Assessing innovation and R&D capabilities across multi-center organizations

How companies can address the new R&D challenges

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Over the last decades most global companies have evolved to organize their innovation efforts through an "open innovation" model with individual research centers. Globalization and mergers & acquisitions have changed these networks, making them more complex to manage successfully. A robust capability assessment is the starting point for capturing synergies, fostering cross-center collaboration and steering critical make-or-buy and resource allocation decisions in the right direction. This article shows how this can be done.

Once upon a time companies handled their R&D activities in a single, large corporate laboratory, well-funded and equipped, with confidentiality closely protected. In fact, Arthur D. Little was instrumental in setting up many of these facilities, including General Motors' first ever research lab in 1911. For many decades this paradigm of corporate R&D was the norm. However, over the last decades companies began increasingly to adopt an "open innovation" model as the benefits of accessing a wider network of innovation resources became clear.

In this new model, corporate research centers became a node in a complex distributed network that involved academic institutions, clients, and specialized R&D companies as well as industry associations and competitors. This new world brought with it new mechanisms for collaboration, such as partnering, joint ventures, corporate venturing, technology licensing and spinouts. In the transition, many corporate laboratories have been downgraded and refocused on a smaller range of technologies, while companies have sought innovation from external sources.

In parallel, globalization and its accompanying mergers and acquisitions have transformed corporate R&D. Mergers have meant that companies have needed to restructure and integrate complementary and overlapping R&D activities and competencies. At the same time globalization has encouraged companies to relocate R&D activities across the world in both emerging and mature markets in order to innovate and exploit sources of expertise locally.

Picture by Cornelius20 / dreamstime

This transformation and the recent economic crisis have created a new management challenge.

How can we maximize return on investment from complex innovation networks spread across multiple geographies and spanning different business areas and units?

Companies looking for an answer to this question, must, as a first step, create a shared understanding of their current innovation and R&D capabilities. Once current capabilities have been assessed, companies can then go on to roadmap how they should be further developed, taking into account market requirements and the company's strategy and ambition. A robust capability assessment is thus the starting point for capturing synergies, fostering cross-center collaboration and steering critical make-or-buy and resource allocation decisions in the right direction

To assess innovation and R&D capabilities in these complex environments, companies must adopt an appropriate approach that is both robust and practical. In this article we outline one such assessment approach that has been found to be effective in large decentralized organizations.

The approach needs to consider the entire corporate innovation ecosystem, which encompasses all activities and participants from idea to finished product. This includes Research & Development (encompassing basic and applied research, as well as technology development through to feasibility testing and laboratory scale prototyping), Demonstration/Prototyping (including innovation operated at or near full scale in a realistic environment in order to show viability) and Deployment. In addition to traditional corporate laboratories, this ecosystem includes innovation groups within business units as well as the universe of external partners such as Research and Technology Organizations and academic institutions.

The approach considers capabilities along two dimensions: firstly, "Extension of capabilities", i.e, where the capability exists along the R&D value chain, and secondly, "Competency levers", i.e., the desired level of a competency in each respective extension. Criteria are defined to enable assessment of capabilities in terms of these two dimensions, as shown in Table 1.

Score/ Levels	Competency levers	Extension of capabilities		
		1 Design & release	2 Performance analysis	3 Testing & validation
Low 1. AC	**Assessment Competency**: Understand basic technical specifications	■ Collect and track the technical development and technology application, analyze the technology development trends ■ Analyze and translate the design requirements and product specification ■ Parts/module/product design and prototype development, including technical specification, process and standard development	■ Analyze the performance of technical elements of vehicle, system or component level ■ Analyze the performance of integrated vehicle, system or component ■ Identify the performance gaps and determine improvement potential ■ Coordinate with design/release to improve the product design	■ Develop, implement and execute the testing/validation plan ■ Conduct testing of key inputs and outputs of the product (system and component) as a whole ■ Conduct failure analysis to identify the reasons for failure ■ Develop testing/ validation procedures and standards according to new testing/validation requirements
2. EC	**Enhancement Competency** (incl. AC): Make marginal enhancement on selective key technical elements			
3. IC	**Integrating Competency** (incl. AC, EC): Understand interaction of all technical elements			
High 4. DC	**Driving Competency** (incl. AC, EC, IC): Drive the innovation standards and directions			

Table 1 **Main assessment criteria used to map capabilities across the organization's innovation network**

Source: Arthur D. Little

As may be seen, the "Extension of capabilities" dimension defines criteria in terms of three parts of the R&D value chain reflecting different aspects of the role of R&D: Design and release, which includes trend analysis, design and prototype development; Performance analysis, which includes analysis of technical elements of products, systems or components; and Testing & validation, which includes testing and validation activities.

The "Competency lever" dimension recognizes four levels of mastery: "Assessment", which means understanding basic technical specifications only; "Enhancement", which means being able to make marginal enhancements to selected technical elements;

"Integrating", which means having a complete understanding of technical elements and being able to create interactions and integrations between them; and "Driving", which means being able to drive standards and requirements.

In the assessment process, specific technological capabilities are assessed on the basis of these criteria for each internal and external organization in the network. Once the mapping has been done, it is much easier to identify potential opportunities for collaboration and options for rationalization within the innovation network. The assessment and the resulting visual representation provides an excellent vehicle to encourage rational debate amongst technical staff and managers on ways to increase effectiveness and performance and to reduce unnecessary duplication – this can otherwise be a sensitive and difficult exercise. The Box below provides an example of the approach as applied to a large power and gas utility provider.

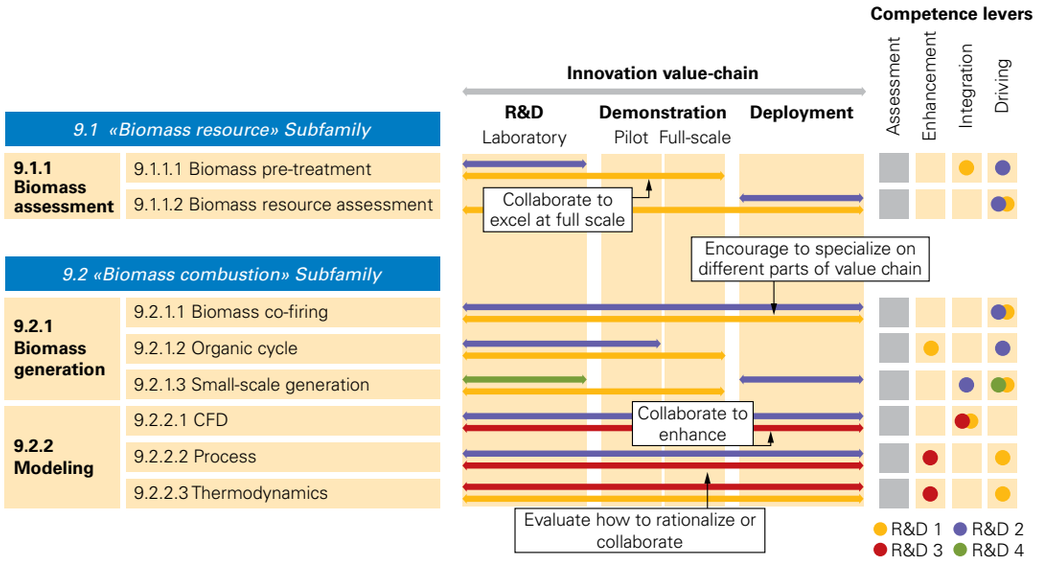

Table 2 **Biomass technology space showing options for collaboration or rationalization**

Source: Arthur D. Little

Assessing capabilities across multi-center organizations: a practical application

A leading vertically-integrated utility company in the power and gas market wished to understand better its R&D capabilities across its extended innovation network, comprising dedicated research centers and innovation groups within business units, as well as partner academic and specialized research service providers.

Table 2 represents the application of the assessment approach in the Biomass technology space covering themes specific to this industry. In this case the innovation value chain steps were customized to reflect the specifics of the industry R&D process and innovation network. The assessment covers four separate entities within the company's network, and highlights several opportunities within this technology family for integration, collaboration and synergies.

For example, in Biomass pre-treatment, Organic cycle and Small-scale generation, one or more R&D units possess Driving competencies in the Laboratory or Pilot Demonstration phases, while another R&D unit has Driving competencies at Full-scale Demonstration. This highlights the potential for collaboration between them to improve speed time to market.

In Biomass combustion modeling, two R&D units show a similar extent of capabilities with either the same competency lever (in CFD) or a very different competency lever (Process and Thermodynamics). Either rationalization or collaboration might be appropriate for this competency, depending on strategic importance and other factors.

In two other cases (Biomass resource assessment and Small-scale generation) one of the R&D units shows the ability to exploit competencies at the Deployment phase. Collaboration with R&D units with Lab, Pilot and Full-scale Demonstration competencies could provide a full "idea-to-application" capability.

Conclusions

For large global corporations with complex extended innovation networks of internal and external resources, it can be difficult to ensure that the returns on innovation investment are maximized. An effective assessment approach, such as the one briefly discussed above, is important in order to understand what capabilities are present across different parts of the network. By creating a powerful visual representation of these capabilities it becomes possible to identify in a transparent and rational manner what actionable opportunities exist for collaboration, exploiting synergies, and reducing wastage of resources.

Picture by Dmitry Shironosov / dreamstime

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