For over a decade, the Conference Board\textsuperscript{1} has published an annual CEO Challenge study that lists the biggest concerns for executives. The 2014 report identified operational excellence as a priority focus for businesses over the coming months. “The survey finds business leaders across the globe are zeroed in on not only what gets done, but, more importantly, how things get done.”\textsuperscript{2}

It’s no surprise that executives are responding in this way when you consider that frequently quoted failure rates of executing strategy and achieving strategic goals have remained at anywhere between 70% and 90% over the past two decades, as explained in our article, “Strategy execution in Africa: focusing on the right things in a complex environment.” The article gives a unique Africa perspective on what the seven success factors are for strategy execution in the country, drawing on over three years of targeted research by EY.

Another critically important element for operational excellence is effective and aligned measurement relating to the company’s specific situation. Two of our articles evaluate and recommend measurement essentials. “Key performance indicators: winning tips and common challenges” provides practical advice that will help any organization generate value. “Measuring open innovation: a toolkit for successful innovation teams” provides a solution in an area that has provided a measurement headache for many experienced managers who are looking to drive innovation.

Operational excellence is also about getting the most from existing resources rather than constantly buying in new skills and tools. “Anti-corruption practices: reinforcement opportunities via internal controls” argues that there are many opportunities for leveraging existing resources and compliance programs to help assess and address corruption risk.

“A new paradigm of Business Intelligence” explains the broader potential for concrete business use of in-memory computing, which, up until recently, has mainly been associated with boosting database performance.

Other articles examine forward-looking strategies for digital realization, getting user buy-in post-implementation of new IT systems, new models to face changing economic climates and mechatronics (a revolutionary, integrated design approach for manufacturing companies).

I hope the articles in this edition of Performance provide valuable insight and information to help your business innovate, grow, optimize and protect.

Enjoy reading this issue!

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\textsuperscript{1} The Conference Board is a global, independent business membership and research association that conducts business management research.

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Strategy execution in Africa
Creating focus and capability in a complex environment

Strong strategic management processes are important to gain competitive advantage and improve organizational performance. Strategy execution, as a component of strategic management, is the critical process to get right; however, up to 95% of strategy execution efforts fail. The key success factors for effective execution have been researched in developed markets, but what about Africa? This article details the seven success factors for execution in Africa, and we examine two overarching, driving factors: the creation of a formalized strategy execution capability and elevating the HR function to manage culture and talent early on in the strategy process.
Authors

Craig Lister  
Strategy Execution Specialist,  
Advisory Services, EY, South Africa

Nyain Swe  
Assistant Manager, Strategy,  
Advisory Services, EY, South Africa
strategy execution in Africa. creating focus and capability in a complex environment

“Strategy without tactics is the slowest route to victory.”
Sun Tzu, sixth-century military general, strategist and philosopher

In a 2006 global survey by the Monitor Group, senior executives were asked about their priorities. Number one, by a clear margin, was the concern for poor strategy execution. Four years later, in December 2010, the findings were consistent. The Conference Board CEO Challenge, which annually surveys around 700 CEOs, presidents and chairmen worldwide, cited the two greatest concerns for 2011 as being excellence in execution and consistent execution of strategy by top management.

Despite the growing awareness of its importance, strategy execution remains a major challenge for organizations. Frequently quoted failure rates of executing strategy and achieving strategic goals are anywhere between 70% and 90%, and have remained consistent over the past two decades. Shikhar Ghosh, a senior lecturer at the Harvard Business School, says this statistic goes as high as 95%.

Furthermore, most of the research around what drives effective execution was conducted in developed countries, so the success factors in Africa are relatively under researched in comparison.

Africa – offering a different execution challenge

EY’s Africa Attractiveness report highlights the continent’s steady rise and its vast potential for profitable and sustainable growth, but it also cautions organizations against viewing it as a homogenous market. Contrary to the popular view that Africa is one big market, it is complex and fragmented, with differing cultures, languages and challenges across its one billion people and unique to each of its 54 sovereign states. As a result, any kind of growth strategy in Africa almost invariably has to take into account multiple markets, which potentially makes execution even more complex.

Seven success factors for strategy execution in Africa

Over the course of three years of targeted research by EY, supporting multiple clients expanding into Africa and including EY’s own experience in expanding the organization’s footprint across 33 countries in Africa, the findings and insights have been distilled into seven interconnected success factors for effective strategy execution. These success factors need to be considered in addition to the success factors identified in prior research. The model is known as EY’s 7-P model4 (see Figure 1) and is similar in structure to the 7-S model popularized by Tom Peters and Robert Waterman.5

Drilling down further into the data, the “softer” dimensions, such as culture and talent management, tended to play a critical role between success and failure. Many of the organizations that have remained in Africa are the ones that have persevered with the “softer” elements and adapted to the uniqueness of each African market. This is evident in the Airtel case study that follows.

Table 1
Overview of the seven success factors for strategy execution in Africa

<table>
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<tr>
<th>Success factor</th>
<th>Definition</th>
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<tr>
<td>Purpose</td>
<td>Knowing why an organization wants to expand into Africa in the first place, and the objective it wants to achieve in doing so.</td>
</tr>
<tr>
<td>Planning</td>
<td>Making well-informed choices about which markets to enter, when and via which mode, is critical. Striking the right balance between sticking to the plan and adapting to the different needs and challenges the organization is presented with.</td>
</tr>
<tr>
<td>Portfolio</td>
<td>Balancing risk across a number of different markets is important, particularly in Africa, where the levels of immaturity and risk vary, as well as the current lack of scale in many individual markets. A sizable African portfolio provides diversification of risks.</td>
</tr>
<tr>
<td>People</td>
<td>Strategies are not self-executing, and a firm’s success will depend on its ability to put human resource development (globally and locally) at the heart of strategy execution, especially for management and technical skills.</td>
</tr>
<tr>
<td>Partnerships</td>
<td>Strong local business partnerships are often critical to success, particularly when it comes to doing business in Africa. An effective local partner can help a new entrant penetrate the local market by providing insights and contacts with relevant stakeholders to smooth the process and navigate the challenges.</td>
</tr>
<tr>
<td>Perspective</td>
<td>Sun Tzu, a Chinese military general, states, “Victorious warriors win first and then go to war, while defeated warriors go to war first and then seek to win.” To succeed in doing business in Africa, one must adopt a positive mindset. Findings from EY’s research show that organizations that have been successful in Africa have tended to look for the opportunities first, and only then factored in risks.</td>
</tr>
<tr>
<td>Patience</td>
<td>Organizations that wish to succeed in Africa need to understand that there are no short cuts to quick and high returns. It generally takes time and investment to generate any kind of meaningful returns from African operations. Successful organizations have made it in Africa because of their commitment and tenacity over many years.</td>
</tr>
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Figure 1
EY’s 7-P model for effective strategy execution in Africa

4. The 7-P model was developed by EY’s Africa Business Center and was published originally as five critical success factors in the EY publication Doing business in Africa: from strategy to execution, 2013.
Case study

Airtel's “Africanization”*

Airtel's experience in entering the African market provides insight into the challenges organizations may face when executing their African growth strategies. Since Bharti Airtel launched its mobile telephony service back in 1995, it has grown its customer base rapidly, reaching over 100 million subscribers by 2009. However, as market penetration in India increased, growth started to slow and Africa became the next potential new growth market. The leadership team had even identified similarities between Africa and India, prompting them to believe their low-cost, high-volume “minute factory”** business model would be ideally suited to Africa's largely underdeveloped markets.

In reality, this was not the case. Expanding in Africa was vastly different from expanding in India. Airtel's business model could not be replicated despite similarities in the markets, and being a first mover meant there were many risks that had to be mitigated through trial and error. Airtel also faced demotivated staff and a business that was fragmented across 15 different African markets. This added extra layers of complexity in the form of culture and language barriers, regulations, currencies and time zones.

Airtel had to pay particular attention to people and culture issues. Indian management and expatriates had to adapt to the cultural nuances and different styles of working of the African countries. It was also initially challenging to find the right local skills for the business, requiring Airtel to bring in expatriates, which increased the costs of doing business in Africa. To address these issues, Airtel sought to invest in the development of local skills and capabilities, over the ensuing years, to empower local talent to run Airtel's businesses under a unifying brand, culture and operating principle.

* The Airtel case study was created through interviews between EY Africa Business Center and Airtel.

** The term “minute factory” is often used to describe Airtel's business model. The basic premise is that lower tariffs (prices) will lead to higher volumes (i.e., minutes) — simplistically, bringing down prices will lead to people talking for longer. By keeping margins per minute steady (through, for example, outsourcing of IT and network operations) while driving up volumes (i.e., minutes per subscriber), overall revenues and profits grew spectacularly in India.
Lessons learnt – don’t forget the “soft stuff”

Is it feasible to expect line management to cope with the execution effort while simultaneously dealing with day-to-day governance, customer, stakeholder, performance, customer and crisis management and, in parallel, setting up operations and ramping up performance over the short to medium term?

The answer lies in recognizing where to focus and understanding the constraints of your ability to execute effectively. Although it is important to address all the success factors shown in Figure 3, knowing where to start is difficult and daunting, however critical. A “shotgun” or indiscriminate approach in an uncoordinated program wastes resources and effort. By focusing on two challenges first – in other words, the drivers – it may improve the chances of the other “harder” issues being resolved with much less effort. These are, often, only the symptoms of the problem. This was clearly seen in the Airtel case study.

The first key constraint or challenge in strategy execution is not having dedicated resources and skills. This can be addressed by creating organizational capacity to support line management and coordinate the multidimensional execution framework illustrated in Figure 2 and elevate the importance of culture and talent shown in Figure 3. This requires unique skills and discipline to ensure the multiple factors are identified, understood, integrated and effectively executed over the longer term. A framework for executing strategy or addressing culture and talent is a good step toward creating structure; however, it still needs resources and skills to make it happen. This is where line management is often constrained and struggles to manage the complexity or workload.
The second key constraint or challenge is not taking culture and talent seriously enough, so not ensuring there is the right framework to manage them effectively in an African context.

These two key themes emerged from the research conducted by EY as the critical drivers of sustainable strategy execution. Figure 3 shows that, across both basic and Africa-specific success factors, these “softer issues” are explicit. In addition to the accountability of line management, strong support from a business function is also important to ensure they are effectively addressed.

"Opportunities multiply as they are seized."
Sun Tzu, sixth-century military general, strategist and philosopher
Examples of culture and talent challenges in the African context

Culture
Strong cultures can have an incredible impact on strategy execution. This is summed up well in the statement “culture eats strategy for breakfast,” a remark attributed to Peter Drucker and popularized in 2006 by Mark Fields, COO of Ford Motor Company.

The danger is assuming that cultures are the same across and even within country borders. This is illustrated by the incorrect application of the philosophy of “ubuntu,” which can be translated as “I am because you are and you are because I am,” across cultural boundaries. Ubuntu’s defining values and principles include respect, group solidarity, conformity, compassion, human dignity and humaneness, interdependence and hospitality. So, the argument goes, organizations in Africa that foster a workplace culture that gives expression to these values will achieve higher levels of employee engagement that will translate into improved performance. As a result, these people are very expensive to hire and very mobile, meaning it becomes an ongoing recruitment and retention challenge.

Talent
Strategies are not self-executing; they need the right people. A commonly cited challenge for many companies expanding in Africa is the shortage of skills. Mining companies, for example, are operating very sophisticated equipment that requires expert maintenance in remote locations in places such as Mozambique, Zambia and the Democratic Republic of Congo (DRC). In most instances, it is still very challenging to find people with the required skill levels. As a result, these people are very expensive to hire and very mobile, meaning it becomes an ongoing recruitment and retention challenge.

Considerations for business leaders
So, what does this all mean for those embarking or continuing on their Africa growth path? There are two considerations worth exploring to help address the multitude of success factors and enhance execution capability.

Addressing challenge 1: Organizational design considerations
The coordination and integration of the seven identified Africa success factors is complex and time-consuming for stretched management teams.

Management should consider creating a formalized or dedicated strategy function, such as a chief strategy officer, strategy execution officer or office of strategy management (SEO or OSM), to integrate, coordinate and navigate the complexity of the Africa market expansion strategy. Such an officer would work closely with the senior management team and program or project leaders to coordinate and drive strategy execution and review and resolve issues throughout the Africa expansion program.

If management teams are focusing predominantly on the harder operating model elements, possibly at the expense of the softer ones, the sustainability of their strategy execution program may be severely jeopardized. Considering the importance of the softer issues of culture and talent management, the role of the HR function is brought squarely into the spotlight.

Organizations should ensure they have the right HR partner who understands the growth strategy, has a strong business background, understands the business and has a deep understanding of the markets under consideration. It is crucial to align the HR strategic objectives and performance incentives to the business’ strategic objectives.

“The soft stuff is always harder than the hard stuff.”
Roger Enrico, former CEO of PepsiCo

Strategy execution in Africa. Creating focus and capability in a complex environment

“People are not your most important asset. The right people are.”
Jim Collins, business consultant, author and lecturer on company sustainability and growth

Addressing challenge 2: culture and talent considerations for HR
With HR in the spotlight and at the forefront of the formulation and execution processes, addressing culture and talent early on is more probable and results in a more effective growth strategy.

A note on culture
For organizations entering into Africa, it is critical to assess the current culture spectrum within each geographically specific workforce and to assess the possible alignment areas and divergences from the original organizational culture of the parent company. Building consensus and codeveloping the architecture of this realigned culture with employees in the new geography will go a long way to building an engaged and productive workforce. For example, during the integration of 33 of its country practices across Africa, EY identified the following tips for a successful organizational cultural journey:

1. Understand the business needs – what works for one business may not work for another. Know what you are trying to achieve and why it is critical for success.
2. Appreciate the importance of executive commitment – ongoing executive and partner support and involvement.
3. Create an empowering platform – allowing everyone to contribute and giving them a voice.
4. Demonstrate innovation and creativity – capturing the imagination and spirit of the organization.
5. Implement meaningful initiatives – delivering messages that are relevant to the local context.
6. Encourage sustainability – embedding the culture in existing processes and systems.

A note on talent
In a recent EY survey across 23 countries in sub-Saharan Africa, in which 224 companies participated, representing approximately 392,000 employees, the following key findings emerged:

1. The war for talent is just beginning, so start thinking ahead. A planning horizon longer than 6 to 12 months should be considered. As the war for talent heats up, so will the requirement for adequate, longer-term planning by the HR function.
2. Organizations need to define specific, practical plans for replacing expatriates with indigenous labor and the transfer of skills. In line with the expected decline in appetite for hiring expatriates, organizations are clearly looking to other labor markets as potential talent pools for sourcing skills.
3. The potential of the returning African diaspora and recruitment from other African countries has not been considered in a meaningful way.
4. Management and leadership development to cultivate the local talent required for growth is the cornerstone of executing the growth strategy.
5. The capability of the HR function to deliver services and processes in a range of areas requires attention.


Footnotes:
Conclusion

There are many factors to consider when executing a strategy, so, as a business leader, how do you create focus and capability? A good starting point is creating a dedicated strategy execution function such as a SEO or OSM to work hand in hand with line management and unravel the complexity, focus on the key success factors, coordinate the execution process and integrate the moving parts. Don’t take it for granted that existing line management will have the inclination, capability or capacity to do so. It is generally out of their comfort zone and they will often default back to operations.

Once a dedicated execution capability is in place, elevate the HR function and soft stuff in the strategy planning agenda. With so much focus by senior management on the hard stuff, such as market assessment, customer strategy, operating and financial model design, the softer issues are often pushed to the back of the planning and execution processes. For many firms that are serious about seeing through their African investment in the longer term, success will depend on the ability to manage culture and human resource development, especially for leadership, management and technical skills. Get the right people in place and they will figure out the “hard” stuff.

Finally, ensure the HR and strategy execution functions have the necessary skills and are empowered, respected by the top management team and business, and able to contribute to and facilitate the growth conversations up front. These organizational elements are at the heart of strategy execution and form the foundations that give the other success factors a stronger chance of not becoming part of the 95% failure statistic.

Our thanks to the following for their contributions to this article:
- Michael Lalor from the EY Africa Business Center
- Kate Skinstad from the EY Africa People & Organization Competency
Measuring open innovation
A toolkit for successful innovation teams

Even experienced managers still go blank when asked how to assess, control and measure the performance of open innovation (OI) activities. To address this, we will discuss a general framework for an OI performance measurement system and present a metrics-based management toolkit that provides a suite of KPIs for a specific set of OI methods.
Thanks to loads of compelling research studies and best practice cases in OI carried out over the last decade, several companies have begun to embrace and partially apply the new principles and methods OI offers. Yet, while the development of innovation metrics, in general, is still an emerging discipline, there is absolutely no clear guidance on how companies should approach them in order to measure the success of their OI initiatives.

Upcoming challenges in measuring today’s OI practices

While, in the past, traditional problem-solving processes led to perhaps a few hundred ideas, these days, a successful ideation contest – if it is directed to an external network – can easily generate thousands of insights. Teamwork will span across companies, universities, governments, suppliers, customers and individuals. And it will involve numerous online tools, such as search engines, databases, podcasts, websites and other toolkits.¹

The incorporation of such a large number of diverse insights can be challenging, confusing and appear uncontrollable.

It is easy to see how the level of complexity of initiatives driven by OI far exceeds that which corporate innovation teams normally deal with in traditionally executed innovation projects. Deploying OI requires not just access to financial resources and the clear allocation of responsibilities. The untapped secret lies in a company’s ability to successfully measure the huge amount of knowledge being gathered.

Does your company measure up?
The need for OI metrics

Studies have shown that around 90% of a company’s innovation efforts never result in commercialized products or services.² This has led to a suspicion that innovation still seems to rely on fairly random incidents, rather than being the result of clearly defined performance measurement procedures.³ Other research confirms this, pointing especially to the shortcomings of coordination and underestimation of the complexity that arises in the context

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of OI processes. However, if companies approach OI in a more organized and systematic way — e.g., through the application of new innovation metrics — they could raise their return on innovation at no or small additional costs.

Among those companies that do measure innovation, we found that most still use very generic innovation metrics that are primarily based on R&D and product-development metrics solely (i.e., the number of patents filed in the past year or the number of ideas submitted by employees). Though somewhat useful, these metrics provide only minimal support for organizations on their innovation journey, since they do not map performance measures that instantly drive, impact or completely indicate a company’s (open) innovation performance. Why do innovation departments still not have access to the right tools and metrics to enable them to successfully control and measure their OI projects?

In our experience, what seems to be a real challenge for companies is finding the relevant metrics for their OI activities and the discipline to make measurement a priority as part of a standardized process. Appropriate tools and metrics are needed that empower innovation teams to properly measure OI in order to be able to promote the best innovation ideas and solutions and turn new knowledge into successful commercialized products or services.

If our clients could raise their return on innovation by just 10%-20% through controlled and measured OI practices, this would give them a significant competitive advantage and the potential to be true game changers.

Framework for an OI performance measurement system

Using our experience in performance measurement and the findings of desk research, we singled out three quite distinct principles that companies must consider in order to successfully implement a metrics-based performance measurement system for their OI projects.

Figure 1 outlines this simple framework, including our three principles on OI metrics. It gives a suite of KPIs and provides a better idea of how to properly set up a performance measurement system that will help you to assess, control and measure your OI activities.

Principle 1
Use unique metrics for each OI method

Measuring OI greatly depends on your desired innovation goals and the underlying OI method with its fundamental features, characteristics and resources that you are going to use in your OI project. In other words, method-specific metrics or KPIs are needed in order to be able to properly assess and measure the progress and success of each of these activities.

We deep dived into the three most prominent methods of OI that cover both the early, as well as the later, stages of the innovation process:
“Method-specific metrics or KPIs are needed in order to be able to properly assess and measure the progress and success of each of these activities.”

- The lead user method identifies innovative users who are at the leading edge of important trends and benefit greatly from obtaining a solution to their needs. Thus, they are motivated to discuss and tackle their innovation needs and ideas in workshops.

- In an ideation contest, a company seeking innovation-related information posts a task-specific challenge to a population of independent, competing agents (e.g., customers or suppliers) who then submit ideas within a given time frame. The company rewards the participants that generated the best solutions.

- Broadcast search involves contests that seek technical solutions rather than just ideas. Online broker companies, so-called intermediaries, such as InnoCentive or Nine Sigma, provide companies access to a global pool of scientists, engineers and other professionals to help them solve, primarily, R&D problems they have been unable to solve through internal methods. The problem has a stipulated time frame and cash prize for the winning solution. With the help of the intermediary, the company defines the problem and develops criteria for picking a solution.

It is quite obvious that measuring the innovation success of a lead user project requires a different set of KPIs than those required for broadcast search. Whereas the focus of a lead user project lies primarily on evaluating the identified new needs and trends provided by innovative users, measuring the success of broadcast search requires metrics that map the potential performance of a technical solution.

**Principle 2**
**Consider different types of measures: input, process, output and outcome (IPOO)**

The second principle concerns the different types of measures that need to be tracked by a holistic performance measurement system. The framework should be designed to link the outputs or outcomes of an OI initiative to the inputs.

- **Input KPIs** measure the input elements within a project, such as human or financial resources.

- **Process KPIs** are used to transform inputs into outputs and to improve the efficiency of the innovation process: time variances, budget variances, error ratio, etc.

- **Output KPIs** measure the results of the development activities within an innovation process: number of ideas, number of patents, number of publications, etc.

- **Outcome KPIs** aim to determine the value of an innovation in terms of economic and market-oriented performance indicators.

Only the combination of both input and output (outcome) metrics can provide a meaningful understanding of the cause-effect relationships of a project. Moreover, since the real value of the output (outcome) of an OI initiative is the result of more than just the resources invested (input), various measures of the processing or transformation procedures should also be integrated into the framework.

**Principle 3**
**Think about how to utilize your OI metrics effectively**

The mere provision of a performance measurement system through the collection of appropriate management information is itself no guarantee of successful innovations. Pelz proposes that metrics can be utilized on three different levels: instrumental, conceptual and symbolic.

- **Instrumental use** refers to the application of information or metrics used directly for decision-making. For instance,
when the OI project is canceled because the metric “expected sales” is below a specific threshold, the metric was used instrumentally.

► A more indirect use is the conceptual one. The use of the information or metric does not directly lead to a concrete action, but rather provides general enlightenment and understanding. For example, when a manager recognizes that the lead time of OI projects is on average 30% lower than for conventionally run innovation projects, they are using the metric “lead time” conceptually.

► Metrics can also be used after decisions have already been made to legitimize and justify them. This kind of use is called symbolic. If an OI project is canceled due to cost overruns, the official reason for its termination is “quality of ideas” – this metric is used symbolically.

The way in which metrics should be utilized greatly depends on your desired project goals. For instance, if you are following long-term goals rather than short-term success with your OI project, i.e., to facilitate a sustainable innovation culture, hard measures such as expected sales should be used conceptually for providing general enlightenment and understanding, and less for decision-making purposes.

Outlook
So far, a simple and easy-to-apply framework for OI performance measurement has been outlined. However, there is still no answer to what we should actually be measuring. What are the relevant KPIs behind that framework?

This question was the focus of our Open Innovation KPI 2012 study, in which we identified the most relevant KPIs from the perspective of innovation managers and performance measurement consultants.
Open Innovation KPI 2012 study

We first had to decide which of the existing methods and tools for integrating external knowledge into the OI process should be applied to our performance measurement toolkit (principle one). As described above, the decision was made to take a closer look at the three most prominent methods of “inbound OI”: lead user method, ideation contest and broadcast search, which cover both the early and later stages of the innovation process. The framework was enriched with a number of meaningful performance measures for each OI method. However, there was no indication that the information and metrics collected from literature would offer a wide enough range of application for practical decision-making in business corporations.

In order to close this gap, experts from corporate functions and management consulting were asked to participate in a survey to assess the relevance of an assembled set of KPIs. Our sample included large European companies from a range of different industries (e.g., chemical and pharmaceutical, automotive and mechanical engineering, consumer goods and professional services) with annual revenues in excess of €200m and with 1,000 employees or more. We received usable responses from 117 consultants and industry practitioners.

Making better use of metrics to drive improvement in OI projects

The study’s first question explored how metrics were being used by both practitioners and consultants to monitor the performance and predict the return of their OI projects.

The results demonstrated that consultants and practitioners share a slightly different opinion on how best to apply metrics to OI. Figure 2 shows 39% of the EY consultants reported that decisions should be made directly on the basis of an indicator score (instrumental use), while almost the same proportion of innovation managers prefer to use metrics tactically or symbolically to delay or spur action on an OI issue.

To some extent, this difference in focus is explained by the different interests and perspectives of the two groups. Innovation managers tend to assume that their OI projects are subject to significant uncertainty, particularly in the early stages of development, thus, for them, concrete targets and measures don’t seem to be definable or detectable.

Consultants, in turn, frequently experience innovation projects going out of control, because no or too few suitable measures have been determined in advance. That fact gives rise to a more instrumental use of metrics, where generated data is incorporated directly into the decision-making processes, thereby leading to improved results.

We also explored the primary role that metrics play when tracking different types of measures. Instrumental use seems to be more prominent at the very beginning (input) and at the end of the performance measurement process (outcome), while conceptual and symbolic use dominate output measures (see Figure 3).

In conclusion:

- Depending on the innovation problem: a dedicated focus on increasing radical innovation should involve a conceptual use of OI metrics.
- Depending on the innovation culture: if companies tend increasingly to lax treatments concerning deadlines and budget, then an instrumental use of measures is recommended.
- Depending on the types of measures: while input and outcome measures should rather follow an instrumental use, output measures should follow a more conceptual use.

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6. The survey, conducted by EY in cooperation with the Technology and Innovation Management Group at RWTH Aachen University, Germany, aimed to identify the most relevant KPIs for measuring OI.
Measures for OI: are there any suitable measures?

To investigate the usefulness of different metrics for measuring OI, we provided our respondents with an assembled set of KPIs for each OI method. In general, industry firms and management consultants view these indicators as important. Thus, they are somewhat confident that these measures are getting it right and helping firms to improve their OI activities.

In general, respondents seem to have a stronger tendency toward financial outcome measures, and prefer less those indicators that, by nature, are more difficult to attract. Interestingly, measures that relate to an economic outturn seem to be more promising than measures that address empirically proven critical success factors of OI. Why isn’t it common to integrate a prevailing empirically validated OI enabler as part of a performance measurement system?

One reason is that the new methods of OI are relatively young and are still maturing. The “old” systems for measuring innovation are, at best, slightly adjusted to external influences but do not capture or quantify critical success factors of OI. Another reason could be that outcome measures are usually more meaningful than high-risk intermediate results.

Qualitative indicators, such as the radicalism and novelty of ideas, are hard to attract, since they have to be collected through painstaking qualitative assessment procedures.
In order to help organizations identify and determine a coherent portfolio of the right metrics, we propose three OI scorecards. These scorecards, shown in Tables 1, 2 and 3, were created based on our three key principles on how to measure OI (see Figure 1) and represent the highest priority measures selected by our survey respondents.

The scorecards are structured around two phases: initiation and implementation. Each phase is split into the relevant stages of the performance measurement process, i.e., input, process, output, outcome. KPIs are then allocated to all of the identified processes within both the initiation and implementation phases. There is also a third part to the scorecard: overall KPIs. Again, this is split into the stages of the performance management process and KPIs are allocated accordingly. It is worth noting that, unlike in the initiation and implementation phases, these overall KPIs are identical across the three scorecards.

On average, we observed the following:
- All the metrics taken from relevant literature play an important role in measuring success across all three scorecards.
- Both lead user and ideation contest are particularly complex methods, and broadcast search is semi-complex.
- All three methods require more than a few KPIs.
Output measures appeared to be relatively less promising across all three methods. KPIs that are used to measure process efficiency of transforming inputs into outputs are rated lowest in importance. Input and outcome KPIs follow a more instrumental use.

Findings specific to each method are as follows:
- Lead user integration: firms seem to have the strongest tendency toward metrics that relate on an input and outcome perspective at all stages (i.e., initiation and implementation).
- Ideation contest: measures that aim to determine the value of an innovation in terms of outcome KPIs are significantly important throughout all stages (i.e., initiation and implementation phase). Interestingly, only input measures that appear at the initiation phase scored significantly high.
- Broadcast search: input and outcome measures that appear at the initiation phase are considered to be of low importance, since they do not show up in our scorecard.

### Table 2
**OI scorecard for ideation contests**

<table>
<thead>
<tr>
<th>I-P-O-O</th>
<th>Category</th>
<th>Measurement of</th>
<th>KPI</th>
<th>Survey results*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cost of implementing the IT platform</td>
<td>Cost of implementing the IT platform</td>
<td>1.2</td>
</tr>
<tr>
<td>Input</td>
<td>Costs</td>
<td>IT platform</td>
<td>Number of available communication channels on the IT platform (e.g., chat function, forum, private message, commenting and rating abilities)</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
<td>IT platform</td>
<td>User friendliness of the IT platform or web page (e.g., measured by the number of complaints per test person)</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>Problem formulation</td>
<td>Scalamblility of the task (is the task description broad enough to engage a large number of participants?)</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>Scope</td>
<td>Heterogeneity</td>
<td>Heterogeneity (diversity) of external contest participants (e.g., customers, suppliers)</td>
<td>1.2</td>
</tr>
<tr>
<td>Outcome</td>
<td>Market potential</td>
<td>Customer potential</td>
<td>Degree to which contest participants represent the mass market that the company is targeting for the future</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>Process</td>
<td>Quality</td>
<td>Degree of interaction (e.g., number and intensity of messages exchanged within the community)</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>Output</td>
<td>Quantity</td>
<td>Productivity</td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td>Sustainability</td>
<td>Reputations and image</td>
<td>Increase in company reputation among participants (e.g., duration of membership or frequency of use of the platform)</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>Outcome</td>
<td>Commercialization</td>
<td>Imitability</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Overall KPIs</td>
<td>Top management commitment</td>
<td>Degree of top management commitment to open innovation initiative</td>
<td>2.6</td>
</tr>
<tr>
<td>Input</td>
<td>R&amp;D</td>
<td>Cost to market</td>
<td>Cost to market of development using open innovation</td>
<td>1.1</td>
</tr>
<tr>
<td>Process</td>
<td>Time</td>
<td>Time to market</td>
<td>Time to market of the innovation</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>Risk</td>
<td>Intellectual property</td>
<td>Degree of protection of intellectual property in cooperation with external partners</td>
<td>1.3</td>
</tr>
<tr>
<td>Output</td>
<td>Sustainability</td>
<td>Culture</td>
<td>Increase in corporate-wide open innovation culture through the open innovation activity</td>
<td>1.2</td>
</tr>
<tr>
<td>Outcome</td>
<td>Creativity</td>
<td>Originality</td>
<td>Customers benefit from the innovation provided (fit to market)</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>Profitability</td>
<td>Revenues</td>
<td>Expected increase in revenue from new customers as a percentage of total sales</td>
<td>1.7</td>
</tr>
</tbody>
</table>

* Base of data collection of arithmetic mean: 3 (very important), 1 (important), 0 (neutral), -1 (unimportant) and -3 (very unimportant). n=86 (August 2012).
### Table 3
**OI scorecard for broadcast search**

<table>
<thead>
<tr>
<th>I-P-O-O</th>
<th>Category</th>
<th>Measurement of</th>
<th>KPI</th>
<th>Survey results*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Arithmetic mean</td>
<td></td>
</tr>
<tr>
<td>Process</td>
<td>Time</td>
<td>Delivery date variations</td>
<td>Average delay in meeting deadlines (due to failed contract negotiations) in relation to projects run with more traditional internal innovation processes</td>
<td>1.0</td>
</tr>
<tr>
<td>Output</td>
<td>Scope</td>
<td>Size of target group</td>
<td>Number of accessible problem solvers via the intermediary compared with the firm’s own R&amp;D employees</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heterogenetic</td>
<td>Degree of heterogeneity of the solver community, e.g., variation in interests and expertise of the solvers</td>
<td>1.4</td>
</tr>
<tr>
<td>B. Implementation phase</td>
<td>Time</td>
<td>Time</td>
<td>The ratio between the number of days the problem is open to solvers and the average number of days for similar problems initiated by other firms seeking solutions</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
<td>Problem formulation</td>
<td>Specificity of the problem (is the task or issue broad enough to attract a relatively large number of solvers?)</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Process</td>
<td>Adaptation effort</td>
<td>Number of times feedback is gathered from intermediary in the development of the problem statement</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Output</td>
<td>Traffic</td>
<td>Number of individuals or solvers opening the problem per submitted solution</td>
<td>1.0</td>
</tr>
<tr>
<td>Outcome</td>
<td>Profitability</td>
<td>Cost saving</td>
<td>Estimated savings from using crowdsourcing initiative relative to costs of a similar in-house problem-solving process</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>Market potential</td>
<td>Technological potential</td>
<td>Anticipated technological lead over competitors from utilizing external solution processes</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>Feasibility</td>
<td>Compatibility</td>
<td>Compatibility of solution with the company’s internal innovation processes (ease with which solution is integrated into subsequent phases of the development process)</td>
<td>1.3</td>
</tr>
<tr>
<td>Overall KPIs</td>
<td>Top management commitment</td>
<td>Degree of top management commitment to open innovation initiative</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td></td>
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<tr>
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<td>Increase in corporate-wide open innovation culture through the open innovation activity</td>
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</tr>
</tbody>
</table>

* Base of data collection of arithmetic mean: 3 (very important), 1 (important), 0 (neutral), -1 (unimportant) and -3 (very unimportant). 
n=83 (August 2012).
When, in the process, to use the scorecards

When looking at it from a process perspective, the developed OI scorecards can be applied to the different phases of the innovation process as follows (see also Figure 4): in the early stages, both the lead user method and idea contests are helpful tools for identifying customer needs and first solution approaches. Broadcast search, however, is particularly useful in the later stages of the innovation process to generate suitable knowledge for technological solutions or to identify potential solution providers. Depending on the chosen method, the individual scorecards can then be used to monitor and predict the success of the OI campaign.

Conclusion

OI is not an automatic success but one that demands appropriate tools and metrics that enable you to change your strategy before mistakes become expensive or great ideas are refused. To this end, a performance measurement toolkit exists, empowering decision-makers and innovation teams – especially in technology-based industries – to properly assess, control and measure the performance of their OI activities.

Contrary to many other OI indicator studies, a toolkit has, in this case, been realized, not only in terms of secondary data sources, but also through an empirical evaluation. This allowed us to reduce the initial amount of indicators to reach a much smaller, though statistically significant, set of relevant metrics provided by our three OI scorecards. Thus, these scorecards might help you to identify and determine a coherent portfolio of right metrics directly associated to your OI strategy, as they reflect only those measures that were rated significantly important by almost 90 innovation experts and consultants.

Once identified, the measures have to be utilized or initiated by the responsible actors within your company. As our study reveals, input and outcome measures should rather follow an instrumental use, while output and process KPIs were dominated by a conceptual use.

However, a successful application of indicators also depends on the innovation challenge (degree of innovation), as well as on a company’s ability and sincerity to appropriately plan and manage an OI campaign (corporate culture). A dedicated focus on increasing radical innovation should involve a conceptual use of OI metrics. Nevertheless, if companies tend increasingly to lax treatments concerning deadlines and budget, then an instrumental use of measures is recommended.
Anti-corruption practices

Reinforcement opportunities via internal controls

Companies are under pressure to demonstrate that they are taking the fight against fraud and corruption seriously. Increasing loss of confidence, in recent years, has led to a greater emphasis by organizations on their internal control activities. This article argues that there are many opportunities for leveraging existing resources and compliance programs to help assess and address corruption risk.
Over the past few decades and at a global level, companies have been implementing controls designed to prevent or mitigate fraud risks liable to cause damage to their reputation or profitability. This has allowed them to forge healthy relationships with suppliers, clients, partners, public authorities and governments in the countries in which they operate. The majority of these companies observe legislation governing anti-corruption practices.

Although some countries (such as Venezuela) have promulgated their own anti-corruption laws, the US Foreign Corrupt Practices Act and the UK Bribery Act (enacted in 2010) generally constitute the most extensive legislation as regards the activities they prohibit and their jurisdictional scope.

The Foreign Corrupt Practices Act (FCPA) of 1977 is a US federal law that is mainly known for two of its primary provisions: the first refers to the transparency of financial reporting of companies in accordance with the requirements of the Securities and Exchange Commission (SEC) of 1934, while the second is concerned with the bribery of foreign officials. The FCPA’s primary objective is to prevent fraudulent acts and, in turn, fraud in companies and public entities. It applies to US corporations or foreign corporations that have securities of any kind registered with the SEC or that are obliged to file compliance reports with the SEC. Likewise, it applies to any person who holds US citizenship or who is born or resident in the United States and any entity incorporated under US law or headquartered in the United States.

By contrast to the FCPA, the UK Bribery Act does not allow exceptions for facilitation payments to public officials and does not impose any requirements relating to the maintenance of books and records. Evidently, having an effective anti-corruption program in place can serve as a defense mechanism against criminal prosecution. Under the FCPA, having a program in place can lead to a reduction in the severity of fines or penalties under the US Federal Sentencing Guidelines. Moreover, the UK Bribery Act provides relief for entities that have an effective anti-corruption program in place. By contrast, the FCPA only considers this a mitigating factor when assessing potential penalties.
How internal controls can support anti-corruption practices

Internal control is “a set of actions, activities, plans, policies, requirements, records, organizational structures, procedures and methods, including the attitudes of management and personnel, organized and institutionalized within each entity for the achievement of institutional objectives and targets.”

An understanding of the law forms the basis for the establishment of an anti-corruption compliance program equipped with adequate policies, procedures, controls and authorization.

The Internal Control – Integrated Framework provides an outline of what a good anti-corruption program should accomplish and how its success should be defined. As illustrated in Figure 1, the framework sets out five components for the implementation of effective systems of internal control: control environment, risk assessment, control activities, information and communication, and monitoring activities.

The five components are supported by 17 principles, such as the board of directors needing to demonstrate independence from management or


The highest priority task is to identify and analyze any risks inherent in the business, while simultaneously taking into account the relationships that the company has with government entities, agents and intermediaries, and also factoring in the complexity of operations and the regulatory environment.

“The highest priority task is to identify and analyze any risks inherent in the business, while simultaneously taking into account the relationships that the company has with government entities, agents and intermediaries, and also factoring in the complexity of operations and the regulatory environment.”
“Even in the most robust companies, management is under pressure to deal very effectively with crisis situations.”

Conduct that is frequently scrutinized includes gifts, invitations or donations made to clients and service suppliers. Recommendations on how to avoid objections to such practices, which are very common in Latin American countries, include:

**Gifts and entertainment**
- Should be restricted to business persons
- Should not be frequent
- Should observe the requirements and policies of the companies involved and, more importantly, generally accepted practice in the industry
- Should be recorded appropriately and in a timely manner in the accounting records of the company making the gifts

**Donations**
- Should be adequately justified and documented and should observe the company’s policies
- Internal control policies established for donations and acts of charity should be approved by the company’s legal counsel
- Donations and acts of charity can be published in social media
- They can be made to nonprofit or non-governmental organizations, provided they constitute an act of charity and do not pursue any ulterior benefits

**Identifying and analyzing inherent business risk: the three stages**

- In the initial risk assessment stage, the policies and controls integral to the nature of the company’s business need to be identified. It is essential that key aspects of the internal control system that are relevant for the detection and prevention of possible instances of fraud or corrupt practices are reviewed in order to protect the company’s shareholders and employees.

- The second stage is geared toward identifying the policies and controls that the company has in place to mitigate corruption risks and analyzing the efficacy of, or any gaps in, such policies or controls. This review is based on the information obtained from the documentation of the controls established by the company (e.g., evaluation of the associated risks, internal control walk-throughs, authorized signatures manual, accounts with service providers, expense reports and petty cash).

- This is followed by a third stage, in which a plan is developed for the establishment of an effective and efficient anti-corruption program based on current risks and controls, and the additional resources available, in a bid to provide reasonable assurance of compliance. Based on these diagnostics, the auditors are able to identify the risks pertaining to the nature of the business and to develop an anti-corruption program that allows them to adequately and continually monitor implemented controls.

The Committee of Sponsoring Organizations of the Treadway Commission (COSO) acknowledges the importance of the risk assessment component when designing any system of internal control, given that a company has to allocate its limited resources to risk activities as efficiently as possible. The principles underpinning the risk assessment component focus on objectives relating to operations, reporting and compliance. COSO clarifies that the assessment of risks includes processes for the identification of risks, risk analysis and risk response. In addition, it broadens the assessment of the severity of risks beyond the aspects of likelihood of occurrence and impact to include speed and duration.
Conclusion

Fraud in companies is increasingly becoming a topic of concern, as it leads to loss of company value, while devaluing its assets and hindering its ability to meet its objectives. Among the requirements imposed by the principles of the United Nations Global Compact, companies have to fight corruption in every shape or form, including extortion and bribery.

In response to a loss of confidence, companies have stepped up internal control activities and internal audits together with the use of new tools for mitigating the impact of losses due to fraud and misappropriation of assets. Even in the most robust companies, in the current business conditions, management is under pressure to deal very effectively with crisis situations or other incidents that are difficult to anticipate and frequently undesired, as they can have adverse repercussions in any organization.

At present, many companies have compliance programs covering aspects of legal and reputational risk that could be leveraged for assessing corruption risk. In the same way, compliance programs encompass professionals and processes tasked with monitoring compliance activities and conducting internal investigations; efforts that could be used to supervise the anti-corruption program.

In addition, there are also several opportunities for leveraging the resources that the company has at its command: for example, extending the code of conduct to include observance of anti-corruption practices, establishing a detailed internal policy, having qualified personnel and implementing zero-tolerance policies for those who commit such acts.

An understanding of the aforementioned laws, regulations and compliance guidelines provides the starting point for designing and implementing an anti-corruption program that is efficient and tailored to the needs and nature of the company.
A new paradigm of Business Intelligence
How in-memory computing can change the analytical landscape

In-memory computing is mainly associated with boosting database performance. However, this perspective is blind to the potential for a broader business use: much greater flexibility in data analysis means that evaluation possibilities are subject to far fewer technical limitations and can be much more closely aligned to a company’s needs. This opens up new opportunities for Business Intelligence.
Authors

Dr. Andreas Reiser
Manager, Advisory Services, EY, Germany

Jens Wende
Senior Manager, Advisory Services, EY, Germany
Analysis of business data to support strategic decision-making has seen a long period of development. Initially, statistics were compiled in the same database system used for day-to-day operations. However, growing volumes of data increasingly led to performance bottlenecks, resulting in analytical systems being hived off and data warehouses being developed that extract the operational data from the source systems, transform it for strategic use and load it into special multidimensional structures. Over time, this rather technical approach shifted to become more analytical.

The current definition of Business Intelligence (BI) puts the focus on data utilization. However, the usage of BI solutions in many companies has become unmanageable and, in numerous cases, developments have gone in the wrong direction. Many companies are trying to simplify legacy complexity and merge everything into a central system of modular components. Enterprise software vendors have recognized this and now provide comprehensive BI solutions that fulfill as many requirements as possible: from rather static reporting functions through to sophisticated interactive data mining tools.

However, two problems have not yet been adequately resolved: firstly, two different datasets are being used and, secondly, there is insufficient performance to handle more complex business questions. Newly developed in-memory databases suitable for deployment in enterprises are a promising solution. These systems have the potential to merge operational and analytical data back into a uniform dataset, thus ensuring high system performance and flexibility.

In-memory databases: what’s new?

In-memory databases are no brand-new development. A great variety of systems have been in existence for years. For instance, most smartphone apps currently on the market use small-scale in-memory databases.

The new addition is a separate class of systems that were specifically designed...
for deployment in large, company-wide applications such as enterprise resource planning (ERP), customer relationship management (CRM), supply chain management (SCM) and BI. The first developments were aimed at accelerating data access, followed by further technical features, such as scalability and parallel processing.

However, it took some time for a breakthrough to emerge. This was achieved only recently by SAP, with its in-memory solution HANA. Alongside a mature technical solution a great amount of consideration was given to the specific application in a business context; and this may be the secret behind the product’s rapid success. Other manufacturers are currently trying to catch up with their own solutions, however, still with a rather technical focus.

**Flexibility is more important than performance**

Performance remains one of the most cited arguments for in-memory systems, and quite rightly so: the shifting of data from hard disk drives into random access memory (RAM), which is 100,000 times faster, makes it possible to significantly accelerate classic database operations. SAP, for example, states that HANA provides a 3600-fold acceleration for reporting applications.

However, focusing exclusively on performance only solves part of the problem. While it is possible to accelerate access to the data in the data warehouse, extraction, transformation and loading processes are still subject to the well-known restrictions. Similarly, there have, so far, been no changes in the flexibility of the data analysis. Until this happens, many companies will not achieve added value. This can only be possible by, at least, partially eliminating the strict segregation between operational and analytical data.

In-memory solutions involve a series of technologies that have a deep impact on the flexibility of data analysis. One important aspect is the employment of a hybrid database with row- and column-based table engines. While row-based storage is especially suitable for transactional data, column-based storage has, primarily, been optimized for analytical data access. By combining the two technologies in one database, there is the potential to merge both fields of application. In combination with high-performance data access, this would avoid the necessity to take the long way round, via a data warehouse, in many application cases. Several models are currently being developed, such as HANA Live, which provides direct semantic views of ERP data. Of particular significance is the term “view,” as what this means is it is no longer necessary to duplicate data – only various analytical perspectives of one and the same data source are made available.

This model provides several advantages. First and foremost, as mentioned, the urgently required flexibility boost. Secondly, direct access to the source data facilitates quicker analyses, as a previous extraction is no longer necessary. Furthermore, many queries can be performed ad hoc and without precalculations; if a query was incorrectly phrased on the first attempt, no opportunity costs are incurred by recalculation. Time-critical data (e.g., production) is available immediately, and similarly, harmful business decisions and behaviors can be exposed instantly (fraud, as an example). One further advantage is the unrestricted search area: even an extensive, well-defined data warehouse never makes all data from an ERP available because extraction from the source data is always based on the current business requirements. In contrast, direct access potentially makes it possible to analyze all transactions.

Another factor that should not be neglected is the twofold de-duplicating effect of in-memory databases: firstly, no extraction into another database for analytical purposes is necessary. Secondly, many analysis processes no longer require double datasets. For example, up to now, it was common for planning and consolidation models to be physically written back into the database. Such double data management is no longer required because of the high performance of in-memory databases. Similarly, business functions that were previously separate can now use the same database (e.g., finance and controlling functions).
A new paradigm of Business Intelligence. How in-memory computing can change the analytical landscape

The database is of secondary importance

We’ve mentioned two de-duplicating effects of in-memory databases, but there is a third that is often overlooked. In the current ERP world, data management, application logic and presentation view are made available in different systems. In-memory databases revoke this traditional separation and provide everything on one physical system; copying data to a second system is, therefore, unnecessary.

This is where new multicore systems, in particular, reveal their strength; in-memory databases not only support parallelization at application level, but already facilitate a massive degree of parallelization in the retrieval of relevant data. This merging of the application and persistence tiers has a considerable impact on the structuring of analytical applications and the technical architecture. Consequently, SAP, for example, emphasizes that HANA essentially serves as an application server; the aspect of data management is of secondary importance.

The application development is subject to similarly strong change process; while preparation of the data previously played a major role in the development cycle of dedicated BI applications, it is easily possible with in-memory solutions to prepare views of the source data and also to provide them with calculations that are made on an ad hoc basis. In other words, the database logic is simplified; the developers are able to focus more closely on the application logic from a business perspective. It should also be mentioned that more complex analyses requiring a deep dive into company data, such as risk analysis or fraud management, only become possible with in-memory solutions. This makes it easier to provide a glimpse into the future of a company.

Will everything improve?

The comments on in-memory solutions made so far might be described as optimistic, aiming, as they do, to emphasize the technology’s potential. There are limits to making an independent assessment of providers, as SAP currently has a clear head start. It remains to be seen to what extent individual developments establish themselves in practice. However, it already seems certain that in-memory computing will, in the future, be an important part of business applications. Nevertheless, there are some aspects that have to be taken into consideration both from a business and a technical perspective.

From a business perspective, attention must be paid to avoid developments in the wrong direction due to a lack of foresight. Increased flexibility also brings about a leap in solutions aimed at specific functional areas. Such special solutions should certainly be welcomed, as they allow shorter release cycles and lower costs. However, they present the risk of isolated applications and redundant developments. The importance of coordinating the portfolio and developments throughout the company as a whole should not be underestimated.

With regard to more recent trends, such as cloud computing, the deployment of in-memory computing should be subject to critical review. While all renowned suppliers now offer a wide range of cloud solutions, not every business will be willing to outsource its data to external systems. In any case, cloud solutions are only of limited use to in-memory computing as it usually involves another duplication of data on external systems. Individual, customized cloud applications are more likely to be relevant. Current sales figures show that providers’ cloud strategies have not been taken up to the expected extent.

It is (currently) not possible to implement some of the advantages of data warehouses using in-memory databases, which means that it will remain necessary to operate such systems in parallel for certain queries. Examples of this include the integration of external data sources and highly time-variant data. In addition, hardware and license costs for additional data warehouse systems need to be considered.

There are also issues that potentially could be worsened by the deployment of in-memory database systems and should also be taken into greater account when planning. These include, for example, the fact that in-memory systems support the concept of a single point of truth through de-duplication, but are not able to replace well-defined master data management. Another example is the necessity of a coherent security concept, which poses new challenges due to the merging of analytical and operational access.

“Companies are well advised to take a holistic perspective on tomorrow’s BI world and place the focus on medium- to long-term planning.”
Final thoughts: planning and costs

It has become clear that what was presumed to be a technical advancement has actually proved to be disruptive on the business side. Thus, the performance aspect moves into the background while medium- to long-term planning of the ERP and BI landscape, as well as the technical infrastructure, becomes much more important. There is also greater risk of planning errors due to legacy issues: the first in-memory solutions for enterprise-wide usage primarily focused on performance and for this reason, current demand concentrates on acceleration of data warehouse performance. As a result, the aspect of flexibility is ignored. In this way, these solutions do not, in many cases, reach their full potential, and users tend to be disappointed. Companies are, therefore, well advised to take a holistic perspective on tomorrow’s BI world and place the focus on medium- to long-term planning.

Turning to cost, a clear differentiation must be made between procurement costs and total cost of ownership. Although the price of RAM has fallen dramatically in recent years, the costs of an in-memory appliance are, nevertheless, higher than for traditional systems. In addition to the systems costs, there are license fees, as well as planning and roll-out costs. At the moment, the license fees are higher than the costs of a traditional database, as SAP currently has a very strong market position.

If, by contrast, the total costs of ownership are examined, a reduction in costs can be expected. In particular, indirect costs should decrease significantly through the development of dedicated analysis applications and the simpler integration of a BI toolbox. This effect is augmented by lowered costs due to de-duplication, elimination of complex ETL processes and savings relating to the actual search for information. In some cases, it will also be possible to reduce the license costs for additional BI solutions.

The only issue remaining is deciding when to transition to in-memory solutions. The wide spectrum of potential applications means that there are different degrees of maturity available in the market. While the use of in-memory databases for data warehouses, and as an independent data mart, has already reached a growth phase, the integration into operating systems is still only at the end of the introductory phase. Specific applications have already been optimized in a number of areas and give reason to be optimistic about the future. The rapid progress and depth of integration in the product range already achieved make it imperative for BI managers to address this technology, at least strategically, today.

The resulting disruption on the business side, furthermore, makes it necessary for specialist departments to learn about new opportunities. CFOs and COOs should also be aware of the possibilities for analysis in the financial and operational environment.

“CFOs and COOs should also be aware of the possibilities for analysis in the financial and operational environment.”
Key performance indicators
Winning tips and common challenges

Having an effective key performance indicator (KPI) selection and monitoring process is becoming increasingly critical in today’s competitive and integrated business environment. Companies rely on managers and staff to choose and monitor the right KPIs. This requires the development of a robust performance-measurement capability that is based on mature KPI-management expertise and supported by a collaborative performance culture. This article will help the reader to use KPIs to generate value in any organization.
This article will introduce some tips on exploiting KPIs and explore some common challenges companies face when using them. It also highlights the factors critical to designing the type of KPIs that will lead to successful strategy implementation. The article focuses on the reasons why some organizations effectively implement their strategic plans, while many others fail to do so. In addition, it aims to inform the reader of various techniques used in KPI management. It is hoped that this insight will help planning and performance professionals to do their jobs more effectively.

A good corporate strategic plan includes a solid set of KPIs that can translate strategy into manageable operational actions for employees. Usually, a business strategy fails to achieve this objective if it includes too many or unaligned KPIs. This can weaken the focus on objectives, making it difficult to communicate a consistent implementation plan to staff. KPIs should give individuals concrete links to the organization’s corporate objectives.

Moreover, a large list of KPIs that does not have clear linkages to a business’s overall objectives may be a sign of a larger problem: a lack of strategic focus. Selected KPIs in any strategy should have clear and solid links to the overall performance. Understanding the importance of different KPIs in driving these objectives is a necessary condition for providing good, actionable information at the operational level where corporate strategy is implemented.

**Setting the right KPIs**

It is fairly easy to find suitable financial KPIs for an organization, such as a measure of total revenue. But defining KPIs is less straightforward when applied to more subjective or vague areas of a business, such as customer satisfaction or employee development. In these instances, more creativity is needed. For example, an appropriate KPI for measuring employee development might be the number of training days per year taken by each staff member. To make the selection of KPIs more systematic, organizations need to be particularly careful when developing them.

The following is a typical sequence for developing KPIs within an organization:

1. **Identify a problem, situation or objective you are trying to address**, e.g., reducing the number of defective products at the end of the manufacturing process.

2. **Develop a view on how you would like the results to look**, e.g., target number of defective products to reduce from 20% to 5%.

3. **Develop a process for how you want things to be achieved**, e.g., this could involve reengineering the whole process or it could be achieved by introducing quality assurance checks at various stages of production.

4. **Develop effectiveness KPIs before efficiency KPIs**. This is because you first need to establish your benchmark, e.g., how many units you produce in a given period of time, before you can begin to think about measuring related efficiencies.

5. **Develop stakeholder and financial KPIs before other KPIs**. Stakeholder KPIs for a government organization, for example, might be that every child receives education. For a company, it is likely that the financial KPIs, such as growth and revenue targets, will drive all other strategic objectives. Hence, it’s logical to set these KPIs before any others.

“A large list of KPIs that does not have clear linkages to a business’s overall objectives may be a sign of a larger problem: a lack of strategic focus.”
Develop output KPIs before input KPIs for each objective. It's not possible to start thinking about input KPIs before output has been determined. For example, you need to know what your production target is, i.e., how many cars you need to produce, before you begin to think about KPIs relating to the manufacture of those cars.

Select best-fit KPIs, share, approve and document them.

Companies should always have a flexible and creative mindset when developing KPIs, as their ultimate goal is to drive the performance changes required by the corporate strategic plan. KPIs cause divisions and departments to act differently, improve certain processes and drive discussion and agenda items at the executive level. Well-designed KPIs enable management to ask the right questions, rather than give neat answers and results.

In other words, KPIs are tools to create a climate for action and to support dynamic high-level discussion.

Putting theory into practice

There are many possible KPIs for every business objective and, for each objective, management should carefully consider the following:

• Topics that executives need to discuss, e.g., profitability or productivity.
• KPIs that already exist and those that need to be established.
• Improvement requirements, e.g., better remuneration program.
• Behavioral changes demanded by this objective, e.g., more loyalty among employees.

Filtering and selecting the most appropriate KPIs is the first step. Managers and their support teams should list potential KPIs and then select the most appropriate from this shortlist. A half-day workshop, in which managers and staff collectively decide which KPIs to apply to each objective, can help the selection process. For example, a workshop could produce 50 KPIs that then need to be discussed and filtered down to 15 KPIs before being agreed.

When thinking through the selection, the following considerations can be helpful: strategic relevance, practicality, frequency, ease of communication and clarity of representation.

Selecting the right KPIs comes with experience. However, there are many KPI sources for people to use, such as staff workshops, competitors, benchmarking, industry standards, historical information and websites.
Which type of KPI is best?

There are many types of KPI. It is important to keep a balanced perspective by selecting KPIs that cover the breadth and indicate the health of an organization. For example, when a doctor sees a new patient, they will conduct a series of measurements, such as blood pressure, height and weight, and from these, determine the person's health. KPIs are similar to these medical measurements. They are extremely effective indicators of the health and maturity of an organization.

Figure 1 shows a range of key maturity indicators. Organizations normally move from left to right on this diagram during their lifetimes. What is meant by this is that organizations will start, in their early years, for example, by focusing on financial KPIs but, as they mature, they recognize they need to broaden out to include non-financial measures, such as employee and customer satisfaction.

For example, “lagging” versus “leading” refers to those organizations on the left (lagging) that focus only on how much profit they’ve made at the end of each financial period. In comparison, more mature companies, on the right of the diagram (leading), are measuring success as they go along, by monitoring aspects such as number of clients lost and the number of projects won.

Another example could be a government that is, initially, keeping a focus on effectiveness, e.g., number of hospitals or schools built. But, as their organizational maturity develops, they begin to change their focus to efficiency measures, such as what is the cost per hospital bed or the cost per student?

In this way, it's possible for a performance expert to look at a company’s balanced scorecard and assess that organization's maturity level. If there are lots of KPIs on the left side, this indicates the company is very effective and short-term focused. The effort is in getting things done rather than understanding how much things are going to cost or how they may impact the business. If the scorecard measures are more to the right of Figure 1, then the company is migrating and looking toward the long term.

When setting KPIs, there are six common forms, each of which has its own strengths and weaknesses:

1. Absolute number, e.g., total profit. This is one dimensional. The advantage is that it's a very clear target but it doesn't address a specific context.

“Companies should always have a flexible and creative mindset when developing KPIs.”

“Well-designed KPIs enable management to ask the right questions, rather than give neat answers and results.”
Index, e.g., an internationally used index, such as the United Nations’ Human Development Index (HDI). This is multidimensional, but it can mask underlying individual variables.

Percentage, e.g., percentage of satisfied employees or customers. This is a good indicator of relative change but is sometimes misunderstood.

Ranking, e.g., very commonly used to rank institutions such as banks, universities or schools. The advantage is that it’s easy to understand, but definitions are often inconsistent or unclear.

Rating, e.g., customer ratings of a product. This is a useful measure for nominal data, but it can be biased or misused.

Ratio, e.g., revenue versus cost ratio. Ratio measures are much used by finance people. They are good at illustrating critical relationships, but can be difficult to understand.

Defining KPIs

To ensure consistency in the organization, a KPI definition sheet needs to be filled and completed for each KPI by those responsible for setting and reporting on the KPI. An example of such a sheet is shown in Figure 2.

Target setting and motivating employees

A well-designed strategic plan relies on establishing targets that are designed to stretch and push an organization forward in meeting its objectives.

Setting targets allows organizations to:
- Ensure individuals focus more clearly when given a quantifiable target
- Encourage departments to focus on executing their business plans
- Forge links between individual and department objectives
- Identify areas in which the department needs to improve
- Set and communicate expected performance levels
- Ensure the success of a department’s business plans
- Motivate departments, rather than control or constrain them
- Communicate to the department the need for change

Targets need to be realistic so that managers feel comfortable about trying to achieve them. In most cases, targets should be mutually agreed between the organization’s executives and the manager responsible for hitting the target. When setting effective targets, top management must strike a balance between setting the bar high enough to encourage greater performance, without prompting risky behavior and leaving holes that allow managers to play the system.

It is worth noting that targets could have disadvantages in terms of setting direction to employees. Employees could focus on what is expected and not necessarily on what needs to be done. Each department should consider the expertise behind the target-setting and how employees concerned will behave.

It’s also important to note that the relationships between targets are also crucial. Setting one target inappropriately can have an impact on other targets. Executives should aim to set targets in such a way that each individual KPI is optimized to result in the best overall outcome for the organization.

One common place to start, when setting a target, is to look at past performance and current baselines. Past trends can be extended for modest improvement. In addition, corporate objectives can give the organization clues as to what targets should be included in its strategic plan. Benchmarking leading practices is another good source of targets.

In summary, the following criteria should be considered when setting targets:
- Ensure that the target communicates expected performance
- Check that the magnitude is appropriate to close the performance gap
- Show the relationship between target and corresponding KPI
- Define targets as a comprehensive set
- Set one target per KPI for a certain time
- Ensure that targets are quantifiable

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**Figure 2**

KPI definition sheet

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Monitoring KPI status

Once KPIs and their respective targets have been set and agreed, it is important, over the ensuing weeks and months, to monitor performance against them. In order to do this, it is necessary to have well-studied and carefully set ranges for targets if an organization's strategic plan is to be successful. Figure 3 shows some universal target ranges that could be used by any business.

When calculating the percentages to monitor the KPI status, the following formulas can be used:

A. For KPIs where an increase is preferable: actual results/target = percentage. For example: US$8m actual revenues/US$5m target revenues = 160% (i.e., green per Figure 3).  
B. For KPIs where a decrease is preferable: target/actual results = percentage. For example: 5 customer complaints/8 actual complaints = 63% (i.e., red per Figure 3).

Conclusion

This article has provided a range of tips and information to keep in mind when thinking about KPIs. But, there are some overarching messages that all organizations would do well to remember.

Firstly, KPIs can have unintended influences on people's behavior. For example, a company might set productivity targets to encourage employees to complete tasks as quickly as possible, i.e., some sort of time-related target. But the unintended consequence could be that employees are so motivated to hit these targets that they endanger themselves and the company finds they have lots of injured employees! This is just one example from many that demonstrates how important it is to understand the broader effect a target could have on employee behavior.

A second point is about the quality of the KPI itself. It's not good enough to set a vague target, such as “improved productivity.” There always has to be a quantifiable and realistic goal. It seems obvious, yet, so often, this is overlooked.

And, finally, it is worth remembering that there is no science behind KPIs – it's an art, something that you can only get really right by trial and error. For example, one expert may recommend a list of KPIs and another expert would likely recommend a completely different list. Neither of them is right or wrong – both lists will have their advantages and disadvantages. So, be confident with your target setting: brainstorm, filter and seek agreement. Be realistic, but be wary of being vague. Be ready to measure your organization's success!

“Management must strike a balance between setting the bar high enough to encourage greater performance, without prompting risky behavior and leaving holes that allow managers to play the system.”

References

- Dennis Campbell, “Choose the right measures and drive the right strategy,” Balanced Scorecard Report, January 2006, pp.14–16.
KPIs

Benefits of using KPIs
- Providing quality feedback
- Supporting decision-making
- Focusing management attention on what matters most
- Helping managers understand and gauge performance
- Assigning responsibility and encouraging accountability
- Providing a common language for communication
- Providing a way to see if the strategic plan is working
- Serving as risk triggers and early warning signs
- Functioning as tools to drive desired behavior

Good KPIs
- Echo an organization’s objectives
- Create meaning at all levels
- Are based on legitimate data
- Establish a trend over time
- Are easy to understand
- Provide context
- Lead to action

Good KPIs start with
- Percentage of ...
- Average of ...
- Number of ...
- Value of ...
- Total of ...
- Cost of ...
- Sum of ...

Why people usually dislike KPIs
- Benefit and value of measurement is not understood
- Individuals don’t know how to use KPIs effectively
- Accountability is placed with the individual
- Poor performance can be uncovered as a result of KPIs
- KPIs can be used as a means of punishment
- Using KPIs costs money, time and effort

Common challenges when using KPIs
- Objectives are not clearly communicated
- Lack of agreement over KPIs
- Calculation method is unclear or incomplete
- Insufficient amount of data available
- Number of KPIs is too many
- Representation is not credible

Common challenges in setting targets
- Striking the right balance between being realistic and challenging
- Achieving alignment between compensation and performance
- Setting targets rests only with top leadership
- Meeting targets is not achievable with approved resources
- Collecting and reporting on the target data is not possible
- Causing anxiety among staff because of target-setting process
- Expressing targets in a clear and simple way
- Selecting targets that staff regard as appropriate
- Identifying targets that are achievable within the required time frame
- Finding alignment with broader objectives

The 5 steps of the KPI life cycle
1. Select KPI
2. Approve and document KPI
3. Gather and analyze data
4. Report KPI
5. Keep or remove KPI
The secret behind mechatronics
Why companies will want to be part of the revolution

In the 18th century, steam and mechanization powered the first Industrial Revolution. At the turn of the 20th century, the assembly line drove the second Industrial Revolution. Then, in the 1970s, computers started to transform the way we work. Now, we stand on the cusp of a fourth Industrial Revolution, led by the use of smart devices in manufacturing and other systems.
Authors

Dr. Christoph Kilger
Partner, Advisory - Supply Chain & Operations Advisory, EY, Germany

Dr. Adrian Reisch
Senior Manager, Advisory - Product Life Cycle Management, EY, Germany

René Indefrey
Senior Manager, Advisory, EY, Germany
The secret behind mechatronics. Why companies will want to be part of the revolution

Enterprises around the world face an extensive reorganization to meet the challenges that this revolution will bring. This article looks at these challenges, how organizations can overcome them and what they can do to be competitive in the future.

What’s driving the need for change?

Manufacturing has always relied on complex machinery that pushes the boundaries of innovation. This is true right back to the earliest industrial revolutions. In recent decades, traditional manufacturing has become even more complex with the addition of software components to plant and machinery.

For the majority of industrial companies, the engineering process involves a sequence of three design stages. Firstly, the mechanical engineers will try to interpret what the sales team has promised the customer in terms of the machinery they need. They then hand over their design to the electrical engineers. This is the second stage, during which the necessary electrics and cabling are identified and incorporated into the design. The
final stage is completed by the software engineers — it is they who bring the machine to life.

But this sequential approach carries the potential for many problems. For example, what if the mechanical engineers haven’t fully understood what the customer wanted? Or what if they have focused only on the mechanical issues and not anticipated the potential electrical or software issues? Information is lost along the way, leading to the three teams of engineers having to keep revisiting and revising their designs. So there is a lot of extra cost, a long lead time, high levels of effort and, at the end of the day, a product that is not of the best quality.

Looking at the whole

To solve these problems, manufacturing companies need to change their approach so that, rather than sequential design, they use a model that allows them to design the machine as a whole. This is achieved by setting up a “functional model” of the machine.

For example, Figure 1 shows the various functions and sub-functions that might be associated with the production of a packaging machine. Under traditional, sequential development, each of these functions would be designed in isolation both from each other and also from the three separate design teams.

But, by using a functional model, this allows a completely new way of thinking for engineers. Whereas, previously, they would have been given a requirement and made their design accordingly, now they are given a more complex, functional picture. This allows them to take into account the various interdependencies and constraints that must be satisfied.
“Using a functional model allows a completely new way of thinking for engineers.”

An integrated mechatronics system model enables the collaboration of all functional units in the development process.

**Benefits**

1. Uniform terminology
2. Graphical representation of product structures and architecture
3. Reduced misunderstanding and iteration loops
4. Uniform, standardized product documentation
5. Identification of connections, interdependencies and similar solutions
6. Improved effectiveness of communication and collaboration
7. Identification and resolution of design issues and problems before detailed design starts

Account not just the requirements for their own specialist discipline, such as electrics, but also all the other relevant requirements associated with the whole product design. In summary, the purpose of the functional model is to describe how the whole thing works together taking into consideration all the functional units, as shown in Figure 2.

One of the main advantages of this functional approach is that it allows you to look at the design from a “modular product architecture” perspective. What this means is that your design is similar to a series of building blocks. For example, there may be a function in the overall model that has already been fully designed by the mechanical, electrical and software engineers. You can then reuse this function or building block and just adapt it for similar or identical functions during the design process. It avoids the need to start each design element from scratch. The benefit is that it speeds up the whole design, improving the chance of a “right first time” product and allowing you to get it on the market much more quickly.

The other significant advantage of this modular approach is that it allows very high complexity in design, i.e., a large variety of products, because you can combine these building blocks to produce new products. So, it enables high
variability with low internal complexity and speed to market – all of which brings competitive advantage.

New change, new ideas

“Mechatronics” is a relatively new term – more well known in engineering circles. It refers to the bringing together of the three disciplines mentioned above, i.e., mechanical, electrical and software. In the past, modular revision approaches have tended to focus only on the mechanical aspects. What this article is proposing is that the focus should be on all three areas together, i.e., a mechatronics modularization approach.

Figure 3 shows the three elements of mechatronics and the transition from the sequential development process to a mechatronics approach, as already described.

There is also a second aspect of change that will help manufacturing companies as they begin to work with a mechatronics development process. This relates to what is called the “V-model.” The V-model is an established way of structuring the product development processes. It is based on an approach called “system engineering,” which has, at its core, a focus on defining the customer needs and required functionality early on in the development process. System engineering is particularly common in the aviation and aerospace industry, but is now becoming increasingly used in plant and machinery engineering.

The system engineering process model generally consists of three phases: system design, system development and system integration. These three phases can be iteratively run through several times in a row.

What the authors are proposing is a more complex V-model that is based around system engineering. In the past, the V-model has been very simple, with a focus on single concepts. You begin by trying to understand the requirements (the left “branch” of the V), you design the mechanics (the bottom branch of the V) and you bring everything together into a final product (the right branch of the V). The V-model on the left of Figure 4 shows this simple approach.

But the V-model based on system engineering would be based around
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“...The benefit is the whole design is speeded up, improving the chance of a ‘right first time’ product and allowing you to get it on the market much more quickly.”

the three phases, with each branch representing a phase, i.e., the left branch is phase one: system design, the bottom is phase two: system development and the right branch is phase three: system integration.

Within each phase are the different streams for mechanics, electronics or electrical design, software design, usability design and so on. This has the effect of forcing the design to focus not just on one element, but the whole thing. For example, when the requirements are being identified, right at the start of the design process, they will include all aspects of production rather than just one at a time. Similarly, as you work through the stages of the design process, such as functional description, system design, behavioral model, test cases and simulation – all will be carried out with a focus on the whole product rather than breaking it into disjointed, sequential and isolated elements. The diagram shown on the right of Figure 4 presents this more complex V-model. The ultimate goal is to describe the whole machine as one system.

Taking this one step further, the authors propose a version of system engineering that is called model-based system engineering (MBSE). The difference between MBSE and traditional system engineering is that MBSE is a digital model rather than relying on paper or documents. The model is used as a means of communication between the

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**Figure 4**
From the incomplete, traditional V-model to the new V-model based on system engineering

- **Requirements**
  - Single concepts
  - Domain-specific design: Mechanics -> Hardware, Software
  - Process engineering
  - Usability

- **Product**
  - Initial operation
  - Physical tests

- **System design**
  - Virtual tests
  - Hybrid tests
  - Model creation and analysis

- **System integration**
  - Physical tests

- **Product**
  - System design
  - Virtual tests
  - Hybrid tests

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developers and the various engineering disciplines. It contains all the essential cross-disciplinary information about the system and describes it in a more accessible, understandable way.

In order to bring the MBSE system model to life, the user needs a modeling language, such as SysML, and a software tool, such as METUS. Languages and tools such as these help define correlations between system requirements, functions, structure, and behavior.

The final piece of the jigsaw is to identify a methodology for describing the system model in MBSE. For this, we propose RFLP (Requirements, Functions, Logic, Product). Firstly, the customer’s requirements (R) are structured according to functional and non-functional aspects. Next, the functions (F) are defined, which are then converted into a logic (L) model and, ultimately, the technical solution, resulting in the final product (P).

**Putting theory into practice**

EY recently applied this model to the existing processes and procedures within a machinery- and equipment-building company. The business was a classical mechanical engineering company using a sequential approach when developing new products, i.e., first the mechanical construction department analyzed the customer requirements and developed a solution, then the hardware was configured and, finally, the automation software was designed. The aim of the EY project was to help adapt the existing process so that the three disciplines — mechanics, hardware, and software — were developed in parallel. The MBSE methods were integrated into the V-model to develop a mechatronics system approach.

Working with the client, we produced a detailed development framework that served as the basis for the project. Furthermore, a data model was created to underpin the development framework, the hardware, and software. Finally, the changes in customer processes and organization were defined.

**Development framework**

The design of the development framework provides a distinction between the three phases of system engineering, i.e., system design, system development and system integration.

During the system design, the objective is to create a model that works across all three disciplines (mechanical, electrical, and software), as previously described. The requirements from each discipline are collected and organized in a software tool. The tool helps to make complex architecture relationships transparent (see Figure 1). Once the requirement structure has been created, this is then passed to a more detailed software tool, such as SPARX Enterprise, which classifies the requirements.
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“The ultimate goal is to describe the whole machine as one system.”

The next step is the preparation of the functional model. The overall function of the product that is being designed is divided into its sub-functions, each of that may be further divided into sub-sub-functions (refer to Figure 1).

The end result of this design phase (phase one) is a model and description of the system and its subsystems, specifications and an overall product concept, incorporating all relevant disciplines. It also includes a definition of which discipline implements which subsystem in which way.

Following completion of phase one, we then move to phase two: system development, during which each of the individual disciplines carries out its specific development work. There is continuous coordination between the different development streams, both over time, i.e., status meetings and milestones, but also as part of the interface specification between the individual subsystems.

The result of phase two is individual components or software that are subject to first testing (mostly virtual) within their respective disciplines.

In the final phase (system integration), the results of the various disciplines are brought together. This is subject to rigorous testing to check that the system design originally specified has been successfully implemented. The final part of this phase is a review and approval process.

The benefits of an integrated approach

The benefits of an integrated product life cycle management approach come from spending more effort in the early phases of design. These benefits can be summarized as follows:

- Maximized profitability
- Reduced development costs
- Reduced time to market
- Extended product life cycle that is actively managed

Figure 5 quantifies these benefits in relation to the client project cited in this article. In addition to the 15%-20% reduction in total project costs and 30%-40% higher probability of keeping to the launch date, other notable gains included:

- New employees were brought up to speed (knowledge transfer) more quickly, by up to 50%.
- Design corrections during the later development stages were avoided by up to 80%.
- Reworking and service efforts (e.g., warranty and additional work) were reduced by up to 40%.

The whole concept allows companies to operate at a much more advanced level in terms of interdisciplinary developments. The modeling of the overall system in
languages such as SysML creates a clear overall view and communications base that is understood by all disciplines.

The linking of requirements, function, logic and product means the company can more easily estimate and anticipate the impact of any changes to the overall product architecture. The time wasted on expensive investigations into which complex functions a component needs can be reduced significantly. In addition, the structured approach also helps to meet documentation requirements. In the life science industry, for example, it makes it easier to test (and prove) which requirements are satisfied by which function and which component.

In the future, it is also conceivable that companies could further drive the pricing of individual functions. On the one hand, this would increase internal transparency and, on the other, it would enable companies to inform their customers about the composition of the price of the machine they are buying. By linking the RFLP method, a traceability of component costs of functions can be easily carried out.

Furthermore, the approach also has a positive effect on the diversity of components. By modeling according to the RFLP method, it is possible to perform a functional standardization of the hardware and thus to specify, per function, the implementation of one or more hardware components. This has a positive impact on service parts management, since the number of components that needs to be managed decreases significantly. This is a factor that should not to be underestimated, especially in the area of electronics.

As manufacturing moves into its fourth Industrial Revolution, businesses need to be embracing an integrated design approach so that they are first to market with their products, while simultaneously optimizing their profits.
Embracing a digital future

“Digital disruption” is already a feature of the business world, presenting great opportunities and grave risks in equal measure. This article explores the digital trends that are having the biggest impact on business and argues that, for those companies that are forward-looking, the opportunities greatly outweigh the risks.
Embracing a digital future

To many people, it feels like a digital future has already arrived. Smartphones put the resources of the web in our pockets. Social networks facilitate near-constant communication and virtual interaction – and even played a role in the Arab Spring in 2011.

But the exciting new technology of today will look tame in comparison with the technologies that could emerge tomorrow. Google Glass promises to put the function of a smartphone in your field of vision, giving users uninterrupted access to “augmented reality.” And innovations will be far more than just gimmicks, with plenty of potential real-world applications. In health care, for instance, Google has already unveiled plans to produce contact lenses that can measure diabetics’ blood glucose levels. Meanwhile, medical firm Second Sight is developing “visual prosthetics” that could give blind people the chance to regain some vision.

Whether or not the “augmented reality” of the future sounds like utopia, there is no doubt that tomorrow’s digital innovation will have a profound impact on our personal, social and professional lives.

It will be big business too: the “wearable technology” sector alone is expected to expand rapidly in the near future, with some experts forecasting growth of between US$10b and US$50b in the next five years.

It seems inevitable that digital innovation will make the future look very different. Despite this, companies today must face up to the fact that “digital disruption” is already a feature of the business world. And it presents great opportunities and grave risks in equal measure. If they are to be successful, modern businesses must account for digital disruption at every stage of their value chains and modify their strategic planning accordingly.

Working in the future, today

Even without disruption from digital, businesses today operate in a challenging environment. The old certainties are disappearing as a new world emerges. After decades of dominance, the developed economies are struggling under the burdens of huge public and private debt, credit shortages and reduced consumer spending. At the same time, the emerging world is taking an increasingly substantial share of global GDP - and despite the recent slowdown, this is expected to continue.

In the coming years, the rise of the emerging markets will completely change the global economy. It is estimated that three billion people from the developing world will leave poverty and join the global middle class over the next 20 years. This shifting landscape brings with it inherent risks for businesses. And this is being exacerbated by external factors, such as political upheavals in the Middle East, the financial crisis and climate change.

But businesses have always faced these kinds of uncertainties, and the global economy has never been static. And, of course, as well as producing risk, the growth of the emerging markets presents many new business opportunities - from supply chain savings to new customers. What makes the current environment so different and so challenging is that these “traditional” business risks are being compounded by the unprecedented development of digital technology, which, in only a few years, has become embedded in almost every aspect of every business.

Of course, these two trends are not entirely separate: technological innovation is integral to broader economic change and vice versa. Nevertheless, it is the combination of these two factors that is leading to changes that are affecting the global economy at a fundamental level. In fact, some experts speculate that capitalism is entering an entirely new phase, suggesting that we can expect to

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3. “Google unveils ‘smart contact lens’ to measure glucose levels.”
4. Innovating for the next three billion, EY, 2011.
“Modern businesses must account for digital disruption at every stage of their value chains and modify their strategic planning accordingly.”

see levels of change last experienced in the 19th century, when the telegraph and the railway revolutionized commerce.5

Four digital trends

According to a survey conducted by Oxford Economics in 2011, the four areas of digital change that will have the greatest impact on businesses are: cloud computing, data, social media and mobile technology.6

First, the cloud has completely changed the way in which companies access computing facilities. Businesses no longer need to buy expensive software licenses; instead, they are able to use programs on a “pay as you go” basis, accessing them via the cloud. This can result in major savings and increased flexibility for businesses. Data storage in the cloud is also widely available, meaning that data can be used whenever it is needed.

And data itself is also a major area of change. The collection, storage and analysis of huge volumes of data is crucial to the operation of many parts of the modern business, and firms have access to more data than might have seemed possible only a few years ago. Although this can provide unrivalled insights, amid the constant onslaught of data, it can be difficult to detect useful intelligence. Data collection needs to be carefully managed. Having too much data is no better than having too little. In order to extract real insight, businesses need to take a value-based approach to collecting data – and ensure that they keep their goals in sight.

Meanwhile, social media has changed the way people interact with each other in the 21st century. From communicating directly with customers to gathering targeted, accurate data, social media offers businesses many opportunities. However, the rate of change in this sector, and its unpredictable nature, mean that it can be challenging for firms to keep abreast of the latest trends. The market for social media firms clearly demonstrates this unpredictability: many have been valued very highly indeed – even if, in their current form, they do not take much revenue. For instance, in February 2014, Facebook announced that it would be buying smartphone messaging company Whatsapp for US$19b.

Social media is a force that businesses cannot ignore.

Although social networking has a very high profile in the Western media, in global terms, perhaps the most important digital development of recent years has been the spread of mobile technology in the developing world, where it is having a huge impact on the personal and professional lives of many people. Mobiles are opening new markets because they are the cheapest and simplest way to connect people – far cheaper than desktop computers or laptops. The spread of the mobile has enabled some people in Africa, the Middle East and elsewhere to access banking facilities for the first time. For instance, M-Pesa, an African mobile-money business, has more than 17 million customers in Kenya alone – from a population of around 40 million.7

And as smartphones become more affordable over the next few years, their use in emerging nations will expand. So the opportunities for businesses to access new data and new markets in the emerging world through mobile technology are almost endless.

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“More and more employees will be ‘digital natives’ – people who have used digital technology from childhood – and will need and expect different tools in the workplace.”

Two types of risk

The relentless progress of digital innovation also means that companies face risk simply from the speed of change. And this risk is twofold: there are direct risks arising from new digital possibilities, but there is also the risk of simply not keeping up with rapid change.

The direct risks that companies face as a result of digital innovation can be devastating. The internet has brought countless opportunities, but it has also meant that firms can be vulnerable to attacks that they can do little to prevent or predict. For instance, in 2013, hackers caused major disruption to US retailer Target. The discount shopping chain announced that the payment card and personal data details of up to 70 million customers might have been stolen by hackers. A number of customers are suing the company as a result, but the impact on the company’s reputation caused by this breach of trust is likely to be far more damaging in the long run.8 In addition to seemingly motiveless, anarchic attacks such as this, the internet can also give activists the ability to cause disruption on a major scale. “Hacktivists” who want to make a political or social statement can attack internal computer systems, disabling company emails and posting propaganda materials such as videos or messages online. The impact can be significant. The attack can result in websites remaining offline for several days with a resulting loss in revenues and reputation. Where 20 years ago, anybody who wanted to disrupt a company’s operation this severely would need to have access to its physical infrastructure – its offices, factories or distribution vehicles – today, hackers and activists don’t even need to be on the same continent to cause serious disruption.

Aside from direct threats, the digital landscape’s relentless pace of change also means that many businesses face the more basic threat of being left behind – of simply missing something as the market develops. For instance, firms might fail to get involved in a new platform or social networking tool. Digital trends seem very volatile, so it is extremely challenging for firms to make wise and informed decisions. For example, it is astounding to think that a cultural force such as YouTube was founded only nine years ago, in early 2005. Perhaps it’s more astonishing to recall that YouTube was less than two years old when it was bought by Google for US$1.65b.9

Missing out on change can have serious repercussions for a business. It is even possible for a firm to find the foundations of its market completely shifting. For instance, over a relatively short period of time, online shopping has completely changed consumer habits. The closure of many high street shops is a very tangible result of this behavioral shift. Retailers that want to survive have had no choice but to offer online services.

At the same time, businesses also face the risk of spending too much time and money on monitoring change. It can seem that new digital innovations, social media platforms and data resources appear every day, and it can be all too tempting for firms to feel that they need to be involved in everything new. Of course, this is not always practical. Companies need to make wise decisions about which digital platforms and channels will really work for them. As with any business risk or opportunity, having a clearly delineated strategy is crucial to long-term success.

In order to face up to the risk of digital and make the most of digital opportunities, companies should focus on readiness throughout the organization. Businesses need to:

- Identify digital opportunities and mitigate threats
- Account for security concerns when using new digital technologies
- Measure their performance in the digital sphere
- Ensure that they are compliant with the legal and tax implications of moving into the digital domain

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- Address and optimize merger and acquisition processes as they apply to digital businesses
- Consider the operational implications of working in different countries and jurisdictions
- Optimize the value of digital to their businesses
- Build a culture of agility and agile innovation processes

**No opportunity without risk**

A particular problem for businesses is the fact that many of the opportunities that digital creates are also risks at the same time. And this is true right through the value chain. At the strategic level, digital can provide the opportunity to create networked scale and reach new markets; concurrently, the same processes can lead to problems of localization and supply complexity. On a customer-engagement level, digital communications – particularly social media platforms – give companies the chance to exceed consumer expectations and generate high levels of loyalty; however, there is an intrinsic risk of setting the bar too high, and then disappointing customers. For instance, it is relatively easy for a business to be proactive in responding to customers on social media, and this can be a great way to improve customer loyalty and gain insights. However, if companies then fail to act on customers’ requests and suggestions for improvement, this can have a negative effect on their corporate reputation.

The digital revolution could bring great opportunities for the workforce, too. The cloud, remote access and new communication channels can offer flexible working options and the chance for employees to reinvent their roles. But at the same time, mechanization will inevitably lead to redundancies. Furthermore, in the future, more and more employees will be “digital natives” – people who have used digital technology from childhood – and will need and expect different tools in the workplace.
Increasing complexity

Although it may feel like the internet, mobiles and even social networks are very firmly embedded in everyday life, in reality, companies today are still negotiating a digital frontier. The opportunities are seemingly endless, but the risks can be huge. The complexity of the situation means that businesses are devoting more and more time and budget to digital. It is estimated that total global enterprise profit from digital business will be US$14.4t by 2020 and that the market for digital consulting will be worth approximately US$72b by 2022.10

But to capitalize on this huge potential, businesses need to develop ambitious digital strategies. EY has developed a three-stage process to help clients maximize the possibilities of digital innovation. The EY Digital Realization™ Framework focuses on three phases of the digital journey: create, incubate and activate. As part of the first stage, EY helps clients to focus on defining their digital business offering. It is important in this initial phase for a firm to look at its digital strategies and capabilities, and to ensure that these are aligned with the business’s broader strategic vision. Companies can then identify and design the products and services of their digital offering – ensuring that this will deliver real value.

Having developed a strategy, the second phase of the Digital Realization™ Framework involves the business validating its digital offering. EY helps its clients to test their digital initiatives through small-scale pilot studies that isolate and test business assumptions. This incubation step then leads through to the final activation phase, in which EY helps clients to refine their strategies and commercialize their digital offerings, creating and capturing economic value.

Realizing potential

Although the rapid rise of digital innovation has the potential to cause huge disruption, with careful planning and management, the opportunities certainly outweigh the risks. From finding new markets through mobile technology, to exploiting social networks in the workplace to foster innovative collaboration among employees, the future of business in all sectors will be digital. Firms that don’t anticipate change will find themselves struggling with risk and uncertainty. But those firms that do develop forward-looking strategies to harness digital innovation and technology will be able to reap substantial rewards.

The most important thing for all organizations to realize is that there will be no escaping a digital future. It will not be possible to operate outside the digital domain. This means that the key issue for business to address is how they are going to thrive in a digital environment, maximizing opportunity and minimizing risk. ■

How can EY support your organization on its digital journey?

**Create**

**Define digital business offerings**
- **Intent**
  - Define digital strategy and capabilities to meet strategic vision of the business
  - Identify and design digital offerings (models, products, services and experiences) that deliver value to the business
  - Grow digital capabilities and competencies
- **What we will do**
  - Digital enterprise strategy
  - Market opportunity assessment (digital segmentation and experience mapping)
  - Digital capability diagnostic (cloud, social, mobility, analytics and emerging technologies)
  - Digital insights and ideation workshop
  - Digital compass and ecosystem design

**Incubate**

**Validate business offerings**
- **Intent**
  - Validate digital initiatives and “de-risk” operating model investments through iterative, small-scale pilot experiments to isolate and test critical business assumptions
- **What we will do**
  - Digital Playbook (business offerings marketing, operations, workforce and enterprise operating model)
  - Digital experiments and pilots
  - Investment plan and business case
  - Partner evaluation and selection
  - Digital delivery solutions (cloud, social, mobility, analytics and emerging technologies)

**Activate**

**Commercialize**
- **Intent**
  - Refine and develop strategy to commercialize opportunities that create and capture economic value for the business
- **What we will do**
  - Digital process design and organization
  - Operating model integration
  - Digital governance
  - Digital risk management
  - Digital performance measurement

"The direct risks that companies face as a result of digital innovation can be devastating."
Making the best of a difficult trend

When a global trend is damaging a business, it can be hard to know what to do. And when revenue and gross margin show a steady decline for reasons that are understood but cannot be changed, what do you do to ensure your organization better fits the economic climate?
There are many methods that companies seeking to protect and boost margin can consider. Businesses can analyze costs to identify potential savings, they can try to create better products or they can change their product portfolio in order to better respond to customer demand. Other options include focusing on the quality of the sales force, creating new customer relationship processes and developing promotional efforts. Sometimes, however, such efforts are not enough. A final option, which could have a huge impact, such as changing from one strategic positioning to another, might be an unnecessarily invasive approach for what is an otherwise healthy company, and could result in risks such as a damaged reputation or a perceived loss in customer value.

Such a situation was faced by one multinational animal feed firm. The Brazilian arm of this organization was looking at an increasingly challenging future. Across the world, since 2010, customers had been buying animal feed with less and less added nutrients, such as enzymes and amino acids. And yet, the high-nutrient additive feed was where the company had traditionally found its biggest margin.

Looking to save money by sourcing their additives elsewhere, customers were increasingly asking:

- “If I adjust the formula and take out certain ingredients, can I source them somewhere else and, by doing so, reduce my costs?”
- “If I include the extras in the feed, how much will my costs increase? And does the benefit justify the added value?”

In Brazil, the inclusion rates for additives had dropped from 1.25% in 2010 to 1.1% in 2013, with a compound annual growth rate (CAGR) for inclusion rates of -4.4%. But far from being a problem local to the Brazilian market only, this was a global trend, hitting many of the company’s key markets:

- In the US, the share of nutritional additives had, over the previous 12 years, a CAGR of -6.5%, with the average amount of nutrient additives declining from around 8kg to under 4kg per ton of full feed.
- In France, the overall inclusion rate had dropped from more than 0.6% to 0.4% in four years, with the trend adding up to a CAGR of -13.6% for inclusion rates.

Although revenues were still growing, mainly as a result of improvements to the marketing strategy that had been implemented in the past three years, the company could see that there was a storm coming and wanted to be prepared for it, as the first drops of revenue loss could change at any time into heavy rain. In this, they were influenced by best-selling author Jim Collins’s concept of “productive paranoia,” which was a strong part of the company’s culture and management style.

Faced with such a bleak picture for its business model, the company asked EY to help find out how it could protect its margins and create added value for customers in the changing market. Thus began a thorough investigation of the Brazilian arm’s price model, product range and the whole way it did business, to see how the company could protect its margin and deliver benefits to customers despite the difficult conditions.

Introducing a new model

Before any radical change and investigation into the company’s commercial strategy, the first step was to understand how the organization ran its yield management. This was an important decision because it was the most influential driver for earnings after tax (EAT) security in the long run, as shown in Figure 1.

Analysis revealed that the current pricing model was damaging the business. The problem was that it increased the difference in price between

![Figure 1: Simulated impact on the company, based on 2013 financial results](image)

Figure 1: Simulated impact on the company, based on 2013 financial results

**A 1% improvement in ...**

- Price: 3.0%
- Variable cost: 3.7%
- Sales volume: 6.8%
- Fixed cost: 1.1%

... creates local EAT improvement of ...

Source: Authors’ own.

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1. “Productive paranoia” is one of the important characteristics of great companies, according to renowned management thinker Jim Collins. J. Collins and M. T. Hansen, Great by choice: uncertainty, chaos and luck – why some thrive despite them all, October 2011.
more expensive and less expensive products — between those with higher and lower levels of nutrient inclusion in the feed. This had the effect of encouraging customers to migrate to lower-inclusion feed because it made the benefits of the more nutritious feed more expensive. The analysis led to a key question for the company: how can we have a pricing model and architecture that protects the margin and captures additional value from this long-term market trend?

The EY team saw that the best way to protect margin was to adapt the pricing model and generate a taxonomy of products with different margin targets. This approach would protect the company’s margin because customers would no longer be encouraged to move to a lower-inclusion feed with a resultant lower margin for the company. In essence, the company would be sharing in the savings that their customers were making when they moved to lower-inclusion feeds.

To test how well this new pricing model would function, the EY team set up a rough simulation to see what effect it would have if the company switched to the new model. The simulation was carried out for three months, in 2013, for a reduced product portfolio. The findings were then extrapolated for a full year, and for the four following years.

It was found that, by shifting the pricing model, the company could capture, over the next five years, an extra BRL 58.8m (approximately US$25m) in comparison with the new model. By the fifth year, the new model would be delivering a margin advantage of more than eight percentage points over the old model (as shown in the yellow segment of the graph in Figure 3).
Making the best of a difficult trend

“The company was overpricing around a fifth of its products to make up the margin lost by underpricing over half of its products.”

Adding further value
Moving beyond the broad scope of a new pricing model, a fresh look was also taken at the value of each product. This was done by assessing the cost side (including raw materials and manufacturing costs) and the perceived customer value of each product. These values were then compared with the average invoice price that customers paid for the products.

On the assumption that those paying more than 5% above the calculated value were paying too much, and those paying more than 5% below were paying too little, it was found that 54% of the total number of products sold, amounting to 67% of the tonnage of full feed, were underpriced and were delivering just 48% of the gross margin. In contrast, 21% of the products sold, amounting to only 11% of the tonnage sold, were overpriced, contributing 24% of the gross margin. In summary, the company was overpricing around a fifth of its products to make up the margin lost by underpricing over half of its products. A detailed view of the value analysis is shown in Figure 2.

This led to the framing of another key question for the company: how can we position our prices optimally, considering product value and customer segments, while reducing underpricing?

To address this question, a new cost set structure was established. This set a price — to be reviewed on a regular basis — for each raw material, and aimed to capture value in the price of these materials and to differentiate in the technological value of ingredients across various sections of the company’s clients.

Applying discounts to protect margins
From looking at the company’s current levels of discounting, it was noticed that customers making low-volume and low-value purchases were getting too big a discount, and that this was putting a further squeeze on the already shrinking margins.

To avoid this situation, the model was adjusted to make sure that discounts were applied in a way that protected margin. One of the ways in which this was done was through a more transparent pricing procedure. Showing customers the cost of producing different quantities of product meant that the customers could see what was a reasonable level of discount, and could also help to reduce the company’s costs, and so could expect to share in the benefit. This transparency would also help the sales force to explain the change in pricing model and to account for any price increases. And, to make sure that over-discounting was made a thing of the past, price corridors were established for each product.

Further investigations and modeling revealed that the company could benefit from better tailoring its products to meet customers’ needs — through the establishment of a new taxonomy for products — and the more sensitive setting of pricing to target customers, which, when modeled, gave a potential increase in margin of up to BRL75m (approximately US$30m), as shown in Figure 3.

Putting the new model into place
To establish a more sensitive pricing mechanism, the company would need to transform its processes and procedures. To this end, the EY team sketched out a model for a new pricing mechanism, which would include a change to the IT infrastructure and training to help staff deal with the more complex and sophisticated way in which prices and discounts would be calculated.

To make pricing more reactive to changes in the business environment and to make the pricing process more efficient, the company needed a change...
in infrastructure and governance. Weekly “situation room” meetings were established, attended by executive board members, workstream leaders and the project manager, reporting on all the fluctuating conditions that could have an impact on the pricing model: the margins being obtained, the manufacturing costs and the costs of materials.

Further steps would capture additional value globally

The experience of the Brazilian arm of this multinational animal feed firm has shown a potential method for yield safeguard and increase, which could be replicated to other countries facing similar challenges – those at the cusp of a revenue decrease. The global rollout would need to be done in such a way as to maintain the consistency and coherence of the model, but would also need to be customized and monitored at a local level to better tailor the company’s offerings to different national customer groups.

Further model improvements and initiatives to improve management would increase the business’s agility in responding to external trends and changing pricing conditions. Introducing a globally integrated IT infrastructure for pricing control would be particularly beneficial.

A severely damaging external trend may lead a company to launch desperate initiatives to make internal improvements, even though the issue is coming from the outside. But an external problem often demands an external solution: in this instance, a customer-oriented approach that could deliver yield management improvement without damaging the company’s value proposition. This is never a trivial response but, when applied carefully and consistently, it may promote additional customer value and sustainable growth.
Getting user buy-in to new IT systems

For organizations implementing new, large-scale information systems, such as enterprise resource planning (ERP), a primary concern is the degree of post-implementation use. There is no certainty regarding a user’s acceptance of new IT-supported procedures. Moreover, short-term usage in line with expectations may disguise an underlying discomfort with the system. It may mask a desire to seek out system circumvention tactics (i.e., ways of getting round the system) down the road.
Both case studies and experimental studies have shown how the process of IT implementation is affected by issues such as the ease with which the new IT implementations can be introduced, the intentions to implement and the perceived levels of system misfit (i.e., mismatch between operating processes and information system protocols). Such perceptions can have not only short-term manifestations, but may also have long-term impacts on the successful use of new systems.

Bending the rules

One way to think about these dynamics is through the valence-instrumentality-expectancy (VIE) framework. In IT implementation contexts, the attractiveness of system procedures relative to existing operating norms can have a significant impact on behavior. If a rule structure established by the IT is relatively non-binding, it is expected that, as users become more uncomfortable with the way the system works, the more they will increase the range or practice used to execute that process. This is a natural response, especially when the guidelines are not strictly enforced, or are not intended to be followed word for word. If the freedom is readily available to depart from the newly instated guidelines, workers will feel free to go down the route that works best for them in the tasks that they are performing.

In such settings, it is, therefore, necessary for implementers of new systems to not only ensure a real fit between technology and operational processes, but also to manage perceptions relating to long-run, task-technology misfit. According to Bendoly and Cottelee (2008), in contexts where perceived misfit is high and circumvention appears to be easy, users will immediately seek to get round or circumvent the implemented IT. If these circumventions are maintained, then the drive for additional circumventions may be reduced. In short, by making changes to the system when it is first implemented, future alterations to the system are largely avoided.

Conversely, when going around the system does not appear to be an immediate option, users may nevertheless persevere in their attempts to undermine authority in an attempt to correct misfit. In this case, long-term circumvention may be achieved. However, these greater levels of circumvention are likely to give rise to greater levels of variation in practice as well. This, ultimately, suggests that organizations seeking conformance to systems exactly as they are implemented should continue to promote an understanding of the system’s fit to local conditions, which may vary depending on the area.

Contrasting the success of two approaches

A comparison between two companies, TECH Manufacturing and Tristen Incorporated (renamed here for proprietary reasons), provides an excellent example of sustained versus non-sustained compliance with IT-supported protocols. The same ERP package was implemented in both companies, but the results in terms of compliance and circumvention differed.
TECH Manufacturing

TECH Manufacturing (TECH) was a US$2b manufacturer of computer and electronic equipment, based in the US. The peripherals division (PD) operated in 12 geographic regions, encompassing more than 20 countries. The PD decided to participate in the rollout of ERP applications with the goal of enabling growth and simplifying a mess of legacy IT applications. Out of this rollout of ERP applications, the PD hoped to gain faster order fulfillment, simplified financial processes and global logistical coordination.

Teams of business experts analyzed social situations to determine the extent to which local operations required customization of the new ERP applications. Where adaptation was justified, it was approved and implemented. However, in the majority of cases, conflict did not seem to arise from true business need. In these situations, extensive discussion with local representatives took place in order to communicate the need for standard system-supported protocols.

Following implementation of the new system, employees gave positive feedback. “We definitely got better as time went on,” reported one local user. “When you first started, it seemed like it took forever to get an order done. Our trainers would say, ‘The more you use it, the better you get.’ So you got in there, did it, and you just got quick at it.” Middlemen called “Super-Users” also served as a means of solving conflicts between processing needs and system capabilities. The help from the Super-Users tended to discourage system circumvention by employees.

“Managers overseeing new IT implementations would do well to understand the perceptions of their users, manage them, if possible, and address remaining issues that give rise to discomfort.”
Tristen Incorporated

In contrast, Tristen Incorporated (Tristen) was a US$4b manufacturer of computer components that operated in three autonomous regions, maintaining more than 20 globally distributed sales offices. Tristen sought to minimize system modification and adhere to the process standards encouraged by the software, just as TECH had. Also like TECH, Tristen sought to provide more predictable service levels to global customers through centralization and process standardization across operating regions.

This deployment effort took place at Tristen’s North American headquarters. As a result, the perception was created unintentionally that managers from other regions had limited project input. One manager characterized the effect of the centralized deployment strategy by suggesting, “If you did not send someone to the project, you were not represented, you were [expletive deleted].” Albeit a very blunt statement, this adequately sums up one of the major problems with this trial for new system implementation. By localizing the process in one location, Tristen’s three autonomous regions were not sufficiently represented. This would lead to issues with centralization and process standardization across operating regions worldwide.

In contrast to TECH, initial reductions in variation were not sustained over time, as seen in Figures 1 and 2. In these diagrams, lead times (i.e., the times between initiation and execution of processes), scaled to the pre-system benchmark, are compared.

Figure 1 shows that, for TECH, in the first month following deployment of the new system, average lead times showed a significant decrease (from the pre-system average of 10.1 days to an average of 7.2 days). The managers of TECH believed that decreased variability indicated a general adoption of the standardized system protocols. The sustained decrease in process variation that appeared over the following 24 months was seen as particularly valuable for future planning purposes and for fostering the perception of TECH as a reliable supply chain partner.

In the Tristen case, Figure 2 shows that lead time variation began to increase as early as the eighth month, and gains disappeared altogether by the 24th month following deployment.

Reasons behind Tristen’s divergence trends

Several issues may account for the increases in regional variation, but in Tristen’s case, it mostly had to do with sustained behavioral reactions to the system change. As system users decided that they did not like the protocol, they found it easier to find ways to circumvent it as they learned more about it – an employee must learn about a system in order to know how to get around it.

Some employees engaged in this circumvention, and others did not. These inconsistencies resulted in particular traits in performance among employees – the same traits that the company had originally planned on reducing through ERP deployment.

Managers reported that substantial site-level adaptation emerged soon after ERP deployment, resulting from widespread, sustained perceptions of misfit between the systems and local process requirements. These perceptions resulted in sustained circumventive behavior. The reasons for these circumventions varied regionally, ranging from discovering new functionality or new ways of accessing information to changing system parameters to better fit perceptions of how the business should function.

It was discovered that the team of implementation personnel really did nothing to stop these circumventions and, in fact, encouraged employees to execute the changes that they desired. “We didn't really have a good process in place to make sure that there was consistency where there needed to be,” reported one team member. “We had some issues specifically with the logistics sites. Once they got into the system, they started making changes. There wasn't a good process to prevent that from happening.”

There are positive and negative outcomes to be seen in the Tristen case. On a positive note, employees are encouraged to implement their own changes to the initially established protocol to better fit what they deem necessary to get their jobs done. On a negative note, Tristen did not really realize its goal of centralizing and creating process standardization across its operating regions.
Further analysis of the differing dynamics

The differences in dynamics in the two cases were compelling enough to warrant further investigation. In fact, Bendoly and Cotteleer (2008) were able to replicate these effects in a controlled laboratory study. In this study, individuals were exposed to new system scenarios involving either high or low levels of ease in circumvention (EOC), and either low or high levels of operational-IT misfit. The results are summarized in the graphs in Figure 3.

What this means for IT implementation projects

The results drive home the point that it can be misleading to view any single time reference as indicative of stable appropriation when appropriation equilibria both evolve over time and may not be accurately described as “faithful.” Managers overseeing new IT implementations would do well to understand the perceptions of their users, manage them, if possible, and address remaining issues that give rise to discomfort. A clear understanding of circumvention paths is, of course, critical. However, where many such paths may not be immediately obvious, those workers with strong long-term intentions will.

Figure 3

Study results comparing ease of circumvention (EOC) with level of operational IT misfit
If you wish to contribute to Performance or comment on the articles published, please contact us via one of the following emails:

- performance@de.ey.com
- anna.di.mattia@de.ey.com

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Ilka Häckert, Nicole Jüppner, Wiebke Hahnen
Argentina
Roberto Osvaldo Fraga
» roberto.fraga@ar.ey.com

Australia
Neil Plumridge
» nelli.plumridge@au.ey.com
Mithran Doraisamy
» mithran.doraisamy@au.ey.com

Baltics
Nauris Klaava
» nauris.klaava@lv.ey.com

Brazil
Cristiane Amaral
» cristiane.amaral@br.ey.com
Carlos Bremer
» carlos.bremer@br.ey.com

Canada
Julie Bourgault
» julie.bourgault@ca.ey.com

Chile
Diego Luis Balestra
» diego.balestra@cl.ey.com

Colombia
Javier Macchi
» javier.macchi@co.ey.com

Czech Republic and Slovak Republic
Vladimír Kaštier
» vladimir.kastier@sk.ey.com

Ecuador
Diego Ramiro Leon
» diego.leon@ec.ey.com

Financial Services
Justin Lay
» jlay@uk.ey.com

France, Morocco and Luxembourg
Vincent Michi
» vincent.michi@fr.ey.com

Germany
Marcus Schreiner
» marcus.schreiner@de.ey.com

Hong Kong
Alex Viale
» alex.viale@hk.ey.com

India
Rohan Malik
» rohan.malik@in.ey.com

Italy
Andrea Bassanino
» andrea.bassanino@it.ey.com

Japan
Junji Suzuki
» junji.suzuki@jp.ey.com

Mexico and Central America
Gilberto Lozano
» gilberto.lozano@mx.ey.com

Middle East
Ahmad Ahmad
» ahmad.ahmad@sa.ey.com
Ahmed Taher
» ahmed.taher@sa.ey.com

Netherlands
Fenna Wegman
» fenna.wegman@nl.ey.com

Norway
Bård Hayland Karlsen
» bard.karlsen@no.ey.com

Peru
Paulo Cesar Pantigoso
» paulo.pantigoso@pe.ey.com

Poland
Robert Dziedzic
» robert.dziedzic@pl.ey.com

Republic of Serbia
Natasa Vuksic
» natasa.vuksic@rs.ey.com

Russia
Sergey Zaborov
» sergey.zaborov@ru.ey.com

South Africa
Gareth Bladon
» gareth.bladon@za.ey.com

Sweden
Per Skallefell
» per.skallefell@se.ey.com

Switzerland
Heiko Schikor
» heiko.schikor@ch.ey.com

Turkey
Bulent Ozan
» bulent.ozan@tr.ey.com

United States of America
Sven Krause
» sven.krause@ey.com

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Ligia B. Parra Barráes
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