Problemsourcing:
Local Open Innovation for R&D Organizations

Sally Davenport, Stephen Cummings,

Urs Daellenbach, and Charles Campbell

> " *There are no problems we cannot solve together,* "
> *and very few that we can solve by ourselves.*

Lyndon B Johnson
36th President of the United States

Open innovation and crowdsourcing are usually focused on using others external to the organization to solve your problems. How then do R&D organizations, who traditionally solve the problems of others, harness the benefits of open innovation and crowdsourcing yet maintain their mission and capabilities? "Problemsourcing" may provide the answer. In this mode of open innovation, the open call to the "crowd" of businesses is for them to suggest problems that, if solved by the R&D organization, could greatly enhance the business' competitive advantage and therefore the nation's economy.

In this article, we describe a problemsourcing initiative developed by Industrial Research Ltd (IRL), a government-owned R&D organization in New Zealand. The "What's Your Problem New Zealand?" competition promised NZ$1m worth of R&D services to the winning business. Using this case study, we map a range of benefits of crowdsourcing for R&D problems, including generating a potential pipeline of projects and clients as well as avoiding the challenge to the professional status of the organization's research capability. A side-effect not initially taken account of was that, by demonstrating openness, accessibility, and helpfulness, the reputation of the research organization was greatly enhanced.

The problemsourcing model provided by the "What's Your Problem New Zealand?" competition represents a new strategic possibility for R&D organizations that complements their traditional business model by drawing on the openness that open innovation and crowdsourcing seek to leverage. As such, it can provide insights for other research organizations wishing to make use of the connectivity afforded by open innovation and crowdsourcing.

Introduction

How do R&D organizations harness the benefits of open forms of organizing for innovation, yet promote their traditional mission to provide excellent and useful scientific services and maintain their research capabilities? Crowdsourcing, whereby the "wisdom of the crowd" is harnessed for organizational problem-solving, is one form of open innovation that has received a great deal of attention in recent years (Albors et al., 2008; tinyurl.com/arnvgn5), spawning many variations including crowdfunding and crowdvoting (Brabham,

2008; tinyurl.com/aapna9g). The benefits of crowdsourcing practices are claimed to include (Howe, 2006; tinyurl.com/lxbf7; Whitla, 2009; tinyurl.com/a8jdwsp):

1. Access to capability: An organization can tap into a wider range of talent than might be present within its own boundaries.

2. Customer intelligence: By interacting with "the crowd", organizations can gain insight into customers' or potential customers' preferences.

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3. Rapid problem-solving: Problems may be explored and solved quickly, without diverting an organization's staff away from their current tasks.

4. Low cost: Crowdsourcing tends to be cheaper than alternatives – payment is only for the solution chosen or may even be omitted/substituted with a prize or even just the kudos associated with winning.

5. Public relations: Good crowdsourcing competitions can create a media buzz that can add to marketing efforts.

6. User community: By interacting with a crowdsourcing company, participants may develop a kinship from a sense of ownership of the company's destiny.

Despite its popularity, however, crowdsourcing is not without its problems (Kleeman et al., 2010; tinyurl.com/b47qrtv; Brabham, 2012; tinyurl.com/b6pjfp2; Chanal and Caron-Fasan, 2010; tinyurl.com/az6ryjm). Resistance to crowdsourcing is perhaps most evident in the advent of "crowdslapping" whereby the crowd subverts the sourcing process for different means. In particular, crowdsourcing may face the following eight issues:

1. Project delays: Because there is no guarantee that the crowd has the ability to provide the solutions sought, or the motivation to see a project through, projects may drag on and not be brought to an acceptable conclusion.

2. Solution quality: Because crowdsourcing participants are often amateurs, their solutions may be unrealistic or of a poor standard.

3. Ambiguous liability: Because of the lack of employment contracts, liability for faulty or poor-quality work lies completely with the company that used the crowdsourcing solution.

4. Temporary relationship: It may be difficult to maintain an ongoing working relationship with a winning crowdsourcing participant beyond them being declared the winner, which may also impact on the quality of what is implemented.

5. Professionalism challenge: Crowdsourcing can annoy and discourage internal employees or traditional contractors who see their professionalism being undermined.

6. Identity clash: Because crowdsourcing winners are not part of the company and have no ongoing relationship with it, their solutions may not fit with the identity or culture of the organization.

7. Exploitation and reputation effects: Below-market wages, or no wages, and the opportunity to exploit the intellectual property and labour of crowdsourcing participants because of a lack of contractual obligations raises ethical issues that may damage a firm's reputation.

8. Losers disenfranchised: Crowdsourcing can discourage those participants who do not win and lessen their opinion of the company that sponsored the crowdsourcing initiative.

When crowdsourcing is aimed at generating novel R&D solutions, several of the issues listed above may be exacerbated. Not only do the problems and potential solutions tend to be of far greater complexity, but the value of the intellectual property may be several orders of magnitude greater than, for example, the typical crowdsourced clothing design solutions. Crowdsourcing can be more time- and effort-intensive and the solution may not "stick" within the firm because it was not internally generated – the "not-invented-here" syndrome at work. If the solution is viewed as good, it may also be perceived as a threat to the professional integrity of the internal research staff.

Thus, for organizations that have been the traditional provider of basic and customized R&D, crowdsourcing has the potential to undermine their traditional business models. With governmental debt crises growing around the world, public R&D investments are forecast to decline in relative terms, placing significant pressure on organizational budgets and raising questions about how new revenue sources may be attained. Can elements of crowdsourcing help solve these challenges for R&D organizations?

In this article, we look at how an R&D organization in New Zealand developed a variant of crowdsourcing processes that addresses some of the dilemmas identified above. The R&D provider's novel approach delivers the benefits of greater openness by developing new connections outside of the organization. In continuing to prioritize and leverage the expertise of R&D staff, it has the potential to avoid some contentious aspects of crowdsourcing for R&D organizations. Because this practice

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seeks to build relationships by exploring problems, we have termed this approach problem-oriented crowdsourcing, or "problemsourcing". Problemsourcing is akin to crowdsourcing *in reverse* in that the open call initiator, not the crowd, holds the problem-solving capabilities, and the crowd-members offer not solutions but promising problems that would create substantial value if solved.

Problemsourcing: What's Your Problem New Zealand?

Industrial Research Limited (IRL; recently rebranded as Callaghan Innovation: callaghaninnovation.govt.nz) is a government-owned Crown Research Institute (CRI; tinyurl.com/ajy5omm), charged with providing R&D support to industry in New Zealand. IRL was founded in 1992 and has a broad mission to encourage firms to invest more into R&D, and thereby improve New Zealand's economy. In 2009, IRL launched the "What's Your Problem New Zealand?" competition by putting out an open invitation to all New Zealand firms to describe their challenging R&D problem that, if selected and solved by IRL, would advance their business and contribute to the national economy. IRL offered the winning firm $1 million of R&D services at its facilities.

The idea behind the competition came from IRL staff members. One of them, Dr. Benjes, stated that "by getting industry to talk to us, we will be far better placed to understand, and respond to, their changing R&D needs". IRL's CEO, Shaun Coffey, commented that "part of IRL's strategy is to better engage with industry over the coming years and when the team came up with "What's Your Problem New Zealand?", the idea really resonated with me". A "whole of IRL approach" was taken to promoting the competition, involving "not just the marketing guys" – IRL also had all its employees talking to existing and potential clients.

The competition attracted over 100 applicants and involved two stages. In the opening stage, applicants submitted a two-page proposal and completed a brief questionnaire. IRL examined the proposals and selected 10 finalists. Coffey stated that it was "particularly encouraging that we got quality entries from across the variety of sectors we serve". Given New Zealand's small size, the high number of applicants indicated to Coffey that "there is clearly a stronger interest in innovation and research and development in medium and small businesses than most New Zealanders realise". He was

particularly impressed by the number of organizations applying given the deteriorating economic conditions and financial climate, noting that this indicated many of New Zealand's leading firms were still thinking ahead. (A working paper containing a demographic analysis of the competition entrants is available at the Problemsourcing website: tinyurl.com/ak95t7n.)

One of IRL's main objectives for the competition was to forge new relationships with New Zealand firms because, in addition to fulfilling its mandate from the New Zealand Government, IRL also needed to secure fresh sources of revenue in response to the global financial crisis. Indeed, the initiative allowed IRL to gain very good market intelligence and create a strong platform of potential future business. This objective was partially met mid-competition. In late 2009, Coffey stated that the "What's Your Problem New Zealand?" competition had already increased the value of IRL's potential contracts pipeline with the IRL business development team working with all the finalists and potentially many more of the applicants – "the lines of communication have been opened with many ambitious firms".

The second stage of the competition required the 10 finalists to consult with IRL science and commercialization experts in submitting a second application form and determining a possible path to solving their problem. The competition's independent judging panel was made up of several business and science leaders including specialists in market development, commercialization, investment, intellectual property, and science. In assessing the applicants' proposals, the judging panel was looking for the following:

1. An accurate description of the business' vision and direction, its target markets, and market positioning.

2. A clear definition of the technology problem or R&D need of the New Zealand company.

3. An identification of key IRL capabilities required to develop the novel solution.

4. A description of the impact (e.g., financial, spill-over, or economic benefits) the $1m solution will have on the business.

5. An identification of the additional resources within the company to take the novel solution into growing markets.

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IRL scientists and business development staff liaised with the judges to ensure they ultimately selected a project that could be feasibly delivered. The judges determined that the 10 finalists were all well deserving of the million dollars' worth of R&D spend, but paint manufacturer Resene's "problem" was determined as that most likely to benefit from the application of IRL expertise and was announced as the competition winner.

Resene (resene.com) proposed to develop a resin-based waterborne paint made of 80 per cent sustainable ingredients. Resene's technical manager Danusia Wypych explained that the firm had been unable to find such a product on the market. At this time, paints with only 30 or 40 per cent sustainable ingredients were considered environmentally friendly. Wypych described today's improvements in paint sustainability as small tweaks of current technology, whereas Resene wanted to challenge the fundamental dependence on petrochemicals. Sustainable paints are typically twice as expensive as ordinary paints; Resene hoped to make a superior sustainable paint for around four-fifths the price of competing sustainable paints. Wypych stated that "we had a clear idea of what we wanted. More than anything, we knew where the gap in the market was".

Yet, Resene lacked the necessary resources to develop its environmentally friendly paint on its own, and therefore entered IRL's competition. Resene expected the million dollar prize to provide around 18–24 months of R&D at IRL. Wypych believed that $1 million worth of access to IRL's world-leading facilities and expertise was much more valuable than $1 million cash in hand. She argued that without IRL's help, developing a sustainable resin-based paint would have otherwise required enlisting the help of an international partner and conducting up to six years of research and development.

IRL made sure to capitalize on the opportunity offered by the competition to acquire new technical knowledge and skills. The CRI put a team of four scientists on the full-time job of solving Resene's problem who were excited by the project because it took them one step beyond what they normally do. Dr. Simon Hinkley, lead IRL chemist stated: "We have had access to the significant expertise within Resene and some of its international partners. As a result, we've learned a huge amount, uncovered a range of techniques and abilities held by our colleagues in IRL, and moved into a whole series of new fields we didn't realise we had the skills to tackle".

The media attention generated by the competition did, however, render it essential for IRL's reputation that the team succeed in solving Resene's problem. By January 2010, Resene announced that the team had discovered the secret ingredient required to produce its environmentally friendly paint. By mid-2012, a novel binding ingredient had been developed and a patent application had been submitted. After teaming up with Auckland University (auckland.ac.nz), a larger four-year grant to develop a full coating system was obtained from the New Zealand Government. The potential for significant future earnings seemed secure.

A potential drawback of the competition format was that the losing finalists were disappointed. Even so, in addition to the Resene project, several other proposals from the competition were also negotiated as research projects. IRL science group leader Richard Furneaux confirmed that "we hope to find ways to get all of the 10 finalists' ideas into proper business cases and then funded in one way or another". IRL had anticipated the need to help losing contestants find funding, and had required all applicants to write their proposals in a similar format to that used by the main government funding body.

Although IRL offered the competition winner R&D valued at $1 million at market rates, it did not actually cost IRL that amount. Moreover, the competition added to IRL's bottom line through other companies that did not win providing new business. IRL's Communications Department claimed that the organization expected to be "reaping the rewards over the next few years… we've built some relationships with companies that we hadn't in the past, and strengthened some other relationships".

Finally, IRL ran the competition partly to stimulate industry thought on how to improve New Zealand's competitiveness as the global economy moved toward recovery. Naturally, IRL's answer to this competitiveness question was a greater commitment to innovation from New Zealand firms, and the competition was viewed to have significantly helped IRL toward its goal of raising the profile of R&D. With IRL leveraging the competition as a newsworthy event, some of the finalists also contributed to the competition's media coverage, helping to tell the story that their involvement in the competition helped them to activate or reactivate their engagement in structured R&D.

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Problemsourcing as a New Open Innovation Practice

For IRL (and Resene), the competition was a great success and not just because the organization managed to source one good problem to solve from the "crowd" of business organizations in New Zealand. Using the framework of eight issues that may befall the use of crowdsourcing outlined earlier, we can reflect upon how this new practice of "problemsourcing" may offer R&D service organizations a number of strategic benefits when looking to take advantage of the new possibilities granted by open innovation.

1. Project delays
When crowdsourcing competitions are not successful, the cause is typically crowd-member disengagement fuelled by vague project descriptions and opaque winner-selection processes. Project delays are less of an issue with problemsourcing, at least at the front end of the project, because there are incentives for both parties to ensure the problem and path towards a potential solution are well-defined. In the case of the "What's Your Problem New Zealand?" competition, this involved negotiations between applicants and IRL staff, so an understanding of each other's requirements was established in the lead-up to the competition deadline. Where project delays may still be an issue is in the phase following the commencement of the research into solving the problem. Once again, though, both sides are motivated to make sure the project stays on track. In the winner's case, Resene is keen to establish these products in their markets and the IRL team is motivated to show that it can solve such business problems in a realistic timeframe.

2. Solution quality
Similar to the factors in problemsourcing that reduce the likelihood of project delays, the second phase of developing applications for the "What's Your Problem New Zealand?" competition significantly reduced the risk of poor-quality problems being serious contenders for the prize. One of the central criteria used in the competition was a consideration of whether it was thought that IRL held the capabilities to potentially solve the problem. Of the 90 non-finalist applications, some problems were filtered out as being either unrealistic ideas or a poor fit for IRL's capabilities. Thus, the issue about professional qualifications of the solvers is more about fit to the problem. The remaining challenge for IRL's professional researchers is to make sure the problem is solved in a high-quality way, but unlike in the case of crowdsourcing, this can be monitored and controlled given that the solution is being developed inside IRL.

3. Ambiguous liability
Because the problemsourcing organization is sourcing a problem rather than a solution, any liability that may originate from its involvement is less likely to be an issue, particularly as the relationship is an ongoing one rather than the more fleeting interactions that can typify crowdsourcing. Given that, in the problemsourcing model, most of the research into finding a solution is conducted inside the problemsourcing organization, and any liability issues can be more easily managed. In the IRL case, the nature of the competition process meant that, by the final selection, thorough contracts with well-defined responsibilities and expectations were in place, which also should have minimize any liability resulting from poor-quality work.

4. Temporary relationship
Unlike solution-oriented crowdsourcing whereby the relationship often starts and finishes very promptly after the solution has been submitted, with problemsourcing there is an ongoing relationship for the duration of the ensuing research project. It is also likely that, if a viable and profitable solution is developed through the collaboration, subsequent projects may result. In this case, the IRL team becomes an essential part of Resene's innovation capability, and it would be very hard for another research organization to replicate the depth of customer understanding that is likely to result from the competition. In addition, relationships with the other nine finalists are also likely to develop to varying degrees, depending on the availability of other funding sources. Because of the staged nature of the competition, IRL and the other companies had all worked together to develop a project and IP plan, so trust and mutual knowledge generation has already been developed to a far greater level than existed prior to the competition. Thus, problemsourcing has the potential to initiate multiple relationships.

5. Professionalism challenge
Problemsourcing potentially has the opposite effect to crowdsourcing in terms of how it affects the professional researchers' credibility, given that it is based on the internal professionals' ability to produce a solution that the competition winner is unable to develop without their help. Thus, employees are most likely to support and actively participate in the problemsourcing activity, unlike the case when external professionals are

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used. Once again though, issues may arise if a solution is not delivered, because the professionalism of the internal researchers could be seriously questioned. Although practicable steps can be taken during the selection process to reduce uncertainty and increase the likelihood of solution delivery, non-delivery will always remain a risk with problemsourcing.

6. Identity clash

In problemsourcing, the problem will always be aligned with the identity of the company that needs a solution, and the open-call initiator should only agree to develop a solution if they have the resources and capabilities to do so. Both crowdsourcing and problemsourcing cannot operate without companies disclosing information about their problems to outsiders, and there will always be some companies that cannot make this reputational "leap of faith". Problemsourcing, however, enables the R&D organization to only tackle problems that are aligned with its identity as reflected in its capabilities. The R&D organization's identity will be reinforced if a solution is successfully delivered and then commercialized. As indicated in the IRL case, the underlying "asking the nation" theme behind the "What's Your Problem New Zealand?" problemsourcing challenge played to IRL's identity as a Crown-owned enterprise charged with providing "public good" research that will enhance the economy. Thus problem-oriented crowdsourcing for R&D or innovation projects is more likely to reinforce than negate the research organization's identity.

7. Exploitation and reputation

Crowdsourcing is often critiqued as commercial exploitation of labour given that crowd members usually lose their intellectual property. Problemsourcing's greatest advantage over crowdsourcing relates to this issue. Although the process of defining the winner's problem could potentially generate points of contention around intellectual property, most of these issues would be uncovered during the problemsourcing negotiation and development of the eventual solution. In the IRL process, these aspects were carefully negotiated with advice from a patent law firm during the competition process. In addition, the researchers internal to IRL are "paid" at their normal salary rate during the problem-solving process so there are no unpaid workers to be exploited during the competition.

Granted, those companies that did not win the competition could potentially be seen to have incurred opportunity costs from the application process. However, the fact that advice about intellectual property was made

available and the application form was designed to align with funding agency requirements meant that the problem-providing companies still potentially benefited from the process.

With standard, solution-oriented crowdsourcing, the sourcing company may be accused of unethical behaviour because it stands to gain even from the unsuccessful solutions, and this aspect can significantly damage its reputation. In contrast, the experience here was that IRL's reputation was greatly enhanced in the eyes of many stakeholders. Overall, IRL was seen to be far more responsive to industry needs, to be contributing to lifting the performance of the economy, and to be encouraging greater private sector productivity through enhanced R&D in New Zealand's firms.

8. Losers disenfranchised

Disenfranchisement of the crowd-member companies that do not have their problem selected is a potential pitfall with problemsourcing. As indicated in the case study, though, the process IRL instituted was predicated on developing potential relationships with all of the finalists rather than just a focus on the winner. The finalists all would have benefited from the knowledge development and sharing that ensued during the negotiation process. Even the companies further down "the tail" of applicants were given some level of advice with respect to market opportunities and intellectual property. Thus, a process for aligning expectations is very important for minimizing the disappointment felt by problemsourcing losers.

Conclusion

The success of the "What's Your Problem New Zealand?" challenge is at this stage measured primarily by the range of high-quality problems that were proposed as well as the sheer number of companies (in a small nation) that, by submitting problems, indicated an interest in participating in such a process. Whatever the eventuality for IRL and Resene, we believe that this case represents an interesting new organizational manifestation of local open innovation, which is a variant of crowdsourcing for corporate R&D and complex innovation. One essential difference between crowdsourcing and problemsourcing is the location of the innovative activity. With crowdsourcing, innovative activity is distributed somewhere in the crowd, but with problemsourcing, it remains firmly within the boundaries of the R&D organization, which we propose mitigates many of the risks and pitfalls associated with typical crowdsourcing initiatives.

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Problemsourcing by R&D organizations has many advantages over solution-oriented crowdsourcing, especially when the process is designed to be considerate of issues relating to the development of intellectual property longer-term relationships with both winners and promising losers. For the competition winner, the prize was seen to be valuable beyond the equivalent cash amount and yet, for IRL, the direct cost was even lower. Both firms view the outcome as a win. The case study also highlights that, by considering the competition participants' objectives and motivations early on, some wins can also be achieved for other contestant firms.

Our study presents a range of implications for managers and researchers. For IRL, as a professional R&D organization, simply sourcing solutions from the crowd would have run counter to its traditional business model and primary means of generating value. Yet, by recognizing that the organization and its potential clients were overly closed to the possible benefits of collaborative relationships, IRL embraced open innovation through the competition. Similar benefits may be attainable for other types of organizations if they adapt their initiatives to achieve a combination of their own objectives and those of their targeted stakeholders. In conclusion, while considerable attention has been paid to open innovation and crowdsourcing, we believe that our case study highlights that companies can still be creative in adapting open innovation and crowdsourcing to suit their business circumstances.

About the Authors

Sally Davenport is Professor of Management at Victoria Business School in Wellington, New Zealand. Her PhD in Chemistry was obtained at IRL's predecessor organization and she has maintained close research relationships based on her scientific background. Sally's research interests include the strategic management of innovation, interaction between innovation stakeholders in the commercialization of research and the discourse of scientific organizations. She has published in a range of journals including *Research Policy, Technovation, Journal of Technology Transfer, R&D Management, Innovation: Management, Policy & Practice, Science & Public Policy,* and *Technology Analysis & Strategic Management.*

Stephen Cummings is Professor of Strategy at Victoria Business School in Wellington, New Zealand. His research interests include the history of management and creative approaches to strategy development. His publications have appeared in *Academy of Management Executive, Academy of Management Learning & Education, Business Horizons, Long Range Planning, Organization,* and *Organization Studies.* His recent books include *Recreating Strategy, The Strategy Pathfinder, Creative Strategy: Reconnecting Business and Innovation,* and the forthcoming *Handbook of Management and Creativity.*

Urs Daellenbach is a Reader in Management at Victoria Business School in Wellington, New Zealand. His research interests focus on the resource-based view of the firm with a specific focus on contexts associated with R&D and innovation and where multiple diverse stakeholders may create advantages cooperatively. His publications have appeared in *Strategic Management Journal, Long Range Planning, Industrial & Corporate Change, Journal of Management Studies, Journal of Technology Transfer,* and *R&D Management.*

Charles Campbell is a researcher at Victoria Business School in Wellington, New Zealand. Charles has a PhD in History from the University Canterbury. He is also a novelist and is currently based in the Otago region of New Zealand.