriented R&D incentive systems are required to encourage individuals to take on the challenge of open innovation and to reward them for doing so successfully.

Limitations and Future Research

Our study has some limitations. First, although we gathered information from several different organizations, our empirical evidence is based mainly on individuals' experience of open innovation in a single organizational setting. Although the experiences of individuals in Neptune reflected problems identified by open innovation professionals in other organizations, we are unable to make a detailed comparison of individuals' experiences across different organizations. Second, it was not clear whether the challenges we observed were due to problems specific to the transition to open innovation or rooted in more fundamental issues related to the nature of knowledge transfer more broadly.[46] Although some of the challenges identified, such as those related to IP, are more salient in the context of open innovation, others may also be present in the case of knowledge transfer within organizations. Future research should compare individuals' coping strategies for internal knowledge transfer to those related to open innovation. Finally, our proposals for organizational solutions are neither exhaustive nor mutually exclusive. It might be that some solutions, such as those related to challenges of making knowledge digestible, would facilitate the resolution of other problems.

The introduction of open innovation is making it necessary for R&D personnel continually to relearn their skills, creating new ways to identify, assimilate, and utilize external knowledge. We hope that revealing the experience of these individuals will enable organizations to develop more effective ways to help their R&D employees to overcome the challenges and exploit the opportunities associated with open innovation.

Notes

1. H.W. Chesbrough, *Open Innovation: The New Imperative For Creating and Profiting From Technology* (Boston, MA: Harvard Business Press, 2003); H.W. Chesbrough, W. Vanhaverbeke, and J. West, *Open Innovation: Researching a New Paradigm* (New York, NY: Oxford University Press, 2006); L. Dahlander and D.M. Gann, "How Open Is Innovation?" *Research Policy*, 39/6 (June 2010): 699-709; M. Sawhney and E. Prandelli, "Communities of Creation: Managing Distributed Innovation in Turbulent Markets," *California Management Review*, 42/4 (Summer 2000): 31-54; E. Von Hippel, *Democratizing Innovation* (Boston MA: MIT Press, 2005); E. Enkel, O. Gassmann, and H. Chesbrough, "Open R&D and Open Innovation: Exploring the Phenomenon," *R&D Management*, 39/4 (September 2009): 311-316.

2. K. Laursen and A. Salter, "Open for Innovation: The Role of Openness in Explaining Innovation Performance Among UK Manufacturing Firms," *Strategic Management Journal*, 27/2 (February 2006): 131-150.

3. O. Alexy, J. Henkel, and M. Wallin, "From Closed to Open: Job Role Changes, Individual Predispositions, and the Adoption of Commercial Open Source Software Development," *Research Policy*, 42/8 (September 2013): 1325-1340; N.J. Foss, K. Laursen, and T. Pedersen, "Linking Customer Interaction and Innovation: The Mediating Role of New Organizational Practices," *Organization Science*, 22/4 (July/August 2011): 980-999.

4. O. Alexy, P. Criscuolo, and A. Salter, "Managing Unsolicited Ideas for R&D," *California Management Review*, 54/3 (Spring 2012): 116-139.

5. L. Mortara and T. Minshall, "How Do Large Multinational Companies Implement Open Innovation?" *Technovation*, 31/10-11 (October 2011): 586-597.

6. Dahlander and Gann, op. cit.

7. H.W. Volberda, N.J. Foss, and M.A. Lyles, "Perspective: Absorbing the Concept of Absorptive Capacity: How To Realize Its Potential in the Organization Field," *Organization Science*, 21/4 (July/August 2010): 931-951.

8. D.C. Mowery, "Plus Ça Change: Industrial R&D in the 'Third Industrial Revolution'," *Industrial and Corporate Change*, 18/1 (February 2009): 1-50.

9. J.D. Ford, L.W. Ford, and A. D'Amelio, "Resistance to Change: The Rest of the Story," *Academy of Management Review*, 33/2 (April 2008): 362-377.

10. Chesbrough (2003), op. cit.; Chesbrough et al. (2006), op. cit.

11. A. Arora, A. Fosfuri, and A. Gambardella, *Markets for Technology* (Cambridge, MA: MIT Press, 2001).

12. V. Van De Vrande, W. Vanhaverbeke, and G. Duysters, "External Technology Sourcing: The Effect of Uncertainty on Governance Mode Choice," *Journal of Business Venturing*, 24/1 (January 2009): 62-80.

13. L.B. Jeppesen and K.R. Lakhani, "Marginality and Problem Solving Effectiveness in Broadcast Search," *Organization Science*, 21/5 (September/October 2010): 1016-1033; G. Verona, E. Prandelli, and M. Sawhney, "Innovation and Virtual Environments: Towards Virtual Knowledge Brokers," *Organization Studies*, 27/6 (2006): 765-788.

14. Alexy et al. (2012), op. cit.

15. C. Terwiesch and K.T. Ulrich, *Innovation Tournaments: Creating and Selecting Exceptional Opportunities* (Boston, MA: Harvard Business Press, 2009).

16. J. Henkel, "Champions of Revealing: The Role of Open Source Developers in Commercial Firms," *Industrial and Corporate Change*, 18/3 (June 2009): 435-471.

17. O. Gassmann, E. Enkel, and H. Chesbrough, "The Future of Open Innovation," *R&D Management*, 40/3 (June 2010): 213-221.

18. Chesbrough (2003), op. cit.

19. Alexy et al. (September 2013), op. cit.

20. Henkel (2009), op. cit.

21. T.O. Salge, T. Farchini, M. Barrett, and S. Dopson, "When Does Search Openness Really Matter? A Contingency Study of Health Care Innovation Projects," *Journal of Product Innovation Management*, 30/4 (July 2013): 659-676.

22. O. Alexy, P. Criscuolo, and A. Salter, "Does IP Strategy Have To Cripple Open Innovation?" *MIT Sloan Management Review*, 51/1 (Fall 2009): 71-77.

23. See also P. Criscuolo, A. Salter, and A.L.J. Ter Wal, "Going Underground: Bootlegging and Individual Innovation Performance," *Organization Science*, published online October 10, 2013; A. Salter, P. Criscuolo, A.L.J. Ter Wal, and O. Alexy, "Open For Ideation: Individual-Level Openness and Idea Generation in R&D," paper presented at the Druid Summer Conference, June 19–21, 2012, Copenhagen Business School, Copenhagen, Denmark.

24. For a similar approach, see P.R. Berthon, L.F. Pitt, I. McCarthy, and S.M. Kates, "When Customers Get Clever: Managerial Approaches to Dealing with Creative Consumers," *Business Horizons*, 50/1 (January/February 2007): 39-47.

25. K. Laursen and A. Salter, "The Paradox of Openness: Legal Appropriability Strategy and the Use of External Sources of Knowledge," *Research Policy*, (Forthcoming 2014).

26. H.W. Chesbrough, *Open Business Models: How To Thrive in the New Innovation Landscape* (Boston, MA: Harvard Business Press, 2006).

27. R. Katz and T. Allen, "Investigating the Not Invented Here (NIH) Syndrome: A Look At the Performance, Tenure, and Communication Patterns of 50 R&D Projects," *R&D Management*, 12/1 (January 1982): 7-19.

28. W.M. Cohen and D.A. Levinthal, "Absorptive Capacity: A New Perspective on Learning and Innovation," *Administrative Science Quarterly*, 35/1 (March 1990): 128-152; P.J. Lane and M. Lubatkin, "Relative Absorptive Capacity and Interorganizational Learning," *Strategic Management Journal*, 19/5 (May 1998): 461-477.

29. R. Gulati, "Does Familiarity Breed Trust? The Implications of Repeated Ties for Contractual Choice in Alliances," *Academy of Management Journal*, 38/1 (February 1995): 85-112.

30. D.C. Mowery, R.R. Nelson, B.N. Sampat, and A.A. Ziedonis, "The Growth of Patenting and Licensing by the U.S. Universities: An Assessment of the Effects of the Bayh-Dole Act of 1980," *Research Policy*, 30/1 (January 2001): 99-119.

31. M. Perkmann and A. Salter, "How to Create Productive Partnerships with Universities," *MIT Sloan Management Review*, 53/4 (Summer 2012): 79-85.

32. Salter et al. (2014), op. cit.

33. <www.hpl.hp.com/open_innovation/irp/>, accessed September 2012.

34. K. Arrow, "The Economic Implications of Learning by Doing," *Review of Economic Studies*, 29/3 (June 1962): 155-173; Arora et al. (2001), op. cit.

35. See also Laursen and Salter (2014), op. cit.

36. D. Kahneman and D. Lovallo, "Timid Choices and Bold Forecasts: A Cognitive Perspective on Risk Taking," *Management Science*, 39/1 (January 1993): 17-31; S. Benartzi and R.H. Thaler, "Myopic Loss Aversion and the Equity Premium Puzzle," *The Quarterly Journal of Economics*, 110/1 (February 1995): 73-94.

37. J.S. Gans and S. Stern, "The Product Market and the Market for 'Ideas': Commercialization Strategies for Technology Entrepreneurs," *Research Policy*, 32/2 (February 2003): 333-350.

38. J. Henkel, C. Baldwin, and W. Shih, "IP Modularity: Profiting from Innovation by Aligning Product Architecture with Intellectual Property," *California Management Review*, 55/4 (Summer 2013): 65-82.

39. J.L. Davis and S.S. Harrison, *Edison in the Boardroom: How Leading Companies Realize Value from Their Intellectual Assets* (Hoboken, NJ: John Wiley & Sons Inc., 2001).

40. M.W. Wallin and G. Von Krogh, "Organizing for Open Innovation: Focus on the Integration of Knowledge," *Organizational Dynamics*, 39/2 (April-June 2010): 145-154.

41. P. Lane, J. Salk, and M. Lyles, "Absorptive Capacity, Learning, and Performance in International Joint Ventures," *Strategic Management Journal*, 22/12 (December 2001): 1139-1161; Cohen and Levinthal (1990), op. cit.

42. Jeppesen and Lakhani (2010), op. cit.

43. O. Alexy, G. George, and A. Salter, "Cui Bono? The Selective Revealing of Knowledge and Its Implications for Innovative Activity," *Academy of Management Review*, 38/2 (April 2013): 270-291; D. Harhoff, J. Henkel, and E. Von Hippel, "Profiting from Voluntary Information Spillovers: How Users Benefit by Freely Revealing Their Innovations," *Research Policy*, 32/10 (December 2003): 1753-1769; J. Henkel, "Selective Revealing in Open Innovation Processes: The Case of Embedded Linux," *Research Policy*, 35/7 (September 2006): 953-969.

44. J.H. Sieg, M.W. Wallin, and G. Von Krogh, "Managerial Challenges in Open Innovation: A Study of Innovation Intermediation in the Chemical Industry," *R&D Management*, 40/3 (June 2010): 281-291.

45. Henkel (2009), op. cit.

46. B. Kogut and U. Zander, "Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology," *Organization Science*, 3/3 (August 1992): 383-397.