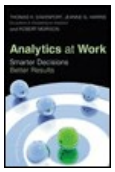


Analytics at Work: Smarter Decisions, Better Results

by Thomas H. Davenport, Jeanne G. Harris and Robert Morison

Chapter 7: Embed Analytics in Business Processes

Overview

If you really want to put analytics to work in an enterprise, you need to make them an integral part of everyday business decisions and business processes—the methods by which work gets done and value gets created. In an analytical enterprise, analytics can't be relegated to a few quants squirreled away in the basement. Nor should a few isolated applications be reserved for special occasions like marketing campaigns. Rather, analytical applications and tools must be used routinely by information workers as a natural part of their daily work. When embedded in processes and workflow, analytics shift from being an occasional ancillary activity to being a consistent, routine, and natural part of doing business. Embedding analytics into processes improves the ability of the organization to implement new insights. It eliminates gaps between insights, decisions, and actions.

The car rental company Avis Europe narrowed the gap considerably when it embedded analytics into its reservation process, for instance. Profitability in the car rental business depends on distributing an exact number of cars to the right places for the customers who will pay the best price. Traditionally, the company would rely upon the experience and judgment of its fleet managers, asking them to study the data in the reservation system each week to predict which areas would have the greatest demand for cars. Yet according to Avis director of station systems Jens Utech, the company fell into a rut, using the same routines year after year. For example, every Friday morning one station manager would transport a truckload of cars from Heathrow Airport to downtown London in anticipation of the weekend rush—with no idea of how many cars would actually be needed. According to Utech, there was no way to see how the company could improve; too many decisions about distribution and pricing were made with "no forecast and no sophistication."

In an attempt to make better and more transparent decisions about fleet distribution, the company tested out an analytical program in the reservation process. Within a year, the program was able to use data from Avis's reservation system to forecast precisely where cars would be needed. For example, rather than send a truckload of cars from Heathrow to London on Friday morning, the program might forecast that the fleet would be best utilized by sending four cars from Heathrow Airport and another four from nearby Stansted Airport. Aside from this more exact fleet management, the system also suggested ways to optimize reservations. During busy seasons like Christmas, for example, reservations may be restricted to customers renting for a minimum of three days; that way, cars would be more likely to be available for the most profitable customers. Similarly, the system helps managers to predict when a certain station might run out of cars, so they can raise prices in advance. By embedding analytics directly into everyday decision making, the company increased its fleet utilization by two points, or $19 million.[1]

As compelling as the economic benefits are, the underlying power of analytics comes in *making connections*—recognizing patterns in business activities, isolating the drivers of performance, and anticipating the effects of decisions and actions. To make connections, you must look beyond the immediate task or decision and appreciate what happens "upstream" and "downstream." That is, you must examine how analytics fit into the entire business process.

Applying analytics to a particular function helps to determine things like the optimal advertising spending for a product. But even more compelling to a marketing executive is when the spending can be optimized across multiple advertising channels, different geographies, and the company's full range of products. To accomplish this broader perspective, we must focus analytics on the entire marketing process, not just a piece of it.

And looking at a single process is really just the beginning. We've noted before that to really maximize business performance you need an enterprise perspective. A cross-functional process perspective enables you to appreciate how different parts of the business work together (or fail miserably in doing so) and to identify all the ways analytics might be used to create a better outcome for the enterprise. From this perspective you can see how people, processes, and technologies work together to promote the best possible decisions and to execute those decisions efficiently. Manufacturers, for example, may invest in product life-cycle management software to coordinate information and analytically based decisions across a product's life cycle from R&D through retirement, affecting nearly every process in the business.

[1]"Optimization Drives $19 Million at Avis," www.fico.com/en/FIResourcesLibrary/Avis_Success_2540CS. pdf.

Craft Versus Industrial Analytics

The earliest application of analytics in any business is invariably for a special occasion when the need for more information and analysis is palpable. Even today, a lot of analytical effort employs the "craft" approach, where each decision is its own ad hoc effort. There's nothing wrong with this approach—it's appropriate for any new analytical decision. However, as decisions (even complex ones) become familiar, well understood, and routine, you may subject them to an "industrial-strength" approach. The industrial approach automates and integrates analytics into decision-based work processes—and all without any of the labor violations and environmental pollution inherent to most industrialization processes.

Table 7-1 contrasts the craft and industrial approaches to employing business analytics. Craft is a one-time effort, inherently limited in effect. Industrial takes more time and effort up front, but later the decisions can be instantaneous. With craft, the analysis is often discarded or forgotten after use. With the industrial approach, analytical models and rules are a seamless part of the process used to execute decisions.

Table 7-1: "Craft" versus "industrial" analytics

	Craft	Industrial
Pattern	Ad hoc, project-oriented	Embedded in an ongoing process
Purpose	One-time decision or event support	Ongoing process performance

Benefit	One-time	Recurring
Investment	Lower, one-time	Higher up front, recurring to maintain the decision model
Time to implement	Relatively brief	Longer
Speed of analysis	Same as time to implement	Once implemented, fast or instantaneous
Staff	Labor-intensive	Labor-intensive up front, modest ongoing effort to maintain
Memory of analysis	Can be saved for reuse, but is often lost	Maintained and improved upon

Three Types of Decisions

To take an industrial approach, you must decide how extensively analytically enabled decisions should be automated. There are three fundamental approaches.[2] With the *fully automated approach,* the system makes the decision and sets in motion subsequent process flow. If the decision is well defined, decision rules are clear, and the policy is "no exceptions," then the decision can be automated. If instantaneous response time is needed, then the decision *must* be automated. Yield management systems in hotels and airlines and loan and insurance underwriting systems in financial services are good examples of analytical decisions that are often fully automated.

Second is the *exceptions/overrides approach*. When a decision covers a wide variety of cases, most of which are standard but some of which are exceptions that demand expertise and judgment, the standard decisions can be automated, but a person should be alerted to examine the exceptions. The trick here is setting the parameters that define exceptions, and determining whether the person needs to quickly review the standard decisions as well as the exceptions. Insurance companies, for example, often invoke human experts when an insurance policy application is particularly large or complex. Too bad this approach wasn't used in the *Terminator* and *Matrix* movies: with it, computer systems could have been overridden before they were able to enslave humanity!

Third is the *assisted approach*. If the decision is very complex (e.g., how to structure a financial deal), involves unpredictable variables (e.g., customer reactions), is unprecedented (e.g., new business models), or requires the expertise of a variety of people and disciplines, then the role of analytics is to assist and inform the decision, not to make it. In medical processes, for example, the physician may first consider an automated recommendation but then make up his or her own mind about how to treat a patient. Ideally, such systems provide a rich set of relevant information and analysis and perhaps a simulation of process flow and results for the decision makers to use. And these more ad hoc, independent models are maintained, improved, and made available for reuse.

Table 7-2 summarizes and contrasts these different methods of enabling decisions. Any given business process may incorporate all three decision types. It will take iterative design, testing, and implementation to determine the best mix in decision design. And note that decisions may migrate toward automated over time as key variables are isolated and understood and as patterns of exceptions are recognized and modeled.

Table 7-2: Three types of decisions

	Automated	**Automated with overrides**	**Assisted**
Decision types	Simple and/or well-defined	Bell-curve distribution of decision complexity	Complex
Exception handling	No exceptions	Exceptions are recognizable and get special handling	Unpredictable variables must be accommodated
Key ingredients	Speed and consistency	Expertise	Expertise and collaboration
Analytics focus	Rules	Alerts	Simulation

Determining the right mix of fully automated decisions, automated decisions with human review, and human decisions informed by analytics takes careful consideration. Your company should ask the following questions: Should a decision be fully automated, or should a person have the power to override a recommended decision? Should the system generate alerts or automatic updates (e.g., informing customers about the status of actions on their behalf)? Should humans who override the analytical recommendation be penalized, or interviewed to find out their reasoning? The answers to these questions will put you well on the path toward embedding analytics into processes, and ultimately achieving analytical process nirvana.

[2]Also see Thomas H. Davenport and Jeanne G. Harris, *Competing on Analytics* (Boston: Harvard Business School Press, 2007), 150–152.

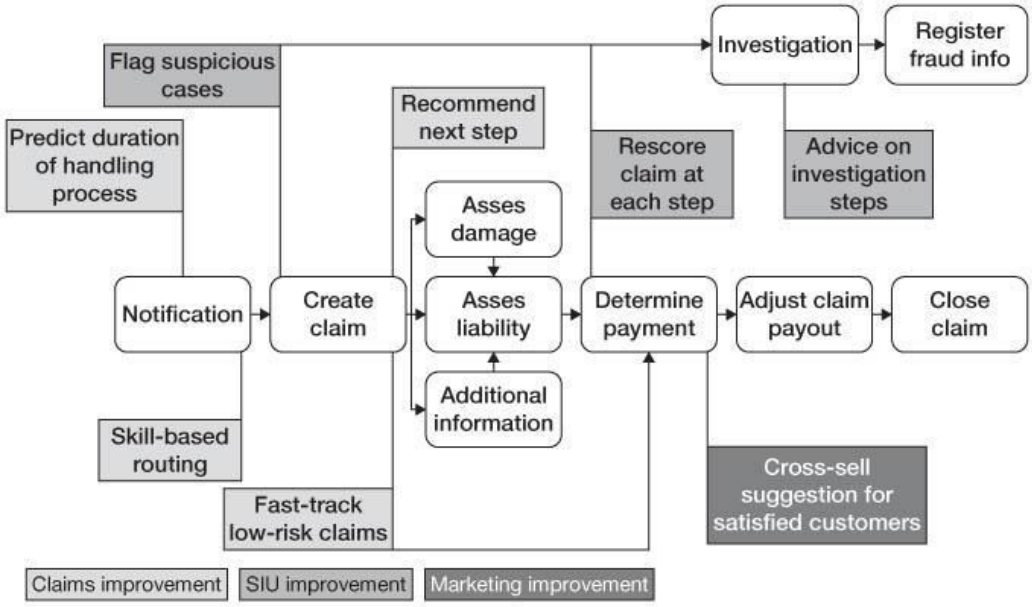
Analytical Process Nirvana

How does a truly analytically enabled business process work? We describe its ideal characteristics as "analytical process nirvana":

- We know the key decision points in the process.
- We have the information to enable each decision that may come from upstream or downstream in the process, from elsewhere in the business, or from the marketplace.
- We rely on analytical techniques and base decisions on facts.
- We employ analytical technologies such as spreadsheets, forecasts, or predictive models to inform, enable, or automatically make each decision.
- Analytical activities and technologies are integrated into the operational systems and processes.

- The process structure and flow are flexible. There are likely different paths, or "lanes," through the process—for example, a fully automated "express lane" for the simple and standard cases, a "regular lane" for automated decisions that are reviewed by a person, and a "specials lane" for unfamiliar or complex cases that demand an experienced decision maker.
- We monitor the performance of these decision systems—and of the process as a whole—with the help of analytics, and we can quickly recognize and act upon the need or opportunity for further process improvement.

Few business processes today approach this state of nirvana. But it's easy to see how they might. Consider claims processing in the insurance industry. Figure 7-1 depicts the key steps and decision points in a claims process for a property and casualty insurance business. The process incorporates a series of analyses and automated or partially automated decisions. The basic process flow—from notification of a claim to closing it—is represented by the boxes with rounded corners and connecting lines. The automated points at which analytics are applied are represented by rectangles.



Source: Based on "Predictive Analytics for the Claim Handling Process." SPSS Inc. Technical Report, 2009.

Figure 7–1: Embedded analytics in a claims process

These decision points fall in three categories. The initial decisions improve the claims process flow itself; the first one serves the customer by predicting how long the claim and payment are likely to take. Another uses the preliminary information in the notification to route the claim depending on the level of skill needed to process it. Once the claim is created the process branches into two paths. One decision point routes the simple cases, those with a low risk of fraud, to a "fast track" resolution and payment. The other recommends the degree to which additional damage assessment and other information are needed to assess liability. At various points in the process flow, the claim is "scored" for likelihood of fraud; a high score directs the claim to a special investigations unit (SIU) with suggested investigative actions. Finally, toward the end of the process, a recommendation engine suggests cross-selling opportunities (e.g., for improvements in coverage) at or after the point when a satisfied customer receives payment.

The result is a process that is simultaneously efficient and flexible—the fast track reduces effort, only complex claims receive the full assessment, and only likely fraud is investigated. In fact, the process is efficient *because* it is flexible, with analytically determined variations in the process flow. Even with capital-intensive processes (e.g., a manufacturer's supply chain), companies have learned that the flexible process beats the rigidly optimized one in the long run. A process fine-tuned to operate just one way inevitably paints the business into a corner when market demand or other conditions change. Through instantaneous, informed, consistent, and automated decisions, embedded analytics enable a wide variety of business processes to be much more flexible while operating faster and more efficiently. Of course, as in the claims processing example, it's hard to achieve these process benefits without excellent analytics and information technology.

You will, of course, want to make your own assessment of the analytical potential of your business processes. (And if your memory is short or you're skipping around, look back at chapter 5 for ideas and techniques on targeting applications.) The real-time and institutional action applications on the top two rungs of the applications ladder particularly benefit from being embedded into ongoing processes. Consider where the heightened speed, efficiency, and flexibility afforded by embedding analytics into processes and real-time applications will have the greatest potential for market differentiation.

You might also want to gauge the difference between the current level of analytical support and the analytical potential of each process. You're likely to find opportunities everywhere—the challenge is to ensure that the opportunities, if exploited, will truly drive business performance and competitive advantage. And keep in mind that ad hoc or "craft" analytics will still play an important role in conjunction with processes that may not be ready for embedded or "industrial" analytics.

Embedded Analytics in Action

We see examples of analytics at work within core processes in a variety of business areas. Statistical analysis has been a feature of supply chain and logistics management for decades, starting with the techniques of statistical process control (SPC) and total quality management (TQM). Real-time analytics are helping guide call center workers in their interactions with customers. And analytics are well established in the engineering and simulation sides of product design.

Among business support functions, analytics are essential to many facets of finance, common in the management of technology operations, and relatively new to human resources (though of enormous potential there). In corporate development, key decisions—for example, regarding mergers and acquisitions—may benefit greatly from analytics, but few companies take a process approach to such activities.

Consider the example of UPS to whet your appetite for embedding analytics in your core business processes. As a logistics company, UPS lives and breathes the "traveling salesman problem"—how to reach a variable series of destinations most efficiently with the right delivery capacity, and often in designated time windows, every day. The solutions naturally demand very sophisticated and industrialized analytics: for capacity planning of aircraft and truck fleets, for routing packages through its distribution network, and for scheduling and routing delivery trucks. For a company this steeped in analytical applications, the frontier is moving closer to real-time, dynamic adjustments. For example, UPS is experimenting with algorithms to adjust the order of deliveries as conditions (e.g., road closures, extraordinary customer need) change.

Making Processes Analytical

The effects of analytics on the operations of a process can be profound, and over time you may want to reengineer the overall business process and revamp its information systems to capitalize on the potential for analytics-based improvement. But you can start embedding analytics without a major overhaul. For processes that rely extensively on enterprise systems, it may be possible to simply start taking advantage of the analytical capabilities that are already included in the software. However, many process analytics initiatives will require tools, techniques, and working relationships that are likely to be new and unfamiliar at first. We have found that implementing analytics-enabled processes requires applying four major perspectives.

The first is *process implementation*. Occasionally a business may create a new analytically enabled process or rebuild a process from scratch, but most often you are adding capability to and altering an existing process. Especially given the iterative nature of many analytical applications, it's essential to measure baseline process performance first and to run the enhanced process in parallel to the original (perhaps as a pilot or test) in order to refine the new process and measure its performance and value. In some cases, process simulation can yield insights about how the process might perform even before implementation.

Next, organizations should consider *model implementation*. Much of the distinctive work of process analytics centers on designing, developing, and iteratively refining statistical algorithms and descriptive or predictive models or rule-based systems. If you are going to industrialize important decision processes, it is important that the rules, assumptions, and algorithms in your model are correct. Analytical projects generally require different tools and development methodologies from those employed in more traditional systems development. And, of course, this work is performed by business analysts and programmers with special skills in statistical methods and modeling.

Third is *systems implementation*. The analytical system must be incorporated into the set of systems and technologies supporting the business process. In building these interfaces, it helps to employ process-oriented technologies, including capabilities of ERP systems, workflow, and document management systems. And integrating and testing the new systems and interfaces is critical given analytics' reliance on a broad range of quality data and the fact that analytics-based decisions may dramatically change process flow.

Human implementation is the fourth perspective. Often the greatest implementation challenge, especially when analytics is new to the process and the people performing it, is on the human side. Only people can tell if an embedded application is resulting in good decisions, so be sure to involve them in developing, managing, and monitoring the assumptions and results of any embedded model. Another important factor is developing the right mix of automated and human decision making and enabling process performers to trust and use their new analytical information and sometimes tools.

All four perspectives must mesh: process flow and decisions are enabled or controlled by analytical models, other information systems interface with the models and provide clean data feeds, and people perform the process better with the help of embedded analytics. If you lack clear business goals, specifications, or momentum, be prepared to demo or pilot the concept, to work with stakeholders to define targets and set ambitions, and to make the business case for investing in prerequisite assets, often starting with data.

IT's Role in Embedding Analytics into Business Processes

Technology is an integral part of most business processes today. So the best route to embedding analytics into processes is often through the technologies and applications that employees routinely use to do their jobs. Embedding analytics into processes starts with a robust analytical architecture that provides an accurate, timely, standardized, integrated, secure, and reliable information management environment. Scorecards and applications that monitor and alert based on predetermined thresholds are the norm these days, but too many remain as standalone applications. An industrial-strength IT architecture makes it vastly easier to weave analytics into ongoing work processes in three ways:

1. *Automated decision applications.* These sense online data or conditions, apply codified knowledge or logic, and make decisions—all with minimal human intervention. Technology is best suited to automate decisions that must be made frequently and rapidly, using any kind of information (data, text, images) that is available electronically. The knowledge and decision criteria used in these systems need to be highly structured. The factors that must be taken into account (the business problem's dimensions, conditions, and decision factors) must be clearly understood and not subject to rapid obsolescence. The conditions are ripe for automating the decision when experts can readily codify the decision rules, a production system automates the surrounding process, and high-quality data exists in electronic form. Business activities that benefit from automated decision-making applications include fraud detection, solution configuration, yield optimization, recommendation/real-time offers, dynamic forecasting, and operational control (like monitoring and adjusting temperature).

2. *Business applications for operational and tactical decision making.* Analytical managers rely on analytical applications (whether custom developed or from third parties) that are integrated directly into Web applications or enterprise systems for tasks such as supply chain optimization, sales forecasting, and advertising effectiveness/planning. Recommendation, planning, and "what-if" applications can incorporate near real-time information and multiple models to dynamically optimize a solution while factoring in conflicting goals like profitability and customer satisfaction. Analytical business applications are best suited to well-defined, periodic tasks in which most of the information needed is predictable and available electronically. Since the data, knowledge, and decision criteria are typically less defined and/or more fluid than those of a fully automated application, they require industry and functional expertise.

3. *Information workflow, project management, collaboration, and personal productivity tools.* Most information work is done through personal productivity tools like Microsoft Office. As vendors increase the analytical quotient of their collaboration and productivity tools, analytics become more accessible to analytical amateurs throughout the enterprise. One consumer products company found that its elaborate modeling tool was ignored by nearly everyone until the findings were distilled into a monthly deck of ten PowerPoint slides and e-mailed directly to the sales force. As platform vendors align their products to work together more seamlessly, a manager needn't know that his Excel spreadsheet is using the company's ERP system to prepare his forecast. These tools and applications work best for less structured information with less defined decision criteria.

To address the growing need to embed analytics into processes, both specialty applications vendors and the major platform vendors are building more analytical functionality directly into their tools and applications. Software companies are building more industry-specific, process-driven applications. Major platform providers like Oracle are embedding analytics into their products by building statistical functions directly into their enterprise data warehouse products. ERP vendors, which are including more sophisticated analytical features, remain a powerful way to integrate industry best practices into business processes. And Microsoft, Oracle, SAP, and SAS continue to quietly embed more sophisticated analytics and business intelligence capabilities into their applications and tools.

Overcoming "Sticking Points" to Embedding Analytics

In the course of our research, we talked with a variety of people experienced in embedding analytics into business processes, from first forays to applications with competitive impact. We'll leave you with a list, compiled from the insights of these seasoned practitioners, of seven of the most common obstacles, or "sticking points," specific to embedded analytics implementations.

Specifications. Where do you start if the analytics are entirely new to the process and it's difficult to envision how they might work? Or if nobody can really articulate how the decisions currently get made? Undocumented decision methods are very common, often in cases where process performers are very experienced. Key to getting over this sticking point is the skill of your analysts—both working with people to understand their work methods and mental processes, and working with data to tease out its patterns and meaning.

Data. What do you do if important information is incomplete or unavailable, or if stakeholders don't agree on its meaning and format? These are common business and systems problems, the bane of information management professionals everywhere. But they are especially damaging to embedded analytics initiatives because of their reliance on complete and high-quality data. Long-term, the key here is of course to get data assets well organized into a robust representation of the business—and to assess your data management methods on an ongoing basis. Short-term, you may be cleaning up data and trying to analyze it simultaneously. Even the best-structured processes still have missing or "dirty" data on occasion; this is often the reason why semiautomated decisions get "kicked out" to human decision makers.

Business Relationships. How do you articulate plans and progress to process owners and other senior managers and stakeholders who may not be experienced with business analytics or the experimental nature of analytical implementations? This kind of explanation can often feel like a high-stakes game of charades. In particular, algorithm and model development may be a "black box" to key players (leading to a reluctance to make decisions based on the results), or they may expect to see progress and progress reports similar to those of more traditional projects. In these circumstances, several companies report success through careful communication and education efforts. Assess each player's understanding of business analytics and analytical initiatives, and let them know what to expect at each stage of the implementation game.

User Training. How do you wean people off decisions that they've long been making, enable them to trust the analytics, and make them comfortable with the fact that the automated decisions may be more consistent and better informed than theirs? The key here is to incorporate the process performers as early as is realistic in designing and testing the new systems and process, given that they may be untrained and unsophisticated analytically. Then make sure you have feedback channels so process performers can be heard during and after implementation.

Rollout. If the business is decentralized, how do you roll out the new analytically enhanced systems, decision methods, and process to organizations with widely varying analytical capability—and attitudes toward analytics? Do you start where the environment is friendliest, the responsible manager most enthusiastic and committed? Where the revised process will get its most realistic exercising? Where the feedback from process performers and their management is going to be most useful? You seldom find a location that meets all these criteria. Keeping in mind that the first implementation is also going to be an iteration of analytics and process design, we recommend placing more emphasis than usual on getting high-quality feedback.

Completeness. How do you know when you're done? When it's time to declare the implementation complete and shift from iterative construction to model management? Unfortunately, you can't stick a fork in an analytics implementation, or throw one at the wall to see if it hangs there. If the analysts building the application or the business people sponsoring it are perfectionists, then they may be tempted to tweak the application indefinitely. And the business process may continue to improve as a result, but have you reached the point of diminishing returns, and should your analysts be more productively engaged working on other processes and projects? There are two ways to mark completeness. One is to set a process performance target, and when that is reached (or progress toward it slows), declare the implementation over. The other is to have renewable funding for each iteration of design and implementation. When the business sponsor does not anticipate enough added value to fund another round of development, then the project is done.

Transparency. How much of the analytical methods and application do you want to reveal or share, especially when the process involves customers or other business partners? This is a subtle and important point, especially when the analytical application is delivering high business value, perhaps competitive advantage. The tendency has long been to treat such processes and information systems as highly proprietary.

However, the trend in business relationships is strongly toward collaboration, including the integration of processes and systems with those of customers and suppliers. Ask yourself periodically whether you can unleash more business value by sharing your analytical capability than by holding it close—particularly if your own organization's analytical culture would be difficult to emulate easily. The details of your algorithms and models may remain trade secrets, but the process capabilities they enable may best be shared.

Organizations that effectively manage these sticking points, while embedding analytics into core processes and systems, begin to approach "process nirvana." These organizations thoroughly understand work-flow, information flow, and decision points for targeted business processes, especially those that are part of their distinctive capability. They leverage analytics to improve efficiency and flexibility simultaneously, and to deliver high performance in the eyes of the process's customers. Embedding analytics into business processes sends a clear signal to employees that analytics are important to the entire organization. The next step to institutionalizing an analytical capability is to embed analytics into the organization's culture. Of course, just as we don't often achieve nirvana in our personal lives, few organizations attain embedded analytical nirvana. But we must all strive for spiritual and analytical perfection.