INNOVATION

The Future of New Product Development

Learn how to develop innovative new products for increasingly global and digital markets.
The Future of New Product Development

1  How to Monetize Your Data  
   By Barbara H. Wixom and Jeanne W. Ross

5  Designing and Developing Analytics-Based Data Products  
   By Thomas H. Davenport and Stephan Kudyba

12  Developing New Products in Emerging Markets  
    By Srivardhini K. Jha, Ishwardutt Parulkar, Rishikesha T. Krishnan, and Charles Dhanaraj
The possession of rich amounts of data is hardly unique in today’s world. Indeed, data itself is increasingly a commodity. But the ability to monetize data effectively — and not simply hoard it — can be a source of competitive advantage in the digital economy. Companies can take three approaches to monetizing their data: (1) improving internal business processes and decisions, (2) wrapping information around core products and services, and (3) selling information offerings to new and existing markets. These approaches differ significantly in the types of capabilities and commitments they require, but each represents an important opportunity for a company to distinguish itself in the marketplace.

Theoretically, companies can pursue more than one approach to data monetization at the same time. In practice, adopting each approach requires management commitment to specific organizational changes and targeted technology and data management upgrades. Thus, it’s best to identify your most promising opportunity and start there. In doing so, you will enhance your data in ways that will accelerate subsequent efforts related to the other approaches. More importantly, you’ll build your company’s capacity for monetizing its data.

Improving Internal Processes
Using data to improve operational processes and boost decision-making quality may not be the most glamorous path to monetizing data, but it is the most immediate. Executives often underestimate the financial returns that can be generated by using data to create operational efficiencies. Companies see positive results when they put data and analytics in the hands of employees who are positioned to make decisions, such as those who interact with customers, oversee product development, or run production processes. With data-based insights and clear decision rules, people can deliver more meaningful services, better assess and address customer demands, and optimize production.

When Satya Nadella became CEO of Microsoft Corp. in February 2014, he urged employees to find ways to improve the company’s processes with data. Within sales, executives believed that, with the right tools and systems, they could improve the productivity of their salespeople by 30%. To do so, Microsoft’s sales leaders sought to deploy tools that would help salespeople spend more of their time engaging with customers — and in more effective ways — by arming them with key computed insights, such as how likely a sale is to close and when.

To deliver actionable insights, sales executives first had to define shared concepts (for example, what is meant by “a lead”). They then needed to locate data sources that could be used to calculate performance. They quickly learned that sales data was located in too many different systems to easily create a comprehensive snapshot of a salesperson’s business. Within a year, they created a
new, integrated customer system that could produce 360-degree views of Microsoft’s relationships with corporate customers, including what those customers bought, what issues they encountered, and how the company engaged with them.

The new system saved 10 to 15 minutes per sales opportunity by eliminating the need for Microsoft salespeople to manually search for and prepare data. The system also helped sales executives more accurately manage their pipelines; it used predictive analytics and machine learning to compute the likelihood of a successful sales engagement based on data that the salesperson provided about an opportunity. For example, buying and deploying enterprise software is complex

Wrapping Information Around Products

Most companies have opportunities — often quite significant ones — to enrich their products, services, and customer experiences using data and analytics, a phenomenon that we call “wrapping.” Companies are wrapping their offerings with data to escape commoditization and satisfy increasingly hard-to-please customers — with the goals of generating sales increases, higher prices, and deeper customer loyalty. FedEx Corp. was an early exemplar of wrapping when it introduced online package tracking as a free service in the 1990s. Now examples abound as companies bundle reporting, alerts, and other information to add value to products ranging from credit cards to health monitors.

Wrapping is a creative exercise in which companies identify what problems their customers have and then find ways to solve those problems using data and analytics. For example, Capital One Financial Corp., a diversified bank based in McLean, Virginia, learned that many of its credit card holders are concerned about fraudulent transactions but find the task of examining every charge to be tedious. So the company helps customers identify fraud more easily and quickly by displaying merchant logos and maps with each transaction in online statements. The visual cues jog cardholders’ memories about whether they made a purchase or not. As a result, customers are more satisfied with the credit card and more likely to use it more often.

Johnson & Johnson has discovered the value of providing pattern identification to users of its health-monitoring products, including those for diabetics. The company offers its OneTouch Verio Sync Meter customers historical reporting on their blood glucose levels, along with tools to help them understand patterns of changes. The reporting is intended to help customers identify the possible causes for the glucose level variations and thus identify behavioral changes that can result in healthier living.

Wrapping activities are best viewed as extensions of a company’s product management processes. This means offering data and analytics to customers at the same level of quality as the core product. Doing so requires comparable levels of scrutiny and control. Most companies don’t manage and cannot deliver data and analytics in this way. In fact, exposing data to customers could reveal quality problems and a lack of analytical sophistication. Thus, in most cases, wrapping requires companies to “up their game” in their information capabilities so that wrapping doesn’t damage their reputation or undermine their value proposition. This effort may entail heavy investment in data-quality programs, advanced computing platforms (for instance, Hadoop), or data-science talent.

Selling Data

Many executives are eager to sell their company’s data, convinced that it has inherent value and can generate important new revenues for the company. We caution that selling represents the hardest way to monetize data, mainly because it requires a unique business model that most companies are not set up to execute.

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and often requires a partner’s involvement, so the system may calculate a higher likelihood for success when customers already have partners involved. Information about an opportunity’s likelihood of success, along with suggestions on how to advance engagements along the sales pipeline, helped salespeople prioritize their leads and act in ways most likely to achieve their goals. Over time, Microsoft salespeople learned how to forecast more accurately (for example, the accuracy of forecasts regarding global accounts has risen from 55% to 70%), which has led to better sales-pipeline data and, in turn, improved pipeline management.
company that reported $10.4 billion in 2015 revenue. It provides products and services to institutional investors such as mutual funds, corporate and public retirement plans, and insurance companies. In 2013, State Street announced a new information-business division called State Street Global Exchange that would combine existing State Street data and analytics capabilities with new research to develop information-based solutions that clients would be willing to buy independently of the company’s core services. State Street established a new division for the information business in recognition of its unique business model needs — something the company had not done in 30 years.

Even though it started out as a discrete unit, State Street Global Exchange focused on developing products that were tightly associated with State Street’s core business. For example, State Street is one of the largest administrators of private equity assets, which means that it collects data about the financial capital that is not noted on a public exchange; this kind of data is of great value to markets that require an accurate representation of the private equity industry. State Street Global Exchange appreciated that the data was not automatically monetizable. Executives secured permission from 3,000 private equity clients to aggregate and anonymize that data — and then created an index that conveyed the financial performance of the private equity industry.

State Street leaders realized that they would need an entirely new operating model to support the information business. For one, sales processes had to change because, although State Street Global Exchange often sold to State Street clients, a buyer of Global Exchange products was frequently a different person or cost center than the kind of buyer traditional State Street products attract. In addition, the information business required salespeople with different selling experience and skills in selling stand-alone data and analytics-based products.

State Street understood that establishing an information business is hard and takes time. State Street Global Exchange had to learn to achieve balance between maintaining key ties with State Street (to create benefits from being a part of the larger organization) and responding quickly to new markets and new needs. Executives believe that State Street Global Exchange is gaining significant traction with its clients — and that their commitment will pay off. But we caution that such a model is not easy to replicate. Other companies should think carefully about the operational capabilities, investment, and commitment required to successfully sell data.

**The Importance of Accountability**

Chances are you have two major obstacles to monetizing your data. The first is the accessibility and quality of your data. Our research has found that only about a quarter of companies offer employees and customers easy access to the data they most need. You can’t monetize data no one can use.

Data monetization through process improvement requires strong process leaders. These leaders systematically use data to analyze the outcomes of existing processes and test hypotheses about proposed improvements. At Microsoft, for example, sales managers designated specific people to reshape and institutionalize new ways of selling. Process leaders are ultimately responsible for the design of best practices, the capture of the right data, the availability of tools, and the training of all staff regarding how to use data to do their jobs.

Data monetization through wrapping requires strong product leaders. These leaders treat the data that accompanies a core product or service much like any other product innovation — they hold it to the same quality standards. At Capital One, product leaders know the value of adding a data or analytics feature to a credit card because they predict — and then track — the lift in revenue from the information as well as the cost of...
providing it. Product leaders assemble teams to design experiments and methodologies that help analyze the impacts of information features and make appropriate adjustments.

Monetizing data by selling it requires a strong business-unit leader. That leader, in turn, must assemble a team that can launch and grow what is for most companies a new line of business. The head of that business will start by ensuring the value of the data and related services to potential customers. But the business head and his or her team must also design data, analytics, and dashboards to monitor the business and enable a rapid response to new business opportunities.

Each of the data-monetization strategies requires new processes, skills, and cultures to generate maximum returns. Companies with data-monetization experience have learned that it is insufficient to simply put data and tools into the hands of employees. Microsoft refined goals, cleaned up data, honed reports and algorithms, grew talent, and changed habits. Capital One and Johnson & Johnson reshaped product-management talent, platforms, and capabilities. State Street redesigned its organization and created a new profit formula that would generate stand-alone revenues from information.

Impressive results from data monetization do not transpire from single “aha” moments. Instead, they stem from a clear data-monetization strategy, combined with investment and commitment.

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THANKS TO SEVERAL WAVES of innovation in recent decades, the rise of information and technology is one of the dominant features of the current economy. The expansion of the information economy that began in the mid-1990s included enhanced hardware and software capabilities, abundant broadband Internet access, and increasingly widespread use of the Internet. These developments helped spur the creation of new products and industries and drove a significant increase in data resources. In an important 1996 article published in this journal, “The Design and Development of Information Products,” authors Marc H. Meyer and Michael H. Zack previewed the impact of these changes.1 (See “Revisiting ‘The Design and Development of Information Products,’” p. 84.)

The past 20 years have brought several reconfigurations of the information and knowledge economy, as enhancements in computer processing and storage capabilities, new software and communication technologies, and the evolution of wireless broadband and mobile computing have taken hold. Technological breakthroughs have driven exponential growth in e-commerce and the emergence of a digital economy with vast data assets. The changes have been accompanied by ongoing attempts to make sense of all the data through the use of analytics.

The original goal of computerized information was to facilitate internal business
transactions and improve decisions. However, the resulting digital assets are now of considerable value in themselves. According to a 2015 Organisation for Economic Co-operation and Development research report, “Data-driven innovation forms a key pillar in 21st-century sources of growth. . . . large data sets are becoming a core asset in the economy, fostering new industries, processes, and products and creating significant competitive advantages.”

When digital assets are made available to customers, they are increasingly accompanied by analytics that provide insights and facilitate decisions. Analytics — which were not typically present in earlier information offerings — add substantial value to intangible assets by making them easier to understand and apply. In a world in which information alone has become ubiquitous and somewhat commoditized, analytics provide a means of making information more useful and valuable.

In this article, we will focus on the combination of new analytical capabilities and burgeoning data assets that together form value-added information product offerings. In common parlance, these offerings are often called “data products.” For our research, we interviewed more than 40 companies that offer data products and specifically addressed their process (or the lack thereof) for developing them. (See “About the Research.”) In our work on this project, we seek to augment and update Meyer and Zack’s findings from 1996.

The Value of Analytics For Data Products
Data and analytics were historically employed for one purpose: improvement of internal decision making. Indeed, one of the earliest names for these fields was “decision support.” The goal was to improve the accuracy and efficacy of decisions in marketing, finance, human resources, and so forth.

But the big data revolution offered companies another use for data and analytics. Beginning with online companies such as Google Inc. and Facebook Inc., companies began to develop “data products” for customers based on data and analytics. Search services from Yahoo! Inc., Google, and others were arguably the first of these, but other sorts of products followed. Linkedin Corp., for example, developed “People You May Know,” and soon added others, including “Jobs You May Be Interested In” and “Groups You May Like.” Online companies such as Facebook have done similarly. (Facebook has its own “People You May Know” product.) Many online data products are available as mobile apps, shaping what has been called an “app economy.” Not every app involves analytics, but those that do qualify as data products.

Data products (most of which can be described as services) are not generally sold separately to customers but are used to attract customers for advertising, draw attention to unknown products in large product pools, and enhance revenue through cross-selling and upselling. They have powered rapid
growth in the value and success of these online companies—not only in creating a much larger user base but also in differentiating offerings.

Analytics used in data products take a variety of forms. The most common is descriptive analytics that provide insight on a customer’s level of activity or product usage. Google pioneered this format with its Google Analytics offering, a free set of data products that informs customers about visits to their websites. Descriptive analytics can also be comparative, for example, relating a household’s utility usage and expenditure to other household’s, or comparing a company’s travel activity with that of its peers.

Predictive analytics are more difficult to generate. One of the most common forms today is predictive maintenance for industrial machines. Using data gathered from sensors in machines, analytics compute the point when comparable machines have broken down and recommend particular services before that time. Large companies such as GE, Siemens, and NCR have recently introduced predictive maintenance offerings. In the consumer sector, Seattle, Washington-based Zillow Group Inc.’s Zestimate, based on publicly accessible housing data, predicts the price a homeowner might receive for the sale of his or her house.

Prescriptive analytics recommend specific actions. In the agricultural products industry, companies such as Monsanto and DuPont offer data products that recommend, for example, when and what farmers should plant, when certain interventions, such as water or pesticide applications, are advisable, or when to harvest. These data products can help farmers achieve higher crop yields. Other forms of prescriptive analytics in data products involve matching algorithms, which match customers with products, dating candidates, or potential business network members.

Current Processes and Issues For Information Products

Relatively little is written or known about developing new generations of data products. Indeed, we have noticed that the companies interested in producing new offerings often lack both structure and process. In their 1996 article, Meyer and Zack offered a clear structure for information product development. Although they were primarily addressing traditional information services companies, we believe that many of their ideas are quite relevant to the issue of designing data products from big data, including the following:

• **Product and process “platforms” can support a variety of specific information products.** That idea has become much more popular in recent years, with many economists and strategists extolling the virtues of “multi-sided” platforms that allow interaction with multiple constituencies at once.

• **Different information products can share an overall product architecture or be part of the same product family.** In Meyer and Zack’s view, it’s a mistake for organizations to think in terms of single products.

• **An idea “refinery” can create value from information.** Although Meyer and Zack presented this concept 20 years ago, few organizations have begun to extract the kind of value from their information that the authors envisioned.

In this article, we will describe what leading companies are doing to create, refine, and generate value from data products. Given the emphasis that has been placed on the potential value that data assets offer as the digital economy progresses, a revised model for providing structure to the product creation process is in order. Meyer and Zack addressed the topic in the form of an information product development process, where raw data sources or repositories provide inputs to the process of producing a product. They created a five-step methodology (acquisition, refinement,
Data & Analytics

Data product development activities today are rarely undertaken in a traditional product development sequence that involves identifying the need, developing the product, and then taking it to market. This introductory step needs to take place before data acquisition. It requires conceptualizing the information product, along with identifying the required data resources. The process involves product definition, data investigation (which should include sourcing data creatively), and establishing the framework necessary to produce a prototype. Once this set of requirements is met, the remaining steps of the development process can be carried out more efficiently. For example, once managers know the data elements that will go into the product, storage and retrieval can be streamlined.

An interesting example is CarMD.com Corp., an Irvine, California-based company that provides services that leverage automotive diagnostic information. The original idea was to provide diagnostic capabilities that led consumers to auto repair estimates and potential service providers. One of the company’s products compares the data extracted from onboard computers in cars against online auto repair databases and offers consumers information on auto maintenance.

STEP 2: Data Acquisition
Once the conceptual model has been worked out, data acquisition can be pursued in a more efficient manner. Organizations tend to acquire or accumulate data that corresponds to their functional activities. However, given the vast amounts of data being generated by information devices and the data available from public sources, the acquisition process needs to connect the requirements of the conceptual model to data that will create the product. In addition to acquiring structured data (for example, customer purchase records), companies should also consider using unstructured sources (for instance, social media comments) that might be able to add value. Companies should be prepared to look within and outside their own systems for such data.

STEP 1: Conceptualizing the Product
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STEP 3: Refinement

Although Meyer and Zack’s data refinement process remains quite relevant, it has to be augmented to facilitate new data sources and to take advantage of advanced analytic methods. The original model talked about the importance of being able to “glean further meaning from combinations of individual [data] elements.” Today, much data refining is achieved with automated tools. Real-time machine learning and algorithmic processing of data elements can categorize, correlate, personalize, profile, and search data quickly to create meaningful models that have significant value for consumers.

For example, Passur Aerospace Inc., based in Stamford, Connecticut, uses both its own data and public data to develop scheduling information for airlines and travelers. Drawing on publicly available data on weather, flight schedules, and other factors, along with its own internal data based on radar statistic feeds, it generates flight arrival estimates. Applying advanced analytics, Passur’s arrival estimates outperform ones based on traditional techniques.

STEP 4: Storage and Retrieval

Storage and retrieval are as important as ever. However, retrieval in today’s environment must incorporate advancements in query and search processing capabilities (for instance, making use of algorithms) that can access more granular levels of data. Traditional storage techniques need to be augmented by new technologies such as map reduction (a software framework for distributed processing of large data sets on computer clusters of commodity hardware) and parallel processing capabilities to manage larger and faster-moving data sources. Many organizations store data in relatively unstructured formats when they initially capture it, refining it over time. Data storage, retrieval, and processing are increasingly taking place in the cloud rather than on a company’s premises. This not only provides companies with flexibility in their technology infrastructures but also can make it easier for them to combine internal and external data.

STEP 5: Distribution

The distribution options for information products have shifted dramatically from the earlier menu of possibilities, some of which (such as fax and CD-ROM) have been superseded by the Web. Timing and frequency remain critical aspects of distribution; data products must be continuously available and updated in near-real time. In the digital economy, online media (such as websites and portals) fully address the required level of continuous accessibility to information products. However, Web access via traditional computers is quickly being overtaken by mobile access via smartphones, tablets, and apps. As a result, providers of information products that are distributed via mobile devices need to revamp their content formats and design.

At the same time, distributing data products through the cloud adds a new dimension to the question of how frequently information needs to be updated for users. Consider, for example, a business-to-business case involving a shipping service provider that offers information products including en-route metrics, such as estimates of time to delivery. Assuming the data is available, the frequency and timeliness of such information — generated through GPS traffic information, location data, and analytics — can be close to real time.

STEP 6: Presentation

In the original Meyer-Zack model, information products gained value from the context of their use. The user interface mattered — and the easier products were to use, the more valuable they were. Although the digital economy places heavier emphasis on analytics than on simple data provision, there are some important constants. While standard reporting (that is, simple information products) continues to meet the needs of many consumers, more advanced analytics-based products...
The competitive nature of the information product space, availability of new data sources, and demand for timely decision support require an ongoing emphasis on innovation and on monitoring product usage.

such as forecasts, predictions, and probabilities (such as real-time calculations generated through machine learning) can lead to differentiation and competitive advantage.

**STEP 7: Market Feedback** The competitive nature of the information product space, availability of new data sources, and demand for timely decision support require an ongoing emphasis on innovation and on monitoring product usage. Adding this step at this stage of the analytics-based data product development process is consistent with the iterative nature of product development in a “lean startup” context. Once again, the evolution of new technologies has provided a mechanism for facilitating a feedback and information extraction process from the marketplace. New forms of market research are capable of leveraging social media platforms (for example, business Facebook pages) to listen to the marketplace. Interactive blogs and flash surveys can be utilized to assess customer perceptions of existing information products. New features of online information products can be tested in a matter of hours with A/B or multivariate online testing approaches. Both user correspondence and digital metrics on product use (for instance, views, clicks, downloads, and bounces) can be analyzed to enhance products continuously.

**A Structured Approach to Stakeholder Involvement**

In order to achieve effective results from the implementation of the product development model, stakeholder involvement is essential. Having particular types of input at different stages of the product development process is important. Therefore, companies need to develop some degree of structure for stakeholder input.

During the stage when the product is being conceptualized, it’s important to have involvement from three specific groups: subject matter experts at the business level (who can help determine the feasibility of the product design); managers of existing and complementary information products (who can help companies avoid cannibalization and duplication); and marketing people (who can help assess the nature and scale of consumer demand). These individuals can assist in providing the framework for designing or upgrading existing products to add value to meet market needs.

For the data acquisition and the storage and refinement stages, stakeholder involvement should expand to include legal representatives, who can speak to data ownership, privacy, and use issues; IT personnel, who can provide input on hardware and software requirements for data products and also help in developing and improving the functionality of the product; and data managers and analytics and data scientists to assist in product platform execution. It is critical to involve analytics and data science professionals to help in structuring and analyzing data.

For the distribution and presentation stages, the stakeholders should again include marketing people (who can help sort out consumer/user needs for the initial product launch and subsequent product releases) and IT personnel (who can deal with hardware and software issues in product functionality during the product rollout).

During the market feedback stage, it’s important to involve people from both IT and marketing. IT personnel will be able to leverage available communication devices to interact with users on a variety of platforms (Web, mobile, social media, email, etc.). Marketing can devise strategies for interaction and feedback and will be able to gather and synthesize the feedback.

If data product development is to be successful, human resources personnel also have a pivotal role to play. Although data scientists can be difficult to hire and retain, they are essential for developing analytics-based data products.
Structure Versus Market Responsiveness

There has always been a trade-off in product development between having structures that ensure that the product addresses market needs and is of high quality, and being able to introduce products quickly and remain responsive to customer needs. Though the pendulum in data products has clearly swung in the direction of responsiveness, there is still a need for structure and method in developing new offerings.

As the proliferation of information has led to commoditization, it is often the accompanying analytics that make data products truly useful. Analytics can be difficult and time-consuming to develop, so it is vital to have a sense of which analytics are needed and valuable before developing and introducing them. We believe that the steps outlined in the Meyer and Zack article — combined with the additional steps we outline — can be helpful to organizations in assembling data and analytics products that provide value to consumers and businesses.

Just as in the early e-commerce era almost every company decided it needed a website, we envision an era in which almost every company feels the need for a data product. It will thus become increasingly important for organizations to have some discipline about which data products are developed and which functions they incorporate.

We doubt that Meyer and Zack could have foreseen the explosion of information and technology that has taken place since 1996. However, their article provided early insights and warnings about the importance of rigorous thinking when developing products based on intangible information assets.

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11. Ibid.
12. One CEO creating a data product in the health care industry told us, “We tried agile [referring to agile product development methods], but it was too slow.”

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Developing New Products in Emerging Markets

How can multinational companies turn ideas from their emerging-market subsidiaries into global products? A successful innovation developed by Cisco’s R&D unit in India offers practical insights into how to make that process work effectively.

BY SRIVARDHINI K. JHA, ISHWARDUTT PARULKAR, RISHIKESHA T. KRISHNAN, AND CHARLES DHANARAJ

FOR MORE THAN a decade, multinational enterprises from developed countries have been moving a substantial part of their research and development (R&D) activity to emerging markets such as India and China. While the location of R&D centers in other developed countries has been driven by lucrative markets or specific expertise available in the local ecosystems of those countries, the location of R&D in emerging countries has been largely driven by the availability of skilled manpower at low cost. At first, these R&D centers in emerging markets operated largely as extended arms of R&D in the home country, executing well-defined projects under close supervision from headquarters.

However, the dynamics of multinationals’ R&D are rapidly changing. Emerging markets are new growth drivers of the global economy, and their unique bundle of opportunities and challenges can be a wellspring of innovation for a multinational company. Simultaneously, many R&D centers in emerging markets have evolved to accumulate advanced technical capabilities, leading their employees to clamor for higher-value-added work and to seek responsibility for a complete product or technology. This clamor gets louder when the R&D subsidiary is located in a country with a large local market, such as India or China.

Given these trends, R&D subsidiaries in emerging markets are uniquely positioned to play an important role in multinational companies’ innovation strategies. However, this thinking is often at odds with the dominant innovation mindset, structures, and processes within multinational companies based in developed countries. Also, the fact that the product-leadership capabilities of...
R&D centers in emerging markets are often not well established within the multinational enterprise creates a higher hurdle. Against this backdrop, we explore several questions: When is the subsidiary ready to take on such responsibilities? What kinds of products or technology should the subsidiary work on? How should this be developed? While many companies have struggled with these issues, a successful innovation from Cisco Systems Inc.’s R&D unit in India — a family of mobile backhaul routers, named ASR 901 aggregation services routers — offers insights into these questions. (See “About the Research.”)

The ASR 901 family of routers acts as the entry point for consumer voice and data into the mobile telecommunication network and sits in what is referred to as the “last mile” of the network. (See “How a Telecom Network Is Structured.”) ASR 901 was conceptualized and developed by Cisco’s R&D center in India to serve the unique needs of emerging-market customers. However, the product also found traction in developed markets, making it a global product. The decisions taken with respect to the choice of ASR 901 as the product to be developed in India, its technological features, and its resourcing strategy provide valuable lessons for multinational managers both at headquarters and at subsidiaries on how to turn the company’s emerging-market presence into a source of innovation.

**Decision #1: Key Enablers of Emerging-Market Innovation**

Managers in emerging-country R&D outfits need to consider three key factors before they embark on innovation for local and similar markets. These enablers are the R&D capability of the unit, the size and uniqueness of the market opportunity, and the presence of executive champions, both at headquarters and at the subsidiary.

**R&D Capability** First and foremost, the R&D unit needs to have well-developed R&D capabilities. This means the unit should have the breadth and depth of technical knowledge required to undertake complete product development. Without this capability, the unit will remain reliant on headquarters and other units within the company, which might unnecessarily prolong the process or end the project prematurely.

Leading up to ASR 901, Cisco India had built these capabilities to a large extent. In 1996, Cisco set up an R&D center in Bangalore, India. The center started with a handful of engineers working as an offshore, extended team of Cisco headquarters, executing specific tasks for one or two business units. The primary driver for setting up the center was the availability of a large pool of English-speaking engineering talent and low operating costs.

In the years following its establishment, the India center consistently met delivery and quality targets, attracting more investment from headquarters and increasing the scale of its R&D. At the same time, the center enhanced the depth and breadth of its technical capability, and by 2009, the center had filed more than 170 patents. The India center was given development ownership for certain product components, although product innovation continued to be driven by headquarters and oriented to the needs of the developed markets.

As the India R&D center matured, the R&D managers and staff aspired to innovate rather than simply execute; a culture of innovation and entrepreneurship emerged. More importantly, the center had accumulated most of the capabilities required to deliver on that aspiration.

**ABOUT THE RESEARCH**

The research method employed for this study was a combination of quasi-participatory action research and the case study method. One of the authors, Ishwardutt Parulkar, was a core member of the ASR 901 project, intimately involved in every aspect of the project from conceptualization to commercialization. This author is also trained in the research tradition. Through the duration of the project, he took detailed notes about the project’s challenges, dilemmas, and key decisions. At the end of the project, he authored a white paper to capture the important takeaways from the project.

We complemented this rich firsthand knowledge with an in-depth case study of the project. For the case study, we gathered data from multiple sources — key respondent interviews, company documents, and secondary data from external sources — in order to understand the evolution of Cisco India R&D from the time of its establishment to the initiation of the ASR 901 project, as well as the activities during the project itself. We conducted 10 semistructured interviews encompassing all the key members of the ASR 901 team, the executives at the India R&D center, and the product champions at Cisco headquarters. This helped us gain multiple perspectives on the development of the product.

We wrote a detailed case study based on the information gathered from multiple sources of data. We had several extensive discussions with our practitioner author to ensure that the emerging framework accurately captured the innovation process, and we refined it as appropriate. We then distilled the important takeaways for managers.
Market Opportunity As Cisco India’s R&D matured, the Indian economy saw a major transformation in the telecom sector. As a result of deregulation in the 1990s, a number of telecom service providers (both domestic and foreign) entered the Indian market. The free-market forces triggered above-average growth, and the telecom subscriber base grew more than 20-fold in a decade, from under 28.5 million subscribers in 2000 to over 621 million in 2010. To keep pace with this growth, telecom service provider investments in network infrastructure also grew sharply in India, going from $60.8 billion in 2007 to $89.6 billion in 2010, at a time when capital investments stayed fairly flat in developed markets. The market opportunity in India and other emerging markets was clearly big, and it was reflected in Cisco’s strategy. In 2006, Cisco’s then-CEO, John Chambers, announced that Bangalore would be developed as Cisco’s Globalization Center East. The goal was to grow the Bangalore site to reach an equal technical footing with the company’s headquarters in San Jose, California, to support Cisco’s globalization strategy. To execute this ambitious goal, Cisco senior vice president of customer advocacy Wim Elfrink was appointed the company’s chief globalization officer and relocated to Bangalore in 2007. As a result, the footprint of the India center, which had been predominantly an R&D organization, expanded. Cisco services — both technical and advanced — gained a strong presence in India. Sales, marketing, and supply chain management also grew.

Growth on multiple functional dimensions created a better dialogue between R&D in India and customer-facing teams. The R&D center started receiving feedback on the lack of appropriate products for the local market. It became increasingly evident that Indian and other emerging-market customers had unique requirements with respect to price, network scalability, subscriber monetization, and simultaneous support for legacy (2G) and 3G/4G network deployments. This created an impetus to innovate.

In sum, a large market opportunity combined with unique customer requirements is a key enabler of innovation for emerging markets. While most emerging markets do present a sizable market opportunity, it is the uniqueness of customer requirements that creates a compelling need to innovate.

Executive Champions The third key prerequisite for innovation by subsidiaries in emerging markets is the support of executive champions, both at the subsidiary and at corporate headquarters. Leading an innovation effort from an emerging-country R&D center, especially one without an established track record, goes against the dominant mindset of many multinationals and presents many challenges. An executive champion who believes in the center’s ability can mitigate these challenges.

Cisco India R&D had built credibility with key executives at the company’s headquarters through its consistent performance over the years. Pankaj Patel, a senior vice president in Cisco R&D at the time, was a strong believer in the emerging-market opportunity and the capabilities of the India center. Wim Elfrink, Cisco’s chief globalization officer, who was located in India at that time, was also a strong champion.

With support from these executive champions, Cisco India’s R&D leadership in 2009 put up seed funding to explore opportunities in emerging markets. The funds supported two key staff positions — a chief technical architect and a product manager — bridging the skill gaps at the India R&D center and creating the core team for new initiatives.

In sum, Cisco India’s R&D had all three enablers of innovation in place: a critical mass of end-to-end product development capability, a growing market with unique needs, and executive champions. It is easy to see how an innovation initiative would falter...
without any one of these three factors. Without advanced technical capabilities, it would be impossible to architect and lead product development. Without a unique market opportunity, there is no business case. Without executive champions, it would be difficult to mobilize resources and find traction within the company. Therefore, R&D managers need to evaluate where they stand vis-à-vis these factors before embarking on innovation in and for emerging markets.

Decision #2: What Product to Develop?
Once the key enabling factors are in place, the next step is to identify a suitable product to develop. This demands careful consideration of market needs and an assessment of both internal capabilities and the overall fit of the chosen product and its category with the company’s product portfolio. While the actual product will vary depending on the industry, attention to these three factors increases the chance of success.

Market Need The product has to address an important need that customers in emerging markets have. The core team at Cisco met with customers in emerging markets to understand their needs and pain points. Cisco found that the mobile-subscriber explosion in emerging markets was fueling rapid capacity expansion by service providers. At one point in 2009, India was adding about 15 million new mobile subscribers a month. The number of cell sites was expected to grow rapidly in such markets: The technology market intelligence company ABI Research predicted that by 2014, 39% of all cell towers would be located in the Asia-Pacific region. These trends indicated that there was an opportunity to develop a mobile backhaul router\(^5\) (also known as a cell site router) that links cell towers to the core telecom network.

Portfolio Fit The product should also fill a gap in the company’s product portfolio. This will generate new revenue streams and increase the chance of internal support for the product. A modern telecom network is hierarchical, with the core backbone network of large routers connecting cities over very high-speed links; the core network is fed by networks that aggregate traffic from cell towers in a geographical area such as a metropolitan zone. In 2009, Cisco was a strong player in the “core” and “aggregation” layers of the service-provider network, but it was less dominant in the mobile backhaul router segment, which had a few strong competitors. Therefore, a product for this segment seemed to be complementary to the company’s existing portfolio.

Further, the pattern of network evolution in India and other emerging markets imposed some unique requirements on the product. Mobile backhaul was moving from the prevalent 2G technology for voice to 3G/4G technologies for data and broadband. However, even with the deployment of 3G/4G, legacy (2G) systems persisted, as voice was still a large source of revenue for telecoms in India. Therefore, the proposed router had to be versatile enough to support existing 2G services as well as to handle rapid scalability to the next-generation 3G/4G mobile backhaul technology.

Product-Capability Fit The product should ideally be one that is reasonably complex, but also one that builds on the capabilities of the subsidiary and that can be developed within a relatively short period. A product of low complexity would not work as a compelling proof point to demonstrate the subsidiary’s product-development capability. At the same time, a very complex product would take too long, which would test the patience of headquarters. The project might even run out of steam before the R&D center could develop a working prototype and validate demand.

The aforementioned attributes helped the core team arrive at a product that could be developed from the India R&D center. Cisco India decided to develop a family of routers, the ASR 901, for last-mile access in mobile backhaul of telecom networks. Essentially, these routers would be the entry point for consumer mobile voice and data from the cell towers into the telecom network. For Cisco India, a product for last-mile access in mobile backhaul was something that could be developed in 12 to 18 months and also filled a critical product portfolio need.

Decision #3: How to Develop the Product?
Once a suitable product has been identified, the next step is to develop a working prototype, followed by the end product, which is fully functional,
is extensively tested and qualified, and can be manufactured in volume. Product development is a resource-intensive activity, requiring head count, equipment, and other infrastructure. At this stage, there are generally two options that subsidiary managers can pursue.

The first option is to present the business case for the identified product to headquarters and secure necessary resources to undertake prototype and product development. In this approach, the development of the product will have the full support of the organization. However, with multiple proposals for products in different market segments competing for resources, there is a chance that the proposal may not be supported. This is especially true in the case of unproven product-development capability and an untested emerging market. The second approach is to develop the prototype with locally available resources and demonstrate product-development capability and commercial viability. In this approach, garnering the necessary level of resources may be a challenge. Furthermore, any unforeseen challenges and delays may compromise the viability of the project due to its limited resources and acceptance within the company.

The Decision Matrix We have developed a decision matrix to provide a general framework for choosing one approach over the other. (See “A Decision Matrix for Product Development by a Subsidiary.”) The horizontal axis captures the relative strategic importance of a given geographic market to the company vis-à-vis other markets, which could be high or low. The vertical axis is project specific and captures the nature of the business case for the proposed product.

The business case may have a strong quantitative orientation, which means it would include hard metrics such as investment dollars, total addressable market, estimated market share, estimated revenue for one to three years, and return on investment. A qualitative business case, on the other hand, would stress factors such as mind share in a new market, gaining early-entrant status, countering growing competitor dominance in an emerging market, and the total addressable market over a longer period. Of course, every business case will have both quantitative and qualitative elements, but this dimension identifies which one predominates. When the business case is quantitatively oriented, it is easier to communicate and garner support than when it is qualitatively oriented.

When the relative importance of the geographic market for a company is high, it can be assumed that the company is well attuned to the market’s trends and requirements. Therefore, any such product with a quantitatively strong business case (top-right quadrant) is likely to be on headquarters’ radar and to get into the development pipeline. In this case, the local R&D center has to compete with other R&D centers in the company to take ownership for developing the product. If there is a quantitatively strong business case for a product, the local R&D unit has a good chance of convincing headquarters to invest. Therefore, initiating the standard product-approval process with headquarters would be the preferred option (top-left quadrant). However, it is possible that the business case has a qualitative orientation because the opportunity is still nascent. In this case, even if the market is important for the company, the opportunity may not be immediately apparent. The local R&D unit, by virtue of its proximity to the market, is more likely to be in tune with such emergent requirements. But the qualitative orientation of the business case makes it difficult to quantify the return on investment and get product development approved by headquarters. In such cases (bottom-right), the R&D center needs to creatively mobilize resources to develop a working prototype. We refer to this as

A DECISION MATRIX FOR PRODUCT DEVELOPMENT BY A SUBSIDIARY

When deciding how to best proceed with an idea for a new product, managers at subsidiaries of multinational companies should consider two important factors: (1) whether the business case for the new product is primarily quantitative or qualitative; and (2) the relative importance of the geographic market to the parent company.
“bootstrapping.” Finally, if the relative importance of the geographic market is low and the business case is qualitative (bottom-left), it is better to wait until there is a more quantitative business case or there is a strategic shift toward the market within the company.

Cisco India’s mobile backhaul router for last-mile access mapped onto the bottom-right quadrant of the decision matrix. Even though India was an important market for Cisco, as evidenced by the establishment of the globalization center in India, the business case for the proposed router would not have met some of the quantitative thresholds typically needed to successfully get through Cisco’s company-wide R&D project-commit process. However, the router project presented a qualitatively strong business case: The product addressed a pressing customer need, filled a critical gap in the company’s portfolio, and aspired to open up a segment where competitors were rapidly gaining a foothold in an important market. Therefore, the core team in India decided to take a bootstrapping approach (bottom-right in the matrix) to develop the prototype. This novel approach to product development provides an alternative to the more common structured product development process within companies.

**Bootstrapping** The core team, comprising the chief technical architect and the product manager, realized that it would be difficult to start the development of ASR 901 through Cisco’s structured R&D project-commit process. They needed to bootstrap by cobbling together the limited resources at their disposal to build a prototype and successively work their way toward broader acceptance within the company. This strategy had to be executed on multiple fronts to mobilize the key resources required for development.

In addition to the chief technical architect, the team needed a few senior technologists with expertise in specific domains to design state-of-the-art, complex features and provide general technical direction to the rest of the engineering team. However, there was a shortage of domain experts, especially in some of the advanced networking protocols, and hiring from outside was difficult and expensive. The team instead bridged the domain expertise gap by borrowing a handful of senior engineers handpicked from other business units in India. This was possible because several groups had developed advanced technical capabilities in specific technology areas over the years. Further, since the success of the project was important for establishing the product-development capabilities of the India R&D center, other engineering organizations within the company’s operations in India were forthcoming in offering resources to help the project get off the ground. This arrangement also kept the costs down and stretched the modest seed funding the team was given. However, the technology implemented was cutting edge and adhered to global standards.

To build a prototype, the engineering team had to be staffed up considerably. With minimal seed funding at its disposal, the team decided to engage with an engineering-services partner. The service partner would execute part of the development effort through a new revenue-sharing model. Instead of the traditional time and materials model, where payment is made at the time the services are provided, the new model involved payment as a percentage of revenue as the product started selling.

This new revenue-sharing model had several advantages. First, it deferred the nonrecurring engineering cost to a future date when the product had wider acceptance within the company, thereby stretching the minimal seed funds available. Second, it helped develop deeper partnerships with local companies and strengthen the local ecosystem through technology transfer. Third, it was a much faster way of staffing the team than hiring from the market. Fourth, the services partner had “more skin in the game” and...
worked as an integral part of the team, which was essential for a new product development effort.

ASR 901 product development involved working across the entire stack of technologies — silicon chips, platform hardware, platform software, network operating system, and network management — and having them closely interface with each other. Many of these technologies were developed within Cisco, some came from suppliers as off-the-shelf components, and other portions were codeveloped with partners.

For codevelopment, physical proximity and constant engagement with the partners was extremely important. However, most of the partners did not have a significant presence in India, and the handful of people who were locally available did not have the in-depth technical expertise to work with Cisco on a complex, next-generation product like ASR 901.

There were two particular touch points when close interaction was critical. First was at the time of architecting the product, when it was important to understand the chip’s capabilities and all its nuances, to be able to clearly define the hardware/software interfaces. Second was the “bring-up” phase, when the functionality of the prototype was tested for the first time, and intimate understanding of the silicon component and the hardware/software interface was critical. Working with partners halfway around the world was not viable.

To overcome this hurdle, the team leveraged Cisco’s long-standing relationship with its suppliers. The team, through its champions at headquarters, was able to convince the key suppliers to staff up in India in order to support the development of ASR 901. The suppliers moved some key personnel to India, and this essentially plugged the gap in the hardware ecosystem for the development of ASR 901.

In sum, the team creatively mobilized all types of resources necessary for prototype development. It worked like a startup within a large company. The hierarchy was kept to a minimum, and all the engineers — Cisco employees as well as engineers from the partner organization — worked in a common workspace. This facilitated impromptu whiteboard discussions and quick resolution of questions and issues. The junior engineers were guided by the senior engineers and received immediate feedback on pieces of code and design. This setup facilitated rapid learning and quick resolution of issues through joint problem-solving. Further, close interactions with the partner organization gave the team ample exposure to technical constraints and trade-offs. As the team members designed and developed the product prototype, they constantly challenged entrenched design norms to meet the stringent product requirements of emerging-market customers with respect to cost, power, and form factor, while simultaneously advancing the state of the art in mobile backhaul technology. With this setup, the team was able to build a working prototype within six months.

The effort shows that bootstrapping can be a viable alternative to the standard corporate prototype-development process that involves getting up-front commitment to a concept. The specific activities involved in bootstrapping will depend on the industry in which the company operates and the nature of the product being developed. However, the Cisco experience provides some general guidelines to managers on the types of organizational arrangements that can be structured to build a prototype on a shoestring budget.

Integration Into Mainstream Development

Once a working prototype is in place, managers can demonstrate the technical and commercial viability of the product to all stakeholders within the company. They can also showcase the prototype to select customers for early feedback and assess the
level of interest in the product. If the prototype is well received by internal and external stakeholders, the business case is made, which paves the way for full-scale development.

The ASR 901 prototype started getting attention from customer-facing organizations in the company. The active engagement of the core team with customer-facing groups resulted in a slow but sure realization that the product filled a gap in the company’s portfolio. This provided market validation for ASR 901. Importantly, the product gained excellent traction with some key customers in the developed markets because it offered leading technology features at attractive cost, power, and form-factor-design points. For example, low power consumption, which was critical to containing operating expenses in emerging markets, found an additional application in the developed markets, where corporations have a social-responsibility mandate to be “green” in addition to delivering economic benefits.

The team now had a working prototype along with a demonstrated business case, thanks to customer interest in emerging and developed markets. The validation of the concept cleared the way for “execution commit” from the company. Headquarters sanctioned the next round of funding, which went toward staffing up the engineering teams and building the large number of prototypes required for full-fledged testing and qualification.

As a result of these developments, the product became part of the mainstream engineering organization. With formal recognition and funding, the team aligned itself with Cisco's standard product-development process and was able to leverage domain expertise from other teams to complete the development and qualification and enter trials with early customers.

The Transformation of Cisco India
ASR 901 was launched in October 2011. Over the next year, several variants of ASR 901 were developed and sold to more than 100 customers in 46 countries. The product improved on the state of the art in some of the key emerging mobile backhaul technology areas. It achieved this with significant improvements in cost, power, and footprint efficiencies, which met the stringent requirements of emerging markets while greatly appealing to developed markets. The success of the project was one of the factors that contributed to the formation of a new Cisco business unit, Provider Access Business Unit (PABU), centered in India.

The market success, strengthening of product-development capability, and organizational evolution led to a string of new products from Cisco India over the next few years. In December 2014, Cisco showcased three new communications products conceptualized, architected, and designed in India.

In 2015, Pankaj Patel, executive vice president and chief development officer at Cisco, summarized the transformation of Cisco India: “We came to India for the costs, we stayed for the quality, we invested for innovation, and now we are creating a new industry.”

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