

# Product Development Performance Measurement

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## 1. Introduction

“Faster, better, cheaper, pick any two” is conventional wisdom among professionals working diligently to complete a product development project. But is it really true that aggressive targets must be limited to two of the three dimensions? To answer that, we first need to *measure* the *performance* dimensions of “faster,” “better” and “cheaper” before we can evaluate potential trade-offs and other management options. And that is crux of it. Without performance measurement, we cannot answer even the most fundamental managerial questions of “how well are we doing?,” “what have we learned?,” and “what should we do in the future?”

This chapter addresses NPD performance measurement. NPD performance measurement is a surprisingly expansive and elusive subject. This is due to the multiplicity of meanings associated with performance measurement; the varied, but simultaneous, roles that performance measurement plays; and the numerous, distinct customers of performance measurement. NPD performance measurement is further complicated by the inherent intangibility, non-routineness, uncertainty and multi-functionality that make up contemporary new product development efforts. There is also confusion over what can be, versus what should be, measured and why. A performance measure appropriate for one project may be inappropriate for another. And NPD is not monolithic -- no single measure is ever fully appropriate because it cannot tell the full story. Different decision-

makers and organizations need different arrays of measures. Finally, even the phrase “performance measurement” is ambiguous since it means so many different things to different players in different contexts at different times.

So then, what exactly is “performance measurement?” It has three meanings, listed here in order of increasing sophistication. First, it can imply a specific *performance measure* (that is, an actual, definable metric). Second, it can mean the *process of measurement* (that is, the systems and organizational processes for going about measuring performance). Third, it can indicate an essential aspect of a *comprehensive strategic planning process* (that is, the management process of setting appropriate performance targets and evaluating their achievement in order to validate or revise the organization’s strategy). The richest consideration of performance measurement must include all three of these definitions.

Given all this, NPD performance measurement in practice is a significant and almost daunting challenge. But it is a challenge that must be overcome to achieve higher levels of organizational effectiveness. Scholarly research has provided some important insights on NPD performance measurement. But, as a whole, this research stream is still largely nascent. There is so much to learn yet. In that spirit, the aim of this chapter is to provide a framework for considering NPD performance measurement. This chapter aims to clarify the numerous aspects of NPD performance measurement and to guide future academic and industry inquiry into NPD performance measurement philosophy and practice.

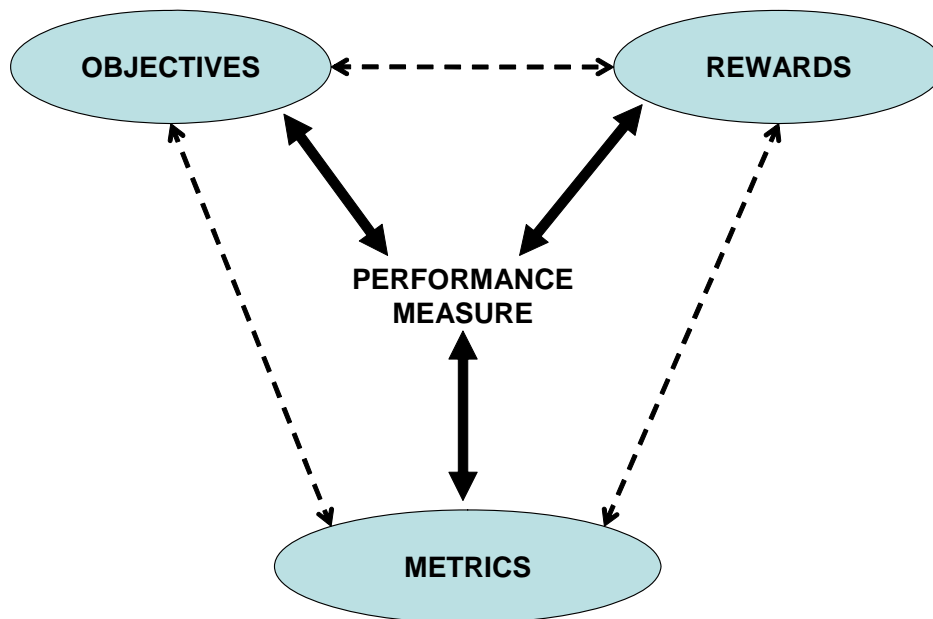
## **2. The Roles, Customers and Challenges of NPD Performance Measurement**

### Roles

A performance measure plays three simultaneous roles. See Figure 1. One role is that of an *objective* (a goal or a target). This represents the disaggregation or statement of a

strategy or a plan. For example, one objective is to “complete the development project within 180 days.” The second role is as a *metric* (an actual measurement tool or instrument). This represents a defined and agreed upon way to measure the managerial construct of interest. For example, one metric to capture project duration is “the number of days elapsed between formal project approval and first customer shipment of completed product.”<sup>1</sup> The third role is as a *reward* mechanism (a means for apportioning benefits and advancement to individuals or groups). For example, a group-based salary bonus could be made contingent on successful timely completion of the project (that is, within the 180 day target).

**Figure 1: The Three Roles of a Performance Measure**



The three roles of a performance measure are distinct but highly inter-related. The statement of an objective publicly presents a goal, a direction to work towards, and a

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<sup>1</sup> It is further helpful to distinguish between a “metric” itself and the “value” of a given metric. Here, the *metric* is the measurement tool defined as “number of days elapsed.” The *value* of the metric is the actual number of days elapsed for the project at hand (e.g., 120 days). The metric can be applied to many projects, resulting in unique values of the metric for each project.

constructive challenge to organizational personnel. The reward role is inherently incenting (or punishing) and indicates accountability of development personnel (individual, group or unit level). As such, the “objective” and “reward” roles serve important motivating and behavioral functions. The “metric” role reflects the desire and ability to collect information to monitor development progress and outcomes. This also allows data-supported business planning and execution, rather than seat-of-the-pants, ad-hoc decision making. Importantly, the metrics role makes individual and organizational learning and improvement possible, and supports fair awarding of rewards.

The organization that does not recognize the three roles of a performance measure will also neglect the essential interrelationships among the three roles. For example, consider how rewards interact with objectives and metrics. Rewards can be given more fairly when objectives are clear and metrics are in place to assess achievement of those objectives. But if rewards are given separate of or in competition with the stated objectives, then the organization is not truly working towards achieving those objectives. And if metrics are not in place, or are deemed irrelevant or unreliable, then again the motivating effect of rewards is lost. An organization that does not recognize the linkages is likely to have disconnected or incongruent objectives, metrics and rewards where each is developed and stated in isolation. This is dysfunctional – its causes organizational actions that are at cross-purposes. The organization does not ultimately state, motivate or measure the desired targets and actions.

Each of the three roles has a second face as well. Regarding objectives, have we selected the right objective? Have we put in place the most appropriate goals? This reflects the quality of the strategic planning process. Regarding metrics, are we measuring the right things and in the appropriate manner? It is often said “you get what you measure.” Individuals and organizations can “game” a measure or work towards high achievement of a measure to the detriment of other (perhaps unmeasured or unrewarded, but critical) organizational objectives. Regarding rewards, have we put in place the right rewards? Are our rewards congruent with the objectives? And are the rewards perceived as sufficiently material and unbiased to motivate the appropriate behaviors? In sum, the

organization benefits most from understanding the existence, purpose and interactions of the three roles, and from putting in place the appropriate manifestations of each role.

### Customers

There are many customers or users of performance measurement, each having unique needs and relying on different sets of performance measures to aid their decision-making. For example, at the top of an organization, executives typically rely on a small number of performance measures that are summary in nature, often predictive and necessarily broader and strategic. At lower levels in the organization, managers typically need a greater array of measures on many dimensions of a narrow and tactical nature. As such, performance measurement has many strata, and can take on different forms. The measures might be strategic or tactical, quantitative or qualitative, financial or not, retrospective or current or predictive, and may range from a summary few to a highly-granular many, all depending on the level in the organization and specific managerial purpose brought to bear by the performance measurement effort.

A comprehensive, integrated performance measurement system -- still a holy grail to many companies -- effectively meets the needs of decision-makers at all organizational levels (and even across different organizations). It does this in large part by linking and aligning the set of metrics employed by one customer with the sets of metrics used by other customers.

### Challenges

Conducting performance measurement poses notable challenges regardless of industry type or application context, be it public or private sector, manufacturing or services. This is evidenced by all the efforts in recent years to develop activity based costing, balanced scorecards, strategic figures of merit and customer service indexes in diverse industries. Unfortunately, performance measurement is even more difficult and nuanced in NPD than in many other managerial contexts. NPD activity is intrinsically intangible, non-

routine, uncertain and organizationally complex. These special characteristics combine to make NPD performance measurement especially challenging.

First, much NPD work is not viewable. Most NPD work is knowledge work, involving the collection and transformation of information and the development of knowledge and organizational learning. This *intangibility* makes it much harder to capture and measure NPD phenomena and performance (than, for example, the transformation of materials, which is far more tangible).

Second, repetitive, transactional and routine tasks and processes are easier to measure than the unique and *non-routine* tasks and processes that make up a significant portion of any NPD effort. As such, some aspects of NPD are easier to measure than others (e.g., task times, part costs and items relating to product features and project budgets). These types of elements are more finite, tangible and definable, and are more likely to be captured in project databases and corporate accounting and ERP systems. New product development by definition involves “newness,” that is, something that is different from before. This newness can manifest in non-standardized work and departures from extant routines. Established measures may be irrelevant when the work is novel since they may not address the substance of the new work approach. And again, the information and knowledge aspects -- the information collection, creation, codification, transfer and application, which can be quite unique to each project -- are much harder to capture.

Third, NPD activity exhibits *uncertainty* in many dimensions (including markets, technology, the internal organization and external organizational networks). Uncertainty makes performance measurement more difficult because it is harder to select appropriate measures and to evaluate the actual outcomes achieved. Under conditions of uncertainty, unanticipated, uncontrollable and even unmeasurable factors may exert significant influence on the outcomes achieved.

Fourth, NPD work is rarely localized. It is commonly recognized that NPD tasks and projects are cross-functional and multi-level, involving disparate disciplines as well as

numerous worker, supervisory, management and executive levels within the organization. And today's NPD efforts are often significantly cross-organizational as well, spanning highly differentiated suppliers, co-developers, distributors and customers. This *organizational complexity* adds further difficulty to NPD performance measurement because of misaligned objectives, differing metrics and incongruent information and reward systems amongst the functions, levels and organizations.

### **3. Framing NPD Metrics: Purpose, Object, Form and Linkage**

This section aims to state and organize characteristics of NPD metrics. There is much confusion (both in practice and in the scholarly literature) over the many characteristics of metrics. Below we explain that a given metric is characterized by its: (1) managerial purpose (that is, what managerial question does the measure help answer); (2) its object (that is, the “thing” that is measured, also called the unit of observation or analysis); (3) its forms (that is, how it measures, such as quantitative vs. qualitative, historical vs. predictive); and (4) its linkages (that is, what other measures it is connected to, informs or influences). The aim of this section, by stating and organizing these characteristics and their sub-dimensions, is to provide a formative framework for considering types of metrics and a firmer basis for discussion and comparison and criticism of metrics.

#### A Metric's Managerial Purpose

An organization utilizes a performance measure to gain insights and answer important managerial and technical questions. These questions motivate why a metric is required, and so states the managerial *purpose* of the metric. Different questions necessarily require focus on different NPD aspects and phenomena. Typical questions or purposes include:

- To provide decision-support, to aid in NPD planning, goal-setting and execution

- To assess or review performance of a task or project that is in-progress or has been completed
- To compare and contrast across tasks, projects and organizations
- To track and assess the direction or achievement of strategic and tactical objectives
- To allocate or reallocate resources
- To determine valuation, net benefits and financial returns
- To design incentives and parcel rewards
- To aid in individual and organizational learning.

### The Metric's Object of Interest

Now we identify the different NPD phenomena that can be measured. The phenomenon that is measured is the metric's *object* of interest. This is also known as the "unit of observation" or the "unit of analysis." A rampant flaw in NPD practice and research is the use of the wrong unit of observation. Clearly, performance measures must be designed to measure the object that they are intended to measure, or else we have irrelevant and misleading information. A similar problem is the negligent commingling of objects. This leads to comparison of "apples and oranges" rather than "apples and apples." Projects should be compared to projects, and portfolios to portfolios, but not projects to portfolios. Without careful definition of the object of interest, we do not really know what we are measuring, and cannot reliably interpret the measurement results, all leading to inadvertent managerial prescription.

What are the relevant units of observation? Here, we do not try to be exhaustive in delineating all possible units of observation in NPD. Rather, we aim to identify two key dimensional spectra and identify salient points along these spectra.

The unit of observation is defined along two dimensions. The first and primary dimension of the object of interest is its *organizational depth*. This is a vertical



perspective, and is analogous to organizational levels or strata. The elements on this dimension, from lowest to highest, are:

- Individual
- Task
- Function (discipline)
- Project
- Portfolio
- Pipeline
- Strategic Business Unit

And a second dimension is the *organizational breadth* of the unit of observation. This is a horizontal perspective. At its narrowest, the breadth is limited to a unitary organization. This broadens to the dyad, where two distinct organizations (e.g., the developer and one of its suppliers) work together on the development effort. This broadens further to triads (e.g., three development organizations, each independently owned and operated, and each having unique development competencies, working together in a co-development effort). At its broadest, we have the network organization, which is a complex set of distributed organizations with differing linkages among particular organizations in that set. This represents the highest degree of inter-organizational complexity.

### Forms of Metrics

Metrics take on different *forms*. Below we list some key forms of metrics:

1. Quantitative vs. Qualitative Metrics. Quantitative metrics are stated in strict numerical terms, and are often described and perceived as more “objective”, while Qualitative metrics are stated verbally, and are often described and perceived as “subjective”.
2. Processing vs. Outputs Metrics. Output metrics assess actual outcomes of a completed work effort, while Processing metrics (this includes “Inputs”)

characterizes aspects of a work effort that is underway. Processing metrics can be intermediate outcomes or lower-level outcomes relative to a stated Output metric. Examples of processing metrics include: number of creative ideas entered into Phase 0; number of projects underway; percentage of engineering staff dedicated to a given NPD project; and number of prototype designs waiting in queue at the prototype lab. In general, Output measures are more tangible and easily defined, and organizations seem to emphasize Output metrics over Process metrics. But, as we noted in Section 2, a one of NPD's performance measurement challenges is uncertainty. In cases of high uncertainty, there is less of a direct or specified relationship between inputs and outputs, and as such excessive focus on outputs alone is not managerially instructive. However, management can influence the process, and so should capture process metrics.

3. Historical vs. Current vs. Predictive Metrics. A Predictive measure uses trend projections or formulae to forecast future states and outcomes (“looking out the front window of the car, viewing what is coming”). Historical metrics have a non-trivial lag between the occurrence of the phenomena in question and the reporting of results (“looking at the rear-view mirror, seeing what has already passed by”). A Current Metric is one where the lag is trivial, and so the information presented is practically instantaneous (“the speedometer on my car”). A general characteristic and criticism of many NPD performance measures is that they are lagged. They provide a time-delayed, retrospective look on performance, rather than an instantaneous evaluation or notable predictive insight.

The following metrics types elaborate on and combine characteristics described above:

4. Financial (monetary-based) vs. Non-Financial Metrics.

5. Planning vs. Execution Metrics. Planning metrics tend to be less routine, more difficult to measure, and broader than Execution metrics which are typically more routine, easier to measure, and more focused.
  
6. Tactical (short-term oriented) vs. Strategic (longer time orientation). Tactical metrics tend to be more focused, quantitative and numerous in number, while Strategic metrics are broader, can be quantitative or qualitative, and tend to be few in number.

Linking and Aligning Metrics

Metrics can be *linked* and aligned to other metrics. The linkages are an important characteristic of a given metric. A simple example of such linkages involves “time to market”. Executives are often concerned with reducing time to market in order to achieve greater competitive success. Project level managers share that concern, but are more operational in that they must manage NPD projects in a day-to-day manner to achieve lead time reductions. And engineering section managers, who report to project managers in a dotted-line fashion, also share the concerns but only have control over work directly assigned to their sub-unit:

<i>Organizational Level</i>	<i>Representative Measure(s) of Interest</i>
SBU Level (e.g., CEO)	<ul style="list-style-type: none"> <li>▪ Reduce Time to Market</li> </ul>
Project Level (e.g., project manager)	<ul style="list-style-type: none"> <li>▪ Project Duration (time from formal project approval to first customer shipment)</li> <li>▪ Project Lateness (actual first customer shipment date vs. target date)</li> </ul>

Task or Function Level (e.g., engineering section manager)	<ul style="list-style-type: none"> <li>▪ Slippage on achieving target date for Gate 2</li> <li>▪ Downtime on prototyping equipment</li> <li>▪ Number of design engineering drawings redrawn</li> </ul>
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In this example, each metric is linked to a metrics at higher and lower levels. Cohesively linked metrics are “aligned” and are supportive. The network of linkages shows a duality, where objectives and guidelines cascade top-down, while more granular information content (in the form of measures and data) aggregates bottom-up (“rolls-up”).

At different organizational levels, the players have access to different information about processes and outcomes, and also need different metrics to guide decisions under their purview. At an executive level, information is much more uncertain and evaluation happens with respect to the broad competitive and operating environment of the firm. Yet, for project and engineering managers, performance is measured with respect to more “objective” measures (e.g., achievement of product specifications, project timing and cost targets).

A critical contemporary NPD management challenge is in creating systems where metrics are linked and aligned purposefully rather than by accident or not at all. This systematically supports the business strategy, increases management decision-making ability at all levels, aids in construction of meaningful metrics “dashboards,” and provides greater richness to the organization’s ability to learn. In sum, an essential characteristic of a metric is its linkages, or pointers, to other metrics. Still, not all metrics must have links -- some metrics are localized but still have notable value in achieving their managerial purpose.

#### **4. The State of NPD Performance Measurement**

Broadly speaking, there is relatively little academic research on the development of NPD performance measurement systems. Selected research does focus on particular metrics in some detail (especially “time”). Many studies, empirical and analytical, employ diverse NPD performance measures as intermediate and outcome variables. And there is now a decade of research literature presenting surveys of management practices in NPD performance measurement.

The previous section explained that a given performance measure is characterized by the combination of four aspects: its managerial purpose, object of interest, measurement forms and linkages with other metrics. The dimensions and elements of these four characteristics make up a formative framework defining the space of conceivable NPD metrics. This framework helps identify the current NPD performance measurement state of knowledge. The framework also exposes the gaps, helping identify the performance measurement questions and issues that remain unanswered and merit both practical and scholarly inquiry.

##### Established Metrics Areas and Relevant Gaps

Two areas in the framework have received the most attention in the literature at large and are quite well developed. They are:

1. Project-Level Tactical Outcomes, such as project duration, project budget achievement, achievement of product specification targets, product sales volume and customer satisfaction.
2. SBU-Level Financial and Market Outcomes, such as return-on-investment, revenue from new products, revenue growth, overall sales and market share.

A number of important areas in the framework are far less developed. These include:

1. Objects at the intermediate organizational level: portfolios and pipelines. In contrast, on one end, the objects of individuals, tasks, functions and projects,

and at the other end, SBU's, have many well-defined outcomes metrics that are utilized in practice. But measurement for the intermediate levels, which cut across projects and functions, and often have shared responsibility across managers, is (with small exceptions) understudied and merits more research attention.

2. Linkages between metrics: This is a relatively undeveloped area *within firms* -- linking and aligning metrics across the different organizational levels. Such linkages help in strategy deployment and enhanced-decision making. An even less developed but especially pressing area is that of linking and aligning metrics *across firms*. This is necessary for effective collaborative innovation.
3. Development of metrics sets: Realizing the non-monolithic nature of measures, organizations need to devise appropriate arrays of measures that can be considered as a set without undue emphasis on any unitary measure.
4. Predictive measures (vs. historical measures). This allows the most proactive guidance of organizations, and could contribute to organizational agility and competitiveness. Predictive measures may rely on processing measures, established historical patterns and more sophisticated understanding of cause and effect in NPD phenomena.
5. Processing (vs. Outputs) metrics: Given the uncertainty inherent in NPD and the preponderance of lagged information, focusing on output measures alone is frustrating and provides an incomplete view of the NPD activities. It provides insufficient managerial guidance on what exactly to act on. Instead, intermediate or in-process metrics capturing operating aspects of the NPD activity underway are needed. Temporally these metrics are predecessors to output metrics. This involves a shift from the measurement of (completed) transactions to the measurement of transformation activity in progress.

## 5. An Illustrative Example: Project Execution Success

How should an organization assess the performance of a recently completed project? Let's consider the case of project-level outcomes. This helps illustrate metrics arrays, trade-offs among metrics and the necessarily non-monolithic nature of NPD performance measures. See Table 1.

The first row captures “internal” measures, items that are largely observed or realized within the organization. The second row captures “external” measures, items that relate to the company’s interface with the marketplace. The first column captures “short-term” measures. These tactical measures relate to outcomes realized directly at the conclusion of the project and shortly afterward. The second column captures “long-term” measures. What is short- or long-term differs by company and project, but in general the strategic measures reflect capabilities or benefits obtained now that have value beyond the immediate product and its introduction.

**Table 1: Arraying NPD Project Outcome Measures**

	Short-term (Tactical)	Long-term (Strategic)
Internal	Time Cost Performance	New technology development New personnel skills
External	Customer Satisfaction Sales Return on Investment	New market entry and development Company survival

The “internal/short-term” cell captures the three classic tactical project management outcomes. “Performance” may be alternatively referred to as “features” or “quality.” These outcomes reflect the quality of the execution of the project management aspects of

the NPD effort. The “external/short-term” cell captures the classic near-term market- and financially-based results attributed to a new product introduction. The “internal/long-term” cell captures new internal capabilities to the organization, gained during or as a result of the project, that may have value later. The development project might have involved first-time use of a new technology, and this technological learning could be leveraged for future, more enhanced products. Similarly, new skills might have been developed by personnel within the firm, or new relationships developed with suppliers or distributors, all of which could be leveraged for benefits in the future without incurring significant costs. This cell is all about organizational learning. The “external/long-term” cell captures company marketplace and environmental elements that are strategic and often qualitative. The new product introduction might open up a new market to the firm, and so might help garner significant sales of future new products.

The array in the table shows that no NPD project is ever truly just a “success” or a “failure.” A project that fails in the marketplace (due to low sales) might well help the firm in the long run because new technology was tested as part of that development effort. The multi-dimensionality of project success becomes clear in the table.

Each product development project has different emphases on different cells. This is due to competitive context. Some firms work on a development project quite leisurely and without a constraining focus on cost, because they have little competition in a given market and are simply trying to prove new technology in their new product. Here, the firm’s emphasis is on internal/long-term over anything short-term (internal or external).

And each product development project has different emphases on elements within a cell. Much NPD research looks at the time, cost and performance outcomes of projects. A subset of this research actually weights the importance of each target or outcome. Again, due to competitive context, some firms rush to bring a product to market, and accept the possibility of higher cost. Here, due to the competitive market window, they aim to hit the window early or in time, and then follow-up with cost-reductions implemented via engineering changes or future new products. Other development projects prioritize



technical performance above all else, accepting a trade-off with time and/or cost. What is clear is that a universal view of the measures and their priorities simply does not exist. It would be wrong to assume that one measure alone would be sufficient and that all measures in the array should have equal weighting.

In a similar vein, a purely functional perspective on NPD project performance leads to limited focus. For example, a traditional marketer might look only at metrics in the short-term external cell. A purely operational view leads to sole consideration of the traditional generic project management outcomes of time, cost and performance (here the tactical, internal outcomes). A strategist who is today looking five years ahead, might only consider the strategic measures capturing leveragable investments and growth opportunities in the long-term. She might completely ignore the short-term measures. Finally, a corporate finance person, if unschooled in marketing and operational issues, might only look at short and long-term financial outcomes. In all, this approach defines functional myopia, and clearly does not provide a complete picture of all the relevant elements of project execution success.

Finally, we note that each metric is a double-edged sword. For example, to reduce NPD time to market, an organization might excessively cut product scope or maximize reuse of part designs from previous products, resulting in a less innovative, “me-too” product that lacks marketplace differentiation and captures limited customer attention, satisfaction and sales. Here, the unitary focus on “time” means sales comes at a trade-off to timeliness. There is no way around this! Any conceivable metric has this double-edged sword quality.

Hence organizations benefit from use of a balanced scorecard or dashboard approach that contains an array of relevant metrics and reduces excessive focus on one metric. In this example, such an array would consider product performance (features) and potential sales in addition to time targets. An even more complete array would consider all elements of the four cells in the project outcomes table.

## 6. Conclusions: Emerging Issues in NPD Performance Measurement

NPD performance measurement is an exciting topic for further exploration. Practitioners now realize that coherent performance measurement is central to informed management, and researchers are starting to recognize the criticality of effective performance measurement systems to overall product development effectiveness. Research on NPD performance measurement systems is in its infancy compared to research on many other aspects of product development. This is at least in part due to the difficulty of studying NPD performance measurement systems.

To aid practice, five metrics areas (identified in Section 4) merit further study: development of metrics for intermediate organizational levels (such as portfolios and pipelines); establishing effective linkages between metrics; developing metrics sets or arrays (in contrast to a monolithic performance measure); and further development of measures capturing NPD activity-in-process rather than at its conclusion. In addition, there are three emerging concerns in practice that also call for future research.

First, companies these days are engaging in more collaborative innovation than ever. This comes in the forms of co-development, outsourcing, joint ventures, alliances and open innovation networks. Distributed and collaborative innovation call on the organization to put in place new and different skills in technology scouting, partner selection, contract development, protecting intellectual property, relationship management and coordination of schedules and plans across organizations and cultures. Accordingly, firms need to devise, test and implement *co-development metrics*. A greater understanding of goal congruence and metrics alignment across organizations would be helpful. Finally, working towards a standardized set of metrics for co-development instances reduces the transaction costs of collaborative innovation.

Second, determining the *universality of measures* would be helpful. This is in contrast to measures that are contingent and useful to limited instances. The aim is to identify when

does a metric employed in one place have the same interpretation when employed in another place. This is the challenge of “apples to apples” comparison across organizational functions and units. Organizations would benefit from determining when and where a given metric can be successfully applied in different functions, divisions or even companies in a network. Identifying potential universality of metrics aids in the cascading-down of objectives, rolling-up of data, aggregation of data and comparing across organizational units in a meaningful way. Not all metrics need be universal. It needs to be determined which ones can be universal, and which ones must be localized, customized or contingent on a specific NPD phenomenon or location in order to extract the best managerial guidance.

Third, performance measures and measurement systems don’t just happen. The development and refinement of metrics, the design of linked metrics, the collection and analysis of data, and the monitoring of external partners, all calls for organizational resources dedicated to the management of *performance measurement and metrics programs*. This may involve a trained, centralized staff or distributed resources utilizing standardized protocols. It certainly involves information systems tools and can be part of an ERP system. This also aids in knowledge management and organizational learning. The ability to effectively manage a performance measurement program is a distinctive organizational competence. It is appropriate to view such a program or system as a critical dynamic capability of the organization. Future research should address the development and value of a dedicated performance measurement programs office or system.

Given its practical nature, performance measurement can easily be seen as an atheoretical topic. But it is not. Several promising theoretical avenues for future research exist. *Organizational Learning* theory can be applied to investigate the linkage and alignment of metrics; selection and design of metrics; knowledge management systems; continuous improvement of metrics; and the evolution and dynamism of performance measurement programs. *Principal-Agent* theory can be applied to evaluate cross-functional, cross-organizational and collaborative innovation contracting, coordination,

operationalized metrics and reward mechanisms. And the theories of *Lean Operations* may be applied to develop new process-oriented metrics for NPD.

NPD performance measurement should be as a dynamic capability in organizations. There will never be an ideal set of metrics or a perfect performance measurement system. Some important NPD aspects may even prove unmeasurable. Nonetheless, organizations can strive towards a meaningful and informative metrics program, one that evolves and innovates along with the organization. Performance measurement systems and metrics are living entities changing and adapting as the organization's environment, strategies and NPD actions evolve. As such, the organization need not aim to create the "perfect" metrics program, because even if it could, it would not remain perfect for long in today's dynamic, competitive environments.

**For further reading:**

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