Introduction
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The contribution of innovation to a firm, region or state’s competitiveness provides a strong incentive to understand how to stimulate creative activity, to create and capture value, and strategically to protect investments made in an innovation system. Economic performance, often measured as per capita gross domestic product (pcGDP), is the most common measure that is used to compare a sector’s contribution to an economy, changes to an economy over time, or state-to-state comparisons. Although pcGDP is faulted for being an unreliable measure, it prevails because it is one of the few simple measures available. It is valued for being a somewhat comprehensive endpoint measure, in the sense that innovative, value-creating activity has to happen before an impact on pcGDP is appreciable. Firms and governments, often feeling the sting of late-stage performance appraisals, seek measures of innovation further upstream in value chains to give them tools actively to manage innovation.

The quest to measure innovation to manage it better generates problems for firms and governments. As many economies around the world make the transition from a production base to a service base, one of the hallmarks of knowledge-based economies, they encounter the challenge of evaluating the assets of firms. The market value of real estate and equipment held by firms dedicated to manufacturing was once enough; now the knowledge base of the firm is its chief asset. Measuring intangibles, an activity that almost seems like an oxymoron, has been one of the management sciences’ greatest challenges in the past decade. Does one, for example, measure the products that arise from knowledge intensive processes, or are the processes themselves what need to be measured? Does one put R&D costs on the revenues side of the balance sheet because they generate knowledge, or does one put them on the side of revenues? More broadly, does one start from the premise that innovation is something, like an endpoint that one can measure directly, or an elusive property of a system that defies direct measurement?

This part examines the issue of how one measures innovation. Operating in the background is an assumption that measuring patenting activity – both patent applications and patents granted – is not a particularly
enlightening approach if taken more or less as a sole indicator of innovative activity. For reasons outlined elsewhere in this book, there are conceptual issues, as well as practical or empirical limitations, on using patenting activity as a measure of innovation. As the deficiencies of patents as measures of innovation have become widely acknowledged, other measures of innovation have been sought. It is this activity of looking for these other measures which is the subject matter of this section, since searching for these measures and then using them to manage innovation is not straightforward. Among the general conceptual problems encountered is the issue of knowing what counts as the right level or unit of analysis if it is not a patent. Some prefer to focus on the role of inputs to innovation such as education, whereas others prefer to focus on outputs of innovative activities like new ideas or services. Furthermore, holding the belief that one can measure implies that one also believes that innovation, whether a product, a process, an organization, or a market, can be quantified with standardized units of measurement.

These conceptual and methodological points, general though they may be, are frustrating to the manager or policy maker who simply wants to get on with the business of doing business. After all, why complicate the already difficult task of staying competitive with what seem like endless loops of theory? In response, the overall point of this section is that theory really matters. Particularly in an economy which is based upon intangible assets, this is no coy statement. The management of intellectual property, and innovation in the processes that lead to products, is not just the invention of new tangible products. Consequently, the chapters in this part take different approaches to the same question about how one goes about the difficult task of first setting the criteria and then implementing the standards for the measurement of innovation. Given what has been said elsewhere in this book, the objective is to do this without relying on bland measures of patenting activity, while at the same time keeping an eye on patents. The chapters that follow are united by the idea that there really is a measurement problem that needs to be addressed head-on. So, for example, in the first of the chapters the conceptualization of the valuation of product innovation is addressed from a purely philosophical perspective. The chapter following examines how organizations address technological challenges and attempt to measure innovation by keeping track of the contribution of intangible assets to dynamic innovative processes. The final chapter is a case study of a firm which has effectively measured and managed innovation by carefully exploited patent value.

In a chapter which is avowedly theoretical, Clinton Francis provides a model of innovation valuation. Francis argues that there are distortions in the way the valuation of innovation is normally conducted. Indeed,
this distortion comes from the lack of interpretative complexity that arises when innovation is interpreted in light of its natural and historical contexts. These, Francis argues, severely limit the ability to value an innovation in ways that are appropriately and sufficiently sophisticated that the task of evaluating innovation is on the same level of complexity as one finds it in current market-based contexts and organizational settings. Francis offers three main lines of arguments to call for a re-examination of the way we value innovation. He proposes that valuations should be divided and analysed according to three main groups: IPR-based evaluations, market-based evaluations, and value-chain-based evaluation. IPR-based valuations, which attempt to attach a monetary value to IPRs held by an enterprise, run into several problems. These include the fact that today’s technologies cannot be valued in the same way as previous technologies (as each generation acts quite differently), making historical comparisons of little value. Second, IPRs protect only a portion of the value of a new technology. To address the valuation of innovation issue, and the potential for hierarchical confusion in the evaluation of the innovation, Francis presented a model called Language System 3.0, which is an application of a semiotics analysis of complexity. The goal of suggesting a method of innovation valuation that is hierarchically orthogonal to the subject matter, as much as is possible, is to avoid the inversion of dependent hierarchies that could limit the competitive advantage bias against emerging innovations.

The chapter by L. Martin Cloutier and Susanne Sirois borrows from the existing literature to assert that, from a scientific conduct and organizational standpoint, the measurement of innovation in the biopharmaceutical sector is very challenging. In part, this is because of the rapidly evolving science and technology, which put constantly shifting value in the intellectual property that is generated in R&D. Only with difficulty can the value of IP be approximated at any given time using traditional measures by which the value of patents is evaluated. The chapter relies on the distinction between tangible and intangible assets, which makes it very much out of step with the normal approach to asset management which often treats IP as if it were practically tangible. Of course, most innovation measures are based on tangible assets or outputs therefrom, and ignore more generally the contribution of intangible assets. Perhaps more illuminating, it must be pointed out that intangible asset creating and exploitation is not normally associated with the evaluation of market trade-offs in firm management. The chapter uses the example of emerging new technology associated with high throughput screening (HTS) for lead and drug discovery and the in silico revolution to show how the technological complexity embedded in the innovation management process only
helps to complicate matters. In addition, the failure of most measurement methods to account for feedback loops associated with the management of the organization ignores the contribution of intangible resources in that process. Thus, existing measures of innovation management are likely to suffer from existing biases due to the data and to limitation for establishing benchmarks in that process.

The chapter by Marc Ingham, Cecile Ayerbe, Emmanuel Métais and Liliana Mitkova provides a substantial case study on the role of patents in the leverage of value. The chapter examines the situation at Air Liquide, a French multinational. The chapter is concerned about how a firm decides why and when to change organizational arrangements at each stage of the patenting process, and what values characterizes these management decisions. This case provides insights on how large companies can increase value from patents through dedicated organizational arrangements that contribute not only to improve the efficiency and effectiveness of the process itself but also to support knowledge sharing and creation. These issues have been discussed widely both in the literature on the management of patents and in the literature on knowledge creation and organizational learning, but it is useful to see what they can mean in practice. The two phases that lead to visible organizational arrangements have different impacts on the social interactions which subsequently take place among the members and groups who were involved in the process. This process is primarily informal, and does not appear in traditional measures of innovation. The new organizational platforms have characteristics that are similar to those that have been identified by Nonaka and Takeuchi (1995) in their researches on knowledge creation. The involvement of more multi-functional team members with different backgrounds at the very early stage of the process enrich and nurture social interactions that are propitious to knowledge sharing and creation.

REFERENCE