INNOVATION METRICS

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Working Paper
No. 99-902
March 99

Tim Ambler is Senior Fellow, London Business School. This research is part of the Marketing Metrics programme sponsored by The Marketing Council, The Marketing Society, Institute of Practitioners in Advertising, Sales Promotions Consultants Association, Marketing Science Institute (USA) and London Business School. Thanks are also due to Kathy Hammond and Joanna Zaleska for comments on drafts.

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Abstract

Innovation, meaning new ideas developed and implemented with a view to improving the company’s market position, is widely seen as a, if not the, crucial ingredient of marketing success. They may be small incremental improvements (kai zen) or discontinuous (radical). On the other hand, more innovation is not necessarily better. The right kind and amount of innovation, in balance with other factors, is defined as “innovation health”. This paper provides a model of innovation health/performance as a pathway toward innovation health “metrics” (defined as top management indicators). Continuing research will test metrics empirically against performance, refine the model and provide a practical basis for innovation health measurement.
Innovation Metrics

Innovation is widely seen as a, if not the, crucial ingredient of marketing success (e.g. Simmonds, 1986; Cooper and Kleinschmidt, 1990). In a UK study, Geroski and Machin (1992) found that more innovatory companies, defined by patent registrations, grew faster and were more profitable. Furthermore profits and growth were less sensitive to downturns in the economic cycle. By “innovation” I mean new ideas developed and implemented with a view to improving the company’s market position. They may be small incremental improvements (kai zen) or discontinuous which is also termed radical, path-breaking, revolutionary, major, or pioneering (Green, Gavin and Aiman-Smith, 1995).

On the other hand, more innovation is not necessarily better. Middle managers suffer from initiative fatigue where too many good ideas rain down from their boards; frenetic novelty seeking by junior managers gives an impression of headless chickens and late movers can take advantage of innovation by others (Shankar, Carpenter and Krishnamurthi, 1998). Furthermore, innovation is expensive: 80 - 85% of new food products launched in the UK are not on supermarket shelves one year later (Curtis, 1998).

Just any innovation will not do: firms need the right kind and amount of innovation in balance with other factors, i.e. what this paper defines as “innovation health”. The presumed causal relationship between innovation health and business performance should incline top management to measure innovation health in much the same way that they themselves visit clinics for check-ups. Health is not symmetric: inadequate health progressively reduces performance, but going beyond “healthy enough” may not improve it.

An unambitious firm may be judged healthy enough by one board and then found to be unfit to tackle the “hairy audacious goals” (Collins and Porras, 1996) of a new leader. Thus innovation health is a relative [to the firm’s goals and competitive environment]
Nevertheless, measuring innovation health is an important part of assessing marketing capacity and performance.

In a study of the top 500 US and 300 Canadian companies (Fortune and Canadian Post listings respectively), 63% (n=253) of respondents saw innovation as highly important but only 22% measured it (Stivers et al., 1998) and about 25% of those actually used the measures. In the UK, 55% of senior marketers and finance executives (n=531) reported that their firms rarely or never measured innovativeness. 34% set innovation benchmarks in plans (Kokkinaki and Ambler, 1999). This working paper is a step towards bridging the gap by providing a model of innovation health/performance and some “metrics” (defined as top management indicators). Continuing research will test metrics empirically against performance in order to refine the model and provide a practical basis for measuring innovation health.

Kaplan and Norton (1992) portrayed “innovation and learning perspective” as the Balanced Scorecard category, of four, most responsible for improving and creating value. Saunders, Wong and Doyle (1994) used a cross cultural study (Japan, US and UK) to show that success depended on a balance of marketing, innovation, planning and entrepreneurial orientations that were independent of country and sector.

Much of the literature concerns culture generally seen as the primary determinant of innovation health. After a brief review, I suggest that culture is only an enabler: an inappropriate culture can kill innovation and good culture facilitates it. By itself culture does not create innovation nor focus energies on those that truly matter. We need to measure the process that drives creativity, focus, impetus and “better, faster, cheaper” (BFC) implementation. Finally, we need to measure performance in such a way that the results of innovation can be distinguished from ongoing effects. We need to assess performance against the firm’s goals and competitive environment. These three factors are not discrete: culture, process and performance overlap and interact.

An innovation-performance model is then constructed as a framework for the selection of metrics. Short lists of generic and goal-directed metrics are presented in two tables.
Empirical research is needed to explore the use of innovation metrics and best practice as well as how the use of metrics affects the firm’s growth and profitability. In the meantime, this paper provides a means by which managers can assess the innovation health of their firm.

**Culture**

Market oriented businesses, i.e. those that track and respond to *customer* needs and preferences, perform at higher levels (Jaworski and Kohli, 1993). But we need to distinguish between customer and competitor orientations (Narver and Slater, 1990), and also between immediate customers and end users. Businesses that track and respond to customer needs and preferences can better satisfy customers and hence perform at higher levels (Jaworski and Kohli, 1993). Empirical research supports this relationship (Lusch and Laczniak, 1987; Narver and Slater, 1990; Slater and Narver, 1994).

Much innovation is sourced and motivated by business partners: suppliers, associates and customers. In business-to-business markets perhaps as much as 80% of innovation is customer inspired (von Hippel, 1988). Customer orientation is likely to support true innovation whereas competitor orientation may be more reactive.

The KEYS scales developed by Amabile et al. (e.g. 1996) assess the climate for creativity and productivity. Note that this is not an innovation/performance model. Figure 1 summarises their conceptual creativity model (p.1159):

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**Figure 1: Amabile et al. Conceptual Model (KEYS)**

![Figure 1: Amabile et al. Conceptual Model (KEYS)](image-url)
Note that all drivers, except the last two, are positive. Clearly this is a partial model in that creativity is presumed to lead to improved business performance which would impact back on the drivers, not always positively. For example, growth might increase workload pressure and organisational impediments.

Building on this and Chiesa et al. (1996), a survey of electrical and electronic engineers in Singapore (n=871) used nine scales to describe corporate culture: leadership, support, task, behaviour, teamwork, how projects were raised and carried out, knowledge/skills and information/communication (Tang and Yeo, 1998).

Organisational slack gives space for serendipity and fosters experimentation but implies a lack of strategic discipline. Slack seems to have an inverse U-shaped relationship with performance (Nohria and Gulati, 1995). 3M, for example, requires managers to spend 15-20% of their time innovating outside strategy. They know, at least intuitively, the broad direction (strategic intent) of the company and use their discretionary resources to experiment beyond. According to de Geus (1997), this is a characteristic of the “living company”. Similarly the wide support for the concept of a learning organisation carries implications of freedom to experiment, support for creativity and a positive attitude to failure (Senge, 1990; Argyris, 1993).

A separate literature deals with the impact of procedural justice on innovation. A work environment seen by managers as fair is likely to be more creative (e.g. Abbey and Dickson, 1983; Kim and Mauborgne, 1996).
Schein (1992) provides an analysis of the learning culture needed for innovation (his table 18.1, p.365):

<table>
<thead>
<tr>
<th>Organization-Environment relationship</th>
<th>Organization dominates environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature of human activity</td>
<td>Proactive, not reactive, fatalistic nor harmonizing</td>
</tr>
<tr>
<td>Nature of reality and truth</td>
<td>Pragmatic not moralistic authoritative</td>
</tr>
<tr>
<td>Beliefs about human nature</td>
<td>Basically good and mutable</td>
</tr>
<tr>
<td>Nature of human relationships</td>
<td>Both individual and groupist and both authoritative and collegial</td>
</tr>
<tr>
<td>Time perspective</td>
<td>Medium term future, not now or past or long-term</td>
</tr>
<tr>
<td>Information and communication</td>
<td>Fully connected</td>
</tr>
<tr>
<td>Sub-cultural uniformity vs. diversity</td>
<td>High diversity</td>
</tr>
<tr>
<td>Orientation</td>
<td>Both task and relationship</td>
</tr>
<tr>
<td>Linear versus systemic field logic</td>
<td>Systemic thinking (complexity)</td>
</tr>
</tbody>
</table>

Summarising, culture is crucially open and encouraging across both external (customers) and internal (functional, hierarchic, business unit) boundaries. It is characterised by learning, notably by providing slack, experiment and failure. With one small intrusion (“authoritative” in Schein’s table), this literature can be characterised as “enabling”. A firm which adopted all these ideals, and none other, would be overwhelmed with initiatives. The sunny side of innovation (culture) removes the blocks but it must have a dark side, here termed “process”, which provides impetus, selection and control. These two sides, which can be seen as freedom and control, may be opposed. Bonner, Ruekert and Walker (1998) found that formal new product development controls detracted from schedule, budget, technical and the team’s satisfaction with performance. Process controls were more negative that outcome (goal) expectations and these results were true for both kai zen and discontinuous innovation. Leadership, reviewed below, perhaps supplies the necessary focus and impetus without the negative aspects of control.
Process

A firm may not need a formal, conscious innovation process. Creative ideas, or consumer usage, can arise by chance and, given a fertile culture, transform the business, Doc Marten boots for example. This paper is not normative: best practice may or may not require conscious process. It merely seeks to measure the culture, process and performance assessment such as they are.

One approach to measuring innovation process is to assess its effectiveness, speed and cost (Voss et al., 1992). Other things being equal, better, faster and cheaper (BFC) are all good but there may be some trade-offs. Kuczmarski and Shapiro (1997) analyse process using two metrics: stage-gate flow and innovation revenues per employee. The first metric combines measures of the speed of innovations through each development stage and the number of innovations at each stage. They found that more than 300 initial ideas yielded only five to seven strong concepts of which two or three would be launched.

Kotler (1997) summarises quick innovation or response time as “turbo-marketing”. Whether trade buyers and consumers are becoming more impatient or more quickly satiated, marketers have to run faster to stand still. An affluent society may have more money than time and be prepared to buy time (convenience) if the transaction can be arranged quickly enough. It would follow that marketers need a set of measures of time performance to a similar level of sophistication to the traditional financial metrics.

Chiesa, Coughlan and Voss (1996) reported on a Technical Innovation Audit developed for the UK Department of Trade and Industry. Their taxonomy and measures (Table 3, p.115) included some elements of culture and performance:

Table 2: Technical Innovation Audit
| Concept generation | # new ideas evaluated in past year  
|                   | # new ventures started in past 5 years  
|                   | satisfaction of customer range and other needs  
|                   | product planning horizon (years, product generations)  
|                   | average length of product life cycle  
| Product development (i.e. the next stage along) | time to market (stage by stage)  
|                 | product performance (cost, technical performance, quality)  
|                 | design performance (cost, ease of manufacture and test, # redesigns)  
| Process innovation | # new processes/significant improvements p.a.  
|                 | installation lead times  
|                 | development cost  
|                 | # improvement suggestions per employee and % implemented  
|                 | average annual improvement in process parameters (quality, cost, lead time, work in progress, reliability, down time, capability)  
| Technology acquisition | R&D/technology acquisition cost per new product  
|                 | R&D project success rate (%% by number and expenditure)  
|                 | # new licences in/out over last 3 years  
|                 | # patents over last 3 years  
|                 | cost/benefit of completed R&D projects  
| Leadership | #/% of top management originally from technical functions  
|             | % employees aware of and sharing innovation policies/values  
|             | # pages in Annual Report devoted to innovation and technology  
| Resourcing | personnel in product development and technical functions who have worked in >1 function  
|             | % projects delayed/cancelled through lack of funding  
|             | % projects delayed/cancelled through lack of human resources  
| Systems and tools | % designers/engineers with access to CAD screens  
|                  | % products on CAD database  
|                  | % products on which specific tools are applied (FNEA, QFD, Rapid prototyping, Taguchi methods)  
|                  | % designers/engineers trained to design for manufacture  
|                  | % team trained in creativity techniques certified processes  

Clearly the process that drives kaizen is very different from discontinuous innovation though that seems to have received little attention in the literature. Incremental improvements can take place at every level without great resources nor disrupting the work of others. On the other hand, discontinuous change can only be few in number and needs wide co-operation if only in the sense of leaving space.

The macro-process that provides direction is leadership which may be active (determining which initiatives will be pursued and then ensuring that they are) or passive (providing general direction,
process and culture but not involved with any particular initiative). One definition of leadership is “the source of the beliefs and values which get a firm moving in dealing with its internal and external problems” (Schein, 1992, p.26) and others are reviewed by Sadler (1999). The trend in the literature is away from the macho charismatic (Napoleon or Jack Welch of GE) towards the shy democratic facilitator (e.g. Petersen, previously CEO of Ford). Whether that trend is justified by changing context or a random walk through different types of leadership or part of the feminisation of Western society is open to doubt. Common attributes appear to be vision, motivation, emotional strength (determination, commitment, and reliability from the staff perspective), anxiety management, good two-way communication skills which include setting a learning example (Schein, 1992).

Of these, in the context of discontinuous innovation, anxiety is perhaps the most interesting. A real or perceived crisis creates the demand for innovation but it needs to be managed to avoid panic and over-reaction. Trust and the leader’s strength are incrementally built by results. At staff level these can be measured by individual awareness of, and commitment to, corporate non-financial goals, anxiety and trust in the leadership. For example, radical product innovation seems to require a willingness to cannibalise the existing product portfolio (Chandy and Tellis, 1998) which in turn demands trust in the leadership.

Metrics provide not only a control system for comparing performance with intended direction but, probably more importantly, symbolise and communicate what the leader considers important to all levels of staff.

**Performance**

Performance can only be assessed against what the firm is attempting (goals) and competitive achievement (Ambler and Kokkinaki, 1997). It is thus *relative* to subjective and objective (external) benchmarks. Preliminary research indicates that the share of sales (sometimes profit) represented by new products is far the most frequent metric, followed by the number of launches during the period.

The Columbia school (Capon, Farley and Hulbert 1988; Capon, Farley, Lehmann and Hulbert 1992) use a construct of innovativeness based on four (subjectively reported) measures: how often is your company

- First-to-market with new products and/or services?
- Later entrant in established but still growing markets?
- Entrant in mature, stable markets?
At the cutting edge of technological innovation?

Three dimensions of innovation performance are market (customer and competitive), financial and product-level (e.g. service quality) (Hultink et al., 1998; Griffin and Page, 1993; Voss et al., 1992).

Han, Kim and Srivastava (1998), in a banking context, used specific innovations, such as the introduction of a 24-hour customer service hotline, to form technical and administrative constructs which were found to mediate the orientation-performance relationship. This mediating role of innovation is adopted in the next section.

**Developing an innovation-performance model**

As noted above, Kaplan and Norton (1992) propose that firms develop their measures from their goals. Each firm’s metrics will therefore differ at least to the extent that their goals differ. Swartz et al. (1996) found few broad generalisations in the relationship between marketing investment and performance. Firms tended to achieve their specified goals which were, in turn, more likely to be measured. Following Han, Kim and Srivastava (1998), but replacing orientation by goals, the model shows both innovation mediating the effect of goals on performance, see Figure 2. A second modification suggests, in line with the comment above, that the use of metrics also [partially] mediate performance through symbolism and control. The use of metrics may contribute to performance additionally to the innovations themselves in two ways: as control mechanisms and symbolically as indicators of strategic intent.

Thus the model (Figure 2) shows the firm embedded in the competitive environment with which it interacts via leadership (vision), culture (including orientation) and performance. Leadership interacts with culture and sets metrics. It directly drives explicit goals and indirectly (via vision and culture) drives implicit (tacit) goals. It moderates the relation between goals and process.

Culture tends to increase initiatives by number (enabling both kai zen and discontinuous) whereas process tends to reduce discontinuous innovations through
direction and control. An example is the well known, originally 3M, champion system where a manager has to put his/her own career on the line for an innovation s/he believes in. This both reduces the numbers and increases commitment.

Performance feeds back to leadership which may be strengthened or weakened thereby.

**Figure 2: An innovation-performance model**

This model is partial, as all models are, and its purpose is merely to create a framework for *metrics* which are presumed to operate in two ways: as parts of the controls needed to improve performance (single loop learning - Argyris, 1993) and, symbolically, as indicators of strategic intent.

**Innovation health metrics**

An excessive number of metrics diffuses management understanding and control. Meyer (1998) cites the 117 performance measures assembled by Skania, of which 35 deal with renewal and development. Yet even the most innovatory firms do not
necessarily measure these vital signs. Preliminary research in such companies has been greeted by disbelief. One respondent from a well known IT products manufacturer stated that innovation was taken for granted. The excitement of their workplace was no more measured than the level of oxygen.

Generic metrics independent of country, firm and sector (Saunders, Wong and Doyle, 1994) need to be distinguished from those which depend on the particular goals of the firm. Where explicit goals do not exist, it is presumed that initiatives are in response to tacit goals, as in 3M. Some generic constructs from which individual metrics could later (see continuing research) be derived form Table 3 and some examples of goal-determined metrics form Table 4.
<table>
<thead>
<tr>
<th>Construct</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Innovation culture</strong></td>
<td></td>
</tr>
<tr>
<td>1.1 Encouragement of creativity</td>
<td>(Organisational, supervisory &amp; work group) Amabile et al., 1996</td>
</tr>
<tr>
<td>1.2 Autonomy</td>
<td>------“--------</td>
</tr>
<tr>
<td>1.3 Sufficient resources (operationalised as risk and payback hurdles)</td>
<td>------“--------</td>
</tr>
<tr>
<td>1.4 Challenging work</td>
<td>------“--------; Nohria and Gulati, 1995</td>
</tr>
<tr>
<td>1.5 Workload pressure (seen as reciprocal of organisational slack)</td>
<td>Amabile et al., 1996; de Geus, 1997</td>
</tr>
<tr>
<td>1.6 Organisational impediments (seen as reciprocal of experimentation being expected of all managers)</td>
<td>de Geus, 1997; Senge, 1990; Argyris, 1993</td>
</tr>
<tr>
<td>1.7 Learning culture, e.g. to what extent are failures celebrated, evaluated and broadcast?</td>
<td>von Hippel, 1988</td>
</tr>
<tr>
<td>1.8 Customer involvement in the firm’s innovation, e.g. suggesting new products or problems for solution.</td>
<td></td>
</tr>
</tbody>
</table>

| Leadership | |
| 2.1 Staff awareness of vision/direction | Schein, 1992 |
| 2.2 Staff commitment to vision/direction | ------“-- |
| 2.3 Level of anxiety about the state of the business | ------“-- |
| 2.4 Trust in the leadership | |
| 2.5 Perceived control (may be the reverse of autonomy above) | Chandy and Tellis, 1998 |
| 2.6 Focus (initiative diversity) | |

| Process | |
| 3.1 Measures of BFC. | Voss et al., 1992 |
| 3.2 Relative state (to chief competitors) of technological development | Capon, Farley and Hulbert, 1992 |

Amabile et al. sought to establish convergent and discriminant validity but the wider literature has prompted additional constructs which may, as shown above, correlate with the existing ones.
Table 4: Examples of goal directed innovation metrics

<table>
<thead>
<tr>
<th>Goals</th>
<th>Initiatives</th>
<th>Innovation performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer retention</td>
<td>New loyalty schemes</td>
<td>% customers lost</td>
</tr>
<tr>
<td>Increased new product</td>
<td># innovations launched</td>
<td>% successful paybacks/shareholder value effects</td>
</tr>
<tr>
<td>innovation</td>
<td></td>
<td>% of turnover due to products launched in last 3 years</td>
</tr>
<tr>
<td>Differential advantage</td>
<td>R&amp;D expenditure</td>
<td># patents registered</td>
</tr>
<tr>
<td></td>
<td>Specific initiatives implemented</td>
<td></td>
</tr>
<tr>
<td>Market leadership</td>
<td># new to the world concepts initiated in period</td>
<td>Average entry position (1st, 2nd…) to market with new products and/or services</td>
</tr>
<tr>
<td></td>
<td>Type of market typically entered (new, mature, declining)</td>
<td></td>
</tr>
</tbody>
</table>

**Continuing research**

The objective is to provide firms with generic metrics and also the means to derive performance oriented metrics from their individual goals. In evaluating the innovation health of the firm, their need for kai zen should be distinguished from discontinuous innovation.

Two types of research are being explored: survey and case study. In the survey methodology, the generic constructs will be developed into indicators using proven variable construct relationships wherever possible. After refinement and piloting, a survey instrument will be developed and administered to company executives. The culture, leadership, process and goal oriented categories above will be tested against overall assessments of innovation health and objective performance measures.

The second methodology would require each respondent firm to identify the most successful and radical [market] innovation in recent memory and then track back to ascertain the causes and sources of that innovation and the roles played by culture, leadership, process, goals and metrics in achieving that success.
Specific areas to be explored include:

- The minimum number of metrics required to indicate innovation health. Multivariate methods should reveal convergence and discrimination either for individual firms or in general. Ideally, innovation health metrics provide not only control and symbols but also predict future performance.

- Whether discontinuous innovation is indeed qualitatively different, requiring its own health check, or just a linear extension of incremental innovation. In other words does one bring the other so that only one form of health need be ascertained?

- Whether more successful and more innovatory firms do in fact benefit from using innovation metrics and how they are used, e.g. whether they are compared year on year, with plan and against competitive benchmarks.

- The framework and the relative importance of goal directed innovation versus culture and process metrics.

- Broadening the framework to include other mediating and moderating variables, e.g. environmental and competitive effects.

**Conclusions**

This work in progress paper sought metrics by which top management could determine the innovation health of their firm. An innovation-performance model was framed as a stage to identifying the constructs and then metrics which would, ideally, not only indicate health but also improve and predict performance. It has to be admitted that the complexity of this area may go some way to explain why firms recognise the importance of innovation to a greater extent than they measure it.

More innovation is not necessarily better. Innovation of different types needs to be balanced with other priorities which may be identified in goals or embedded in culture and process. Measures are needed to manage innovation through control and communicating what matters through what is measured.
References


