REGAL: A Successful Model of Collaboration for Innovation between University and Aluminium Industry

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Abstract

Innovation is the key driver to meet business objectives in today's highly competitive industry and the aluminium industry in not exempt from this rule. In turn, the backbone of innovation is "*people*" since no innovation is expected from a machine. Education is of primary importance to assure the succession of highly qualified "*people*" and training "*minds*" for tomorrow. Although the educational institutes are the primary responsible to train "*people*", the training is a shared responsibility and the collaboration of the industry is necessary to make this process more efficient and targeted. In this paper, we will present Aluminium Research Center (REGAL) as an example of successful collaboration between aluminium industry and educational institutes. The objectives of the Center and its mode of operation will be discussed, followed by a few examples and outcomes.

Keywords: University-Industry collaboration, REGAL, Innovation, Training.

1. Introduction

Innovation is the leading component of competitiveness of a company, especially when the characteristics of the market is rapidly changing. According to McKinsey & Company [1], 84% of the executives interviewed agree on the importance of innovation on the success and growth of their business. More drastically, many of them support the theme "*Innovate or Die*". While there is a consensus that innovation gives competitive advantage to the companies, this advantage is volatile or difficult to maintain in a rapidly changing market environment [2]. Thus, to keep the competitive advantage, the company needs to innovate, constantly and sustainably.

Innovation, according to Merriam Webster, can refer to something new or to a change made to an existing product, idea, or field. In more specific terms, innovation could be defined as "*developing new technologies and bringing them to the market*" or "*developing the new means of operation to adapt a process to the new market realities*". The literature is rich of ideas, surveys and reviews, all attempting to provide successful models for innovation.

Innovation is indeed crucial in rapidly changing industries; i.e. video-game or software industries, with products of extremely short life span. In a more traditional industry, such as aluminium industry, one may think that the need for innovation is not that urgent since the industry uses a century-old technology, Hall-Héroult process. Furthermore, all competitors use the same technology, with some minor differences which give them competitive advantage to some extent. The point is that the need for innovation is not necessarily limited to the core business or technology. In fact, the competitiveness does not rely on the core process only, but also on the related technologies. For instance, integration of sophisticated measuring and monitoring tools, artificial intelligence, and data processing algorithms into the main process have substantially changed aluminium process during the past decades. New solutions, namely digitalization and automation have emerged in this industry, leading it to the fourth industrial revolution: Industry 4.0 [3]. This makes the industry more multidisciplinary than ever. No one

producer can hope to keep its competitiveness without aggressive innovation plans to integrate and take advantage of these emerging technologies in its core process.

Beside the competition with traditional competitors, that are the other aluminium producers, a number of other parameters also force the industry to innovate. The main one is the competition of aluminium with other materials. Development of high-performance steel alloys or light-weight composites threatens the market share of aluminium, forcing the industry to be more and more cost effective and to permanently innovate to develop new alloys meeting expressed or unexpressed end user needs. Another parameter is the shortage of raw materials or their degrading characteristics. The tremendous growth of aluminium production rate during past few decades results in the shortage of high-quality raw materials, thus forcing the industry to continuously adapt itself to the new, rather low-quality, raw materials. Finally, new and increasingly tight regulations force the industry to decrease its environmental footprint and improve its social image. Addressing all these challenges is not possible but by sustainable innovation.

Considering the multidisciplinary characteristic of the aluminium industry and the need for innovation in multiple fronts, it is hard to conceive that a firm can afford it alone. The good news is that part of innovation process can be outsourced. The concept of outsourcing innovation was very well described by Henry Chesbrough [4]. It is so important that Chesbrough's book was cited more than 19 000 times since its publication in 2003. The concept, as summarized below, is quite simple: it challenges the "*closed innovation paradigm*" and proposes "*open innovation*" instead.

Closed innovation, having been practiced for longtime in the past century by many successful companies, is based on full control of the innovation by the firm. That is the company generates the new ideas, develops them and markets them. The famous innovation funnel (Figure 1) is well describing the closed innovation process, where the ideas are generated inside the company, pass through R&D and development steps followed by the *Gate Reviews* and finally few of them survive up to the commercialization step. The boundaries of the funnel are impermeable and do not let any idea go out. The full control on whole innovation process gives the company a competitive advantage. New products are generated and the revenue increases. The firm re-invests a fraction of the revenue in R&D and innovation, resulting in generation and commercialization of other new ideas. Although the concept worked very well for a while, it suffered from difficulty to keep the sensitive information confidential, namely by moving employees. In addition, supporting the whole innovation chain required substantial R&D infrastructure and only large firms were able to afford it. Small and medium-sized businesses can still use this concept for simple processes, not requiring multidisciplinary R&D infrastructure.

Open Innovation concept was proposed to address issues encountered with *closed innovation*. The logic behind it is: It is more and more difficult to do everything internally and keep it confidential, so, why doing internally if it is possible to make it externally? As stated by J. B. Quinn [5]: "*with billions of minds becoming innovation sources for our marketplace, no one company acting alone can hope to out-innovate every competitor, potential competitor, supplier or external knowledge source around the world"*. Thus, the *open innovation paradigm* suggests to outsource the innovation and take advantage of it, no matter who generates it or where it is generated. As schematized in Figure 2, any part of the innovation process chain can be outsourced, as long as it is in line with the business model of the firm. The boundaries of the firm are not hermetic anymore, allowing the integration of the ideas or well-developed technologies inside the firm. Once integrated inside, the external innovation can be further developed by the firm or can be combined with those generated inside the firm to create new value-added innovation. In addition, if for any reason, the firm cannot

- UI collaboration is more efficient when the firm has an *Open Innovation* policy with a high-level of involvement in all steps of a research project and when the university team is recognized as a worldwide expert cluster in the collaboration field.

- The university team or the research center is more productive when it is multidisciplinary, capable of addressing all aspects of the technology simultaneously.

- The critical mass of the university team or the research center is an important factor enhancing the interaction of students, promoting collaborative learning process, and organizing complementary training sessions.

- The long-term collaborations with a firm result in the development of the specific know-how by the university staff related to the firm's requirements, making the training process more attractive and the communication and knowledge transfer more efficient.

- The benefits of the UI collaboration project should not be limited only to the measurable parameters, but the non-measured parameters should also be taken into the account.

7. References

1. https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/how-we-help-clients/growth-and-innovation.
2. Patrick Coldstream, Training minds for tomorrow: A shared responsibility, *Higher Education Quarterly*, 1994, 48(3), pp. 159-168.
3. C. Vanvoren et al., Contribution of ICSOBA in setting development trends in global bauxite, alumina and aluminium industry, *International ALUMINIUM Journal*, 2019, (7-8), pp. 37-41.
4. Henry William Chesbrough, Open innovation: The new imperative for creating and profiting from technology, *Boston, MA: Harvard Business School Press*, 2003, ISBN: 1-57851-837-1.
5. James Brian Quinn, Outsourcing innovation: the new engine of growth. *Sloan Management Review*, Summer 2000; 41, 4, ABI/INFORM Global.
6. Doris Schartinger, et al., Knowledge interactions between universities and industry in Austria: Sectoral patterns and determinants, *Research Policy*, 2002, **31**(3), pp. 303-328.
7. M. Perkmann and K. Walsh, University–industry relationships and open innovation: Towards a research agenda, *International Journal of Management Reviews*, 2007, 9(4), pp. 259-280.
8. Markus Perkmann et al., Academic engagement and commercialisation: A review of the literature on university–industry relations. *Research policy*, 2013, 42(2), pp. 423-442.
9. Nisit Manotungvorapun and Nathasit Gerdsri. University–industry collaboration: Assessing the matching quality between companies and academic partners. *IEEE Transactions on Engineering Management,* Early access 15 May 2019, pp. 1-18.
10. M. B. Sarkar, et al., The influence of complementarity, compatibility, and relationship capital on alliance performance, *J. Acad. Marketing Sci.*, 2001, vol. 29, no. 4, pp. 358–373.
11. Edwin Mansfield and Jeong-Yeon Lee, The modern university: contributor to industrial innovation and recipient of industrial R&D support, *Research policy*, 1996, 25(7), pp. 1047-1058.
12. Christian Barra, Ornella Wanda Maietta, and Roberto Zotti. Academic excellence, local knowledge spillovers and innovation in Europe, *Regional Studies*, 2019, 53(7), pp.1058-1069.

13. Ornella Wanda Maietta, Determinants of university–firm R&D collaboration and its impact on innovation: A perspective from a low-tech industry, *Research Policy*, 2015, 44(7), pp. 1341-1359.
14. Pablo D'Este et al., The relationship between interdisciplinarity and distinct modes of university-industry interaction, *Research Policy*, 2019, Article in press: https://doi.org/10.1016/j.respol.2019.05.008.
15. http://www.nserc-crsng.gc.ca/Innovate-Innover/alliance-alliance/index_eng.asp
16. Stephanie Bell, Project-based learning for the 21st century: Skills for the future, *The clearing house*, 2010, 83(2), pp. 39-43.
17. https://www.regal-aluminium.ca/en/home/
18. http://www.frqnt.gouv.qc.ca/accueil
19. https://www.regal-aluminium.ca/en/jer-en/encyclopaedia/
20. https://aluquebec.com
21. https://ceal-aluquebec.com