

IP and proof of concept

In the experience of Dan Richardson and Dr Paul McEvoy at Technology from Ideas in Dublin and Cathal Lane at Tomkins & Co, there are four main disciplines to observe in taking early-stage technologies to market.

The translation of technology ideas into tangible and viable concepts is an activity known as proof of concept (POC) development. This early-stage development process lies at the interface between research and development activities, and is critical if valuable resources are to be deployed efficiently in creating and protecting intellectual property (IP). POC development is conducted by industry, universities and inventors themselves. However it is an activity that is often not conducted well, and may be best outsourced to specialist companies.

Irrespective of whether the customer for your IP is internal or external,¹ a well-conducted POC project leading to a robust business case is achievable provided certain principles are followed. This chapter describes methodologies used by POC specialists that can be successfully deployed to improve the identification, development and exploitation of early-stage technologies, particularly in small and medium-sized enterprises (SMEs) and universities.

Environment and people

As ideas emerge from research, their fast and efficient transition into revenue-generating IP is a challenge which requires the right environment and people. The successful ingredients include:

- bottom-line focus with a willingness to terminate projects when required;

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- focus on delivering ‘investment ready’ technologies;
- focus on delivering what prospective customers want, with direct market feedback rather than areas of interesting science setting project objectives;
- a generalist, system engineering perspective of the technology and how it fits into the broader product or system;
- a multidisciplinary team of scientists, engineers, patent attorneys and outsourced expertise.

Assembling these ingredients, all within the right commercially focused yet objective culture, is not easy, which is why universities and SMEs often find POC development challenging. It is important to note that the inventor is often not the best person to lead a POC project, and their expertise can best be exploited in a technical capacity.

Sourcing ideas

It is important that developers of technology recognize that good IP can come from any source, not just internally. The transition towards open innovation² demonstrates that successful technology companies exploit IP from multiple sources (eg universities, SMEs, customers, competitors) and organize themselves to engage with a multiplicity of potential IP suppliers.

It can be difficult to know where to look for in-licensing opportunities, and it can be more reassuring to stick to ideas sourced internally. However, something as simple as a patent search on competitor names can start the ball rolling on the assessment of the IP landscape. Government support is available in many European countries to assist (see box). Furthermore, it can be beneficial to explore bundling IP from multiple sources to create more substantial opportunities and fill gaps in internal IP portfolios.

Technology search service

In Ireland, the government agency Enterprise Ireland provides a dedicated technology search service (Tech Search www.techsearch.ie) to SMEs. This enables SMEs to find IP from many sources including universities, other SMEs and multinationals. This support can fast track the POC process and help identify potentially valuable IP of which SMEs would otherwise be unaware.

Selection/filtering

Once a potential idea has been identified, a decision needs to be made whether to invest in it. This decision-making process should ensure critical issues are highlighted at an early stage:

- Be clear on the benefits of the technology to the end customer. Technologists are often poor at framing the benefits of their technology (eg it saves €15 million per

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year; it generates €50 million in new revenue over three years). This is best linked to known problems or shortfalls that can be ultimately linked to the bottom line of a business (what is the corporate 'pain' your technology is relieving?). Avoid technical terms and keep it simple as decisions on subsequent investment are usually not made by technical experts.

- Estimate, reduce and eliminate risks. Be clear where your risks are (market? IP? technology?), and use the initial analysis project to reduce them. For those that cannot be removed, assess whether your planned POC project will reduce them sufficiently to make the IP 'investment ready'.
- Calculate the potential return on investment (ROI) for the project, considering the outstanding risks. Sometimes this is difficult to do where new products or new markets are concerned. Whatever discount factors you use in establishing the viability of your project, be realistic about the risk of the project. Early-stage projects are invariably risky, and therefore should have discount factors attributed appropriately.
- Include strategic fit as part of the process. Do not be sidetracked on interesting projects which do not fit with the longer-term plans of the company.

Development

Project management

There is often a risk that POC activities are run more like curiosity-driven research projects than commercially focused development projects. This should be avoided. Clear project management principles must be employed, such as PRINCE2 or PMI, with a stage gate plan formulated and progress regularly reviewed against it. This plan should be augmented with two other documents: a risk register and business case.

The risk register is used to track and monitor how the identified risks change during the project. It is important that these are the perceived risks identified through dialogue with potential customers. The aim should be that by the end of the project these risks reach a low enough level that there is confidence to invest in the next stage of development.

The business case is a document that should 'sell' the opportunity to those investing in the next stage of development. It should summarize the market opportunity, the robustness of the IP position and the viability of the technology. It is a living document and should be updated regularly during a project along with the risk register to ensure that the rationale for investment has not changed. Ultimately this should lead to a view on the valuation of the IP.³

Well-defined project deliverables should be identified that have a clear link to the risk areas identified by potential customers. In early-stage POC projects, new information can be gained very quickly and this could change what you want in your deliverables. While 'moving the goalposts' is often seen as a sign of poor project management, it may be necessary to do it, in a systematic way that improves the likelihood of a successful project. Flexibility is the key.

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Perhaps the most important and difficult skill to develop in your POC team is the ability to take an unbiased view of the potential of the IP. Management must be willing to terminate a project at any stage, and should encourage project managers to do this without fear of being seen as failures.

Key activities

There are four key work packages that should form the core of any POC development: All are interrelated, and can inform and stimulate further activities in each of the other work packages. Each work package will typically be conducted continuously throughout the project, and will then form the main content of the business case.

Market analysis

As in any market-led project, market research fundamentals (eg analysis of competitors, technology cost structures and business models) underpin this analysis. The most common reason that POC projects fail is that the market has not been understood adequately. This can be for a multitude of reasons including:

- Lack of understanding of the *real* user requirements.
- Lack of understanding of who the customer is: the person who pays you for your IP is not necessarily the end user of your IP.
- Targeting the wrong market. The largest market may not be the right market to target first. Smaller, niche markets may present better entry opportunities because of their lower specification requirements or higher risk tolerance. Larger high-value markets often have regulation risks and manufacturing cost risks attached.
- Poor knowledge of cost structure in the market. It is important that you understand what is typically paid for IP in your market, and furthermore, what value may be attributed to your piece of IP (see box).
- Bad timing (the opportunity passes). It is crucial that you look ahead and factor in adoption timescales typical for the market you are in.

It is therefore vital that before embarking on a POC project, discussions with potential customers are conducted. There are various tools for capturing this knowledge and mapping it onto your concept characteristics (eg quality function deployment (QFD)⁴), and if appropriate these should be used. If you direct your project towards specific customer requirements, it becomes less ‘technology push’ and more ‘market led’. This should be the objective of all POC projects as this can significantly reduce market risk.

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Cost structure

The cost of mobile phones varies greatly across a number of different price points. Typically, IP itself runs around 5–7 per cent of the total cost which is different than the price at retail because the wireless operator always ‘buys down’ the capital cost of the product and gains it back on monthly revenue. Taking the example of a low-end mobile phone, a typical manufacturing cost may be around €50. For a mature mobile phone technology, the cumulative IP element of this is typically around 6 per cent (around €3) and comprises a basket of about 20 patents covering ‘essential IPR’ associated with the standard. Of these patents, a small number will be considered key, some will be middle ranking with the remainder being lower value. The royalties will therefore be attributed to IP owners on this basis. For high end, more technically advanced phones, the IP costs can increase significantly. Understanding such complexity in cost structure is therefore vital if your POC project is to be successful.

IP development and protection

The best and often most efficient method to develop and actively manage IP through the project is to engage professional advisors as part of a team. This ensures that the targeted IP position is tested as part of the project, extending the IP space occupied by the patent to its fullest extent. It also ensures that searches are conducted at the earliest point possible, often saving money that would otherwise be wasted on pointless work.

This way of working is common amongst large R&D companies and technology development specialists, but can often be hard to achieve in SMEs and universities. However, dynamic patent attorneys are willing to work in this interactive way with clients as it invariably leads to better and stronger patents, and also improves the understanding of development staff in the drafting and filing process.

Technology prototyping

The level of evidence required to make your IP ‘investment ready’ will vary from sector to sector and from customer to customer. Some may be happy with simulation results and some may require laboratory-scale prototypes. Your plan must establish this in advance to ensure you will meet the expectations of the customer by the end of your project.

A useful method for focusing your project is the NASA technology readiness level (TRL) scale.⁵ This provides a view on the maturity of your IP and how close it is to the market in a systematic fashion (eg a TRL of 0 is ‘Basic principles observed

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and reported' and a TRL of 9 is 'Actual system "mission proven" through successful mission operations'). One additional factor to consider here is the TRL of other technologies that your IP may be reliant on. In reality the customer is not only interested in your TRL but the combination of all IP and the readiness of the overall system solution (often called the system readiness level or SRL).

The golden rule here is to avoid getting sidetracked by interesting science. Achieving the deliverables within cost and budget is the key metric of success in POC development, not producing scientific papers.

Product development road map

This is the element that is most often missing from the marketing of IP. It essentially outlines to the customer what they will have to do next to take the IP to market. Often the customer may be best placed to establish this, and therefore this road map can be developed further through dialogue with them. To make IP investment ready it is important that a clear plan to market is in place detailing:

- The risks to be overcome. How large are they? What are the chances of failure?
- Finance required to take this IP to market.
- Timeline for, and stage gates in, the development plan.
- Other IP required to make this happen. What are the constraints on access to this IP?

Sale

Depending on who is conducting a POC project, its completion either leads to a sale/licence, further technology development projects and/or a subsequent product development programme. Whether your customer is internal or external, a sales pitch will be required to secure further investment. This should be based on the outputs from the four work packages outlined above in a way which sells the benefits of the technology, not the technology itself.

As the market for IP becomes more liquid, the routes to market for IP are increasing. Patent brokers can support this process, as can web portals. Patent auctions are now also becoming a viable alternative for realizing value quickly and effectively.

Summary and future trends

The dramatic increase in the levels of licensing within the IP market over recent years, and the trend towards open innovation, mean that there are an increasing number of IP suppliers pitching their wares to potential buyers, which are now open to using externally sourced IP. However the challenge of taking IP from the lab to market

remains as demanding as ever, with many technologies on offer just not ready for customers to license. To make technology ‘investment ready’ requires a POC project to be undertaken by a commercially focused, multidisciplinary team that addresses the key concerns of prospective customers. Whether you engage specialists in this field or conduct your own POC projects, developing revenue-generating IP remains an exciting but difficult activity.

Notes

- 1 In this chapter, customers for IP are considered as external, but the same principles apply if your customer is within your own organization.
- 2 Henry Chesbrough, *Open Innovation*, Harvard Business School Press (2003).
- 3 There are a number of different methods and all are summarized in Richard Razgaitis, *Valuation and Pricing of Technology Based Intellectual Property*, Wiley (2003).
- 4 see http://en.wikipedia.org/wiki/Quality_Function_Deployment
- 5 see http://esto.nasa.gov/files/TRL_definitions.pdf

Technology from Ideas (TfI) is a technology commercialization company that specializes in conducting proof of concept (POC) development of early-stage ideas within the physical sciences and engineering domains. TfI sources ideas mainly from researchers in partnered universities, and develops these into investment-ready technologies with their own scientists and engineers in their own labs. It then sells or licenses the proven technology in conjunction with its partners, who conduct subsequent product development work for end customers. Profits from sales are then shared with the university and researcher.

Tomkins & Co. was established in 1930 by Arthur Bellamy Tomkins, and is one of Europe’s longest-established IP law specialists. With 50 top quality people, working in established teams, it consistently delivers high-calibre practical advice across a broad range of technical domains. Its clients range from large corporations and multinationals to individual inventors and entrepreneurs.