



Analytic Business Processes: The Third Generation

A Monash Information Services White Paper

by

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November, 2004

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Introduction -- The Analytic Process Challenge

Data analysis is essential for enterprises.

Enterprises live and die on their decision-making, and specifically on its accuracy, timeliness, and effectiveness. Most enterprise decisions are based at least in part on data analysis. So as the quantity and comprehensiveness of available data keeps expanding, the scope of analytic decision-making expands as well. Data analysis is now central to almost every kind of enterprise decision(s) – marketing tactics, sales tactics, investment strategy, budget strategy, supplier selection, personnel decisions, research plans, and many others.

Analytic technology has been valuable.

Accordingly, enterprises have increasingly invested in data warehouses, business intelligence (BI) tools, and other analytic technology. These investments have for the most part been extremely worthwhile. Superior data analysis can lead to an almost unlimited range of operational advantages -- cheaper supplies, more targeted marketing, wiser investments, more profitable product mix, and many more. Also, enterprises increasingly wish or need to provide various kinds of data to outside stakeholders, for their own analysis; indeed, such disclosures are increasingly required by regulators or by law.

But it could accomplish much more.

Even so, the potential of analytic technology remains largely untapped. Major analytic tasks – for example, enterprise planning and budgeting -- could be performed much more accurately and efficiently than they generally are today. Many simple or routine decisions – for example, a price offer to a single customer or single vendor – could benefit from rigorous analysis. And the basic analytic framework on which managers now rely can be much enhanced and streamlined.

Analytic business processes are too primitive.

To achieve any of these improvements, it will be necessary to greatly upgrade the *processes* by which analytic technology is used. Over the past few decades, most enterprises have implemented sophisticated and efficient transactional business processes throughout their operations. But analytic business processes are much less advanced. Most are very simple, along the lines of “*Look at data. See if anything jumps out from it. Poke around a bit. The end.*” Most of the rest are convoluted and inefficient, too often resembling “*Solicit spreadsheets from 42 managers. Consolidate them somehow, notwithstanding that they’re basically incompatible. Circulate the error-laden results back to the managers. Repeat until exhausted.*”

New processes will transform enterprises.

Fortunately, next-generation analytic business processes are now emerging. Not only do these processes gather and analyze data; they also turn the results of the analysis directly into business decisions -- via organized procedures that are efficient, repeatable, and transparently auditable. These new, integrated

analytic business processes promise to transform every aspect of enterprise operations, from consumer marketing to purchasing to strategic planning.

Figure 1: Four Generations of Analytic Business Process

<i>Generation</i>	<i>Transactional integration</i>	<i>Key supporting technologies</i>	<i>Time frame</i>
First	Almost non-existent	Abacuses, pencils, adding machines	Antiquity-1970s
Second	Low	Analytic point products	1960s-2010s
Third	High	Analytic suites, application suites	1990s-???
Fourth	Almost total	Completely integrated information systems	???

This paper can get you started.

This document is a survey of the issues involved in upgrading from *second-generation analytic business processes* (2G ABPs) to *third-generation analytic business processes* (3G ABPs), where the generations are as outlined in Figure 1 above. After establishing a conceptual framework for analytic processes in general, we highlight specific areas where upgrades to third-generation processes are especially beneficial and feasible. Finally, we discuss practical issues in the actual implementation of third-generation analytic business processes.

Analytic Business Processes: An Overview

Transactions and analysis are usually separate.

Information-centric business processes have historically been divided into two groups. One consists of primarily transactional business processes, which center on the accurate recording of low-level transactional facts. The other consists of primarily analytic business processes, which center on decision-making, often based upon higher-level summary information.

Hybrid processes are needed.

In the past, this distinction made technological sense. Analytic and transactional business processes were supported by different sets of software products, often running on totally different platforms (e.g., a mainframe running a transactional database manager vs. a PC running a spreadsheet). Today, however, this separation is an unfortunate legacy of past limitations. What enterprises really need are hybrid business processes, in which managers both analyze information *and* do something useful with the results of the analysis.

They're coming.

Increasingly, the distinction between transactional and analytic processes will blur. True, there should and will always be purely transactional business processes, comprising nothing more than simple, precise, highly repetitive clerical work. A few purely analytic business processes should also survive; there's always room for blue-sky speculation and investigation. But more and more, analytic business processes will take on transactional aspects, and hybrid processes will become the norm.

In this paper, we divide analytic business processes (ABPs) into four generations:

First-generation ABPs predated computing.

First-generation analytic business processes (1G ABPs) are those that existed before the advent of enterprise computing in the 1960s. For several obvious reasons, they involved less analysis of less data than do Information Age processes.

2G ABPs currently predominate.

Second-generation analytic business processes (2G ABPs) are what analytic technology is generally used for today. Most commonly, these processes take transactional and/or summary data, apply specialized analytic tools to it, and come up with some sort of answer -- at which point the process ends. There is no repeatability or process design as to what happens after the answer is found.

When not simple, 2G ABPs are chaotic.

More complex second-generation processes are typically chaotic. For example, there is often a step in which incompatible spreadsheets get collected and manually retyped, leading to much error and disputation. In those cases, efficiency, repeatability, and accuracy may break down before any kind of answer is reached at all.

Third-generation ABPs are emerging.

Third-generation analytic business processes (3G ABPs) have begun to emerge. The main subject of this paper is how you can, and why you should, accelerate their adoption in your particular enterprise. Unlike 2G ABPs, third-generation analytic processes are explicitly designed to be consistently repeated, much like transactional processes. In many cases, they are in fact integrated with transactional business processes. Ideally, this integration ensure that the results of analysis are immediately implemented as operating decisions. At a minimum, it boosts efficiency by ensuring that analysis is performed in the context of practical operational needs.

Fourth-generation ABPs are still far off.

Fourth-generation analytic business processes (4G ABPs) can be found only in the fertile imaginations of software marketers, and may not be well-defined even there. Most leading vendors of BI technology have marketing diagrams showing closed-loop all-encompassing enterprise-wide processes with steps like "forecast," "plan," "measure," and so on. While visionary, these processes assume a degree of technical integration that few enterprises enjoy. What's more, they assume a wholly rational, highly numerate decision-making culture that no large enterprise now has, nor is likely to have in the near future.

Four Generations of Analytic Business Processes

Analytic business processes date back to antiquity.

Transactional business processes have been around literally since the beginning of recorded history. Some of the oldest known writings are clay tablets that record merchants' tallies in Sumerian cuneiform, complete with seals to enforce transaction integrity. Analytic business processes date back nearly as long, especially in military applications; the first chapter of Sun Tzu's *The Art of War* is called "Calculations," or in some translations "Laying Plans."

They blossomed in the 19th Century.

As enterprise complexity increased, so did the sophistication of analytic business processes. Almost two centuries ago, Nathan Rothschild made an investment fortune from early news about the Battle of Waterloo, and several decades later Florence Nightingale introduced statistics to the study of public health. With the invention of machines to tabulate information in the late 19th Century, analysis began to blossom.

2G ABPs emerged with computers.

What utterly transformed both transactional and analytic business processes was the advent of electronic computing in the 20th Century. In particular, the volume of available data exploded. Even more important to analytic processes was the superhuman increase in the speed of computation. Various types of software emerged -- business intelligence (BI) tools, spreadsheets, statistical packages, and the like -- permitting kinds of analysis that had been infeasible without computers.

2G ABPs are not well-designed.

A broad variety of second-generation analytic business processes sprung up around these technologies, and today it is almost impossible to imagine an enterprise that doesn't make heavy use of them. These processes, however, share an almost universal drawback: *They lack rigorous definition, because nobody ever actually designed them.* Instead, most analytic business processes in use today evolved more or less spontaneously, unstructured and unplanned. Accordingly, analytic technology tends to be used in ways that are erratic, chaotic, inefficient, error-prone, or just more limited than they need to be. Enterprises may have manufacturing, distribution, accounting, sales, or customer service running like well-oiled machines, but actual analysis, planning, and decision-making typically run much less smoothly.

Most 2G ABPs are incomplete.

The single most common problem with analytic business processes is that most of them are incomplete. A manager looks at a report, notices a number -- and that's about as far as the process is defined. She might explore the numbers a little further, communicate with a subordinate based on the numbers, or maybe just file them away in the back of her head. The decision as to whether and how to follow up is hers alone, without any kind of guidance as to "best practices" or recommended next steps. And so it's usually impossible for her superiors to be confident that any particular kind of situation, if it arises, will

be handled in the best possible way, or in the same way a similar situation was handled the time before.

Others are cumbersome.

Of course, not all analytic business processes are so trivial. In particular, budgeting and planning can be elaborate, enterprise-wide exercises. But complex and structured ABPs tend to be cumbersome and error-prone. They may entail the manual retyping of figures from dozens of incompatible spreadsheets. Colleagues may argue in meetings about whose assumptions or calculations are more valid. So once again, senior management cannot be confident that the enterprise is doing efficient, accurate analysis of all the important information that is or should be available.

ABPs need rigorous definition.

What's lacking, as we previously noted, is rigorous definition of analytic business processes. Just as in the transactional case, designed processes can work better than accidental ones. Designed processes lead to predictable and consistent results. They also lead to more efficient work. And since transactional processes are carefully designed, any process that hopes to go from a decision straight to a transactional implementation needs to be carefully designed as well.

Transparency is needed for other reasons too.

Further, rigorous process definition is often needed for its own sake. Legal requirements increasingly mandate consistent decision-making processes – for example when discrimination is an issue, such as in employee hiring and evaluation. Reporting and auditing processes also need to be increasingly well-defined, to meet requirements such as Sarbanes-Oxley and Basel II. And even where legal pressure isn't an issue, management theory suggests that straightforward, transparent, objective decision-making contributes greatly to aligning employee actions with an enterprise's core strategic goals.

Improved processes are now possible.

In the past, there was a good excuse for the unstructured nature of analytic business processes – it was hard for the underlying technology stack to support anything much better. Analytic technologies are typically very read-oriented, and integration with update-oriented transactional technologies was not very robust. But this excuse is fading fast. With the advent of better workflow and integration technology -- most specifically web user interfaces and service-oriented architectures – robust, integrated business processes have become much more practical. Also beneficial have been a series of advances in analytic functionality. For example, web-based portals and dashboards are much more scalable than client-server report writers, and upgraded tools for planning are obviating spreadsheet chaos.

3G ABPs should be adopted now.

So it's time to move aggressively in implementing, or at least planning the implementation of, third-generation analytic business processes. Technology is no longer a reason to hold back. Changing habits, processes, and organizational culture is always difficult; but just as in the case of transactional processes, it will ultimately be very worthwhile. And if you're worried about

stymieing the creativity of your decision-makers, don't be. The more transparent your strategy and operations are, the more opportunity there will be for your managers to improve them. As decades of experience in the manufacturing industry have shown: The more streamlined your processes are, the more opportunity there actually is for your people to "think outside the box."

Major Themes in Analytic Business Processes

Analytic tasks come in many kinds

Having explored the different levels of sophistication of analytic business processes, now let's run through the different kinds of things they actually do. Of course, no simple classification of analytic business processes can be entirely accurate. There are a variety of basic analytic tasks, and one analytic process will often combine several of them. Even so, in a hunt for opportunities to upgrade your processes, it is useful to consider some of the major kinds of analysis businesses and other enterprises carry out.

Here are some major examples.

Some of the basic kinds of analytic task are:

1. *Monitoring for exceptions.* The most basic analytic task of all is checking that things are going as they should be. Ancient generals counted the number of troops they had, multiplied by the amount of food each soldier needed, and compared the answer to the amount of food actually on hand; if the result was inadequate, they knew they needed more supplies. Every time a manager looks at a report or dashboard to see if a key performance indicator or ratio is outside the desired range, she's essentially doing the same thing.

2. *Monitoring for and evaluation of trends.* Perhaps the second-most-basic analytic task is measuring and assessing change. Are sales increasing or falling? How about if you adjust for inflation, seasonality, weather, and other variables? Are specific products gaining or losing favor? How are crime rates changing, both overall and specifically in more heavily-policed neighborhoods? The sooner you notice a trend, the sooner you can take action to exploit or correct it.

3. *Planning/budgeting/forecasting.* Many of an enterprise's most important decisions involve allocating resources among competing demands – i.e., budgeting. Budgeting entails planning, and planning almost always entails forecasting. Tasks of this kind are thus implicit in a large fraction of managerial decisions. Almost every enterprise has formal, periodic (or continuous) budgeting and planning processes for the overall enterprise and for each sufficiently large portion of it. But even outside of those processes, planning and budgeting are happening all the time.

4. *Investment analysis.* In the financial services business, possible and actual investments get meticulously analyzed. At many enterprises, the same is true for large decisions such as mergers, partnerships, major capital expenditures and the like. Typically these functions use more sophisticated analytical techniques than the forecasting and budgeting tasks they otherwise resemble.

5. *Statistical analysis.* Whenever somebody looks at a series of numbers and judges whether they reflect a genuine trend or just random variation, he is implicitly doing a little bit of statistical reasoning. (At least, he should be!) But there's also a whole separate domain of much more sophisticated statistical analysis, especially in the application realms of mass marketing and quality assurance. Sometimes elementary statistical techniques such as linear regressions do the trick; in other cases "black boxes" such as neural networks are invoked.

6. *Engineering and/or optimization.* Statistics is the most common kind of advanced mathematics used in business, but it isn't the only one. Linear/integer programming and other forms of optimization have a place, as do various kinds of simulation. Engineering activities of course use an incredible range of analytic techniques. But in most cases these advanced mathematical techniques are supported by "technical" rather than "business" computing, and hence are beyond the scope of this particular paper.

Most ABPs fit three categories.

Perhaps the most useful grouping of analytic business processes, based on this taxonomy of analytic tasks, is to sort them along the lines of the kinds of software that have traditionally supported them. Pursuing this approach leads us to sort ABPs into three overlapping buckets:

1. *Monitoring and evaluation of performance, exceptions, and trends.* Most of what a manager does day-to-day is often monitoring and evaluation, whether to check that things are as he expects, or to assess trends and changes to the prior pattern. And most of what is generally thought of as analytic technology was invented to support these activities – BI tools for information access, manipulation, and delivery; the data warehousing technology that supports BI; and predecessor technologies such as the decision support systems of the 1970s and 1980s. Spreadsheets are also often used for these purposes, as are transactional reports.

2. *Strategic analysis, including planning, budgeting, forecasting, and investment analysis.* When a manager isn't worrying about short-term concerns, she's probably working on longer-term strategy – plans, forecasts, budgets, major potential investments, and the like. Spreadsheets are the traditional technology to support these functions, but specialized enterprise planning and budgeting tools have becoming increasingly important. Most BI technologies also get some use in this area as well.

3. *Statistical analysis.* Statistical analysis uncovers trends and correlations, using much more powerful techniques than the simple arithmetic of traditional monitoring/evaluation tools. Specialty statistical packages are used for these analyses, as is “data mining” technology. Better interfaces are making this kind of analysis accessible to ever more operating managers. In most cases, statistical business processes have the classic second-generation structure of “Analyze. Reach conclusion. The end.” However, structured processes for adjusting to statistical feedback have long existed in manufacturing environments, and are increasingly common in consumer marketing as well.

Practical Third-Generation Analytic Business Processes

3G ABPs are broadly feasible.

Thanks to new technology, third-generation analytic business processes are practical today in all three of the major analytic categories: monitoring and evaluation, strategic analysis, and statistical analysis.

- In monitoring and evaluation, the two main technological drivers are *better information delivery technology* and *integration with transactional systems*.
- In strategic analysis the main technical driver is *technology to replace and/or augment spreadsheets*. Spreadsheets still will have lots of uses, but where they're inadequate for enterprise purposes better alternatives are evolving – even if those replacement technologies still use spreadsheets as a front-end. The most important replacement/augmentation for spreadsheets is enterprise planning technology, and its most important area of technical development is better integration with transactional systems.
- In statistical analysis the main technical drivers are *analytic ease of use* and, once again, *integration with transactional systems*.

Each of these developments has multiple practical applications.

Third-Generation Monitoring and Evaluation

Monitoring is central to ABPs.

If there's one function that's central to analytic business processes, it's monitoring. The list of things that are reported on or queried about is almost endless: inventory, production, receivables, sales, returns, fraud, purchases, staffing, crimes, arrests, risk, earnings, investments, and many more. Managers at all levels of an organization scour reports to check for trends, or simply to see if things are as they should be.

So is evaluation.

Monitoring often segues into evaluation. Is a factory or sales division performing satisfactorily? Which customers and product lines are the most profitable? How good are seasonally adjusted same-store sales of soft goods? What is the return on each different version of our mass mailing? Which suppliers are giving us good terms? Second-generation processes for monitoring and evaluation are usually supported by business intelligence software, as well as by the reporting functions of transactional applications.

KPIs are the key. Central to modern monitoring and evaluation is the concept of key performance indicators (KPIs) or – equivalently and less pretentiously – *metrics*. Metrics can include almost any factor which contributes to revenue, costs, or execution – e.g., new accounts, wastage, highly-credentialed new hires, or late shipment percentages – plus of course more obvious examples such as revenue growth, profitability, etc. Tools such as dashboards and alerting engines quickly communicate to managers whether metrics are significantly above target, significantly below target, or boringly on plan.

3G APBs produce action. If a KPI is significantly off-target, that’s not just of intellectual interest; often, the information indicates that something should actually be done. Third-generation analytic business processes formalize that obvious point. The key piece of supporting automation is typically integration between analytic and operational applications. For example:

Alerts aid timely monitoring. Enterprise business applications from SAP and other high-end vendors feature *alerting capabilities*. If the value of a certain metric gets too far out of its usual range, somebody is notified. Typical uses include controlling inventory levels for manufacturing, distribution, and so on. Traditionally, it’s been up to the manager alerted to structure a response; the alerting process itself ends with the notification. But that’s changing. Alerts can now automatically lead into the appropriate analytic or transactional business process, allowing the alertee to efficiently resolve the exceptional situation. That efficiency, in turn, makes it reasonable to establish a broader range of useful alerts; and those in turn can allow operations can be run more tightly than before without requiring additional managerial effort.

KPIs help evaluate personnel. A class of third-generation analytic business process that seems about to blossom is objectives-based personnel evaluation. If a transactional human resource system such as mySAP ERP Human Capital Management is integrated with a monitoring system like mySAP SEM Balanced Scorecard, a process like the following can be implemented:

- Manager analyses business – possibly based on enterprise planning as well as BI technology -- and sets employee’s annual objective.
- Employee analyses and responds with any counterproposal.
- Manager modifies objective and updates HR system.
- Employee monitors his performance against the objective over the course of the year.
- Manager sets compensation at year end (formulaically or with discretion), and it is entered into the payroll/HR systems.
- Repeat for next year.

Such a process promises to make major contributions toward several major goals of compensation policy:

1. Real and apparent objectivity.
2. Alignment of the employee's goals with the enterprise's.
3. Constant, constructive job feedback for the employee and manager alike.

Procurement can be transformed.

Third-generation analytic business processes are beginning to revolutionize procurement. The basic 3G procurement process, in our opinion, is:

- Enterprise-wide supplier relationships are documented, leveraging and extending the data cleaning that goes into building a data warehouse.
- These relationships are then evaluated, to highlight opportunities for improvement.
- Strategic relationships are negotiated with key suppliers, providing favorable pricing, terms and conditions, etc.
- The transactional procurement system is informed of these relationships, and enforces them with whatever degree of rigidity or flexibility the enterprise chooses.
- Supplier relationships are periodically reevaluated and renegotiated.

Large multinational manufacturing companies are already enjoying huge savings from these new procurement processes, using mySAP SRM and predecessor technologies. These initial successes suggest that a broad variety of enterprises will benefit as the supporting technology matures.

Stored queries aid auditors.

There is hardly a more well-established analytic business process than internal auditing. Over 30 years ago, one of the first real “report writer” packages – Cullinane Software’s fairly unsuccessful Culprit – was repositioned as “EDP Auditor,” and sales promptly boomed. But auditing technology, along with the associated business processes, is still evolving. Auditors need, and increasingly are getting, the ability to explore data with all the power of modern BI tools, to identify specific queries that produce interesting results, and to add them immediately to a structured, automated, periodic auditing workflow. Good examples may be found in both current and future versions of SAP’s Audit Information System.

Compliance mandates 3G ABPs.

Regulators and lawmakers are increasingly requiring enterprises to have structured, repeatable internal measurement and audit processes. The most famous example is Sarbanes-Oxley in the United States, but Basel II has similar aspects. So in many cases there is no choice; enterprises simply must adopt structured analytic business processes for regulatory compliance.

Third-Generation Strategic Analysis

Strategic ABPs are often unsound.

CEOs and management theorists alike are unsure about what it really means to set a corporate strategy, let alone what a good process would be for doing so. Even so, strategic decisions are made all the time. And in a couple of major areas, such as budgeting or capital investment analysis, there even are complex, structured analytic business processes supporting these decisions.

2G ABPs for planning are weak.

Every enterprise has a process for budgeting and planning. Usually, the process amounts to:

1. Budgets and targets are established for the overall enterprise, and broken down by division, department, cost center, etc.
2. Line managers comment on the budgets.
3. Meetings and arguments ensue.

Electronic spreadsheets – usually a whole lot of different spreadsheets -- provide supporting detail for all three steps.

Enterprise planning tools help.

Enterprise planning tools allow more robust processes. Spreadsheet inconsistency is reduced, as is manual retyping of spreadsheet data. Differences in assumptions are not eliminated, but they are at least more obvious and hence can be dealt with more easily. So at worst, enterprise planning tools support better versions of the old second-generation planning processes.

Line managers can plan continuously.

But it's possible to do a lot better, exploiting the power of integrated planning tools to transform the budgeting and planning process. Indeed, quite a few enterprises have already implemented third-generation planning processes. In these, planning is largely bottom-up, with line managers directly entering forecasts into an enterprise-wide planning tool such as SAP's Business Planning and Simulation* (finance specialists and senior management are of course also involved in the process). The result is an actual living plan that reflects the beliefs of the operating managers best equipped to judge market conditions. And more accurate plans naturally lead to better decisions.

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Even salespeople can be involved.

Ideally, everybody in the enterprise who possesses unique insight into some part of the business should participate in planning. Salespeople are a great example, since they're the company's experts on business expectations for specific customer accounts. In an emerging area of application integration, sale forecasting is being tied to enterprise planning, and thus salespeople can directly update the overall enterprise forecast as part of each call report.

Building cockpits is strategic.

A new kind of strategic ABP has emerged in the *building* of cockpits and balanced scorecards. (“Cockpit” is SAP’s word for what most others call a “dashboard.”) The process of selecting which KPIs to watch, and how to define them, is in itself a form of strategic analysis, supported by ever better cockpit-definition tools. An excellent example may be found in the customer that inspired SAP to call them “cockpits” rather than “dashboards” – a NATO-member Air Force. In the process of selecting KPIs for its management cockpit, senior officers realized that traditional measures such as speed-of-repair were not what they most cared about. Instead what they really cared about was doing repairs well enough to keep the planes in the air the greatest possible fraction of the time, a discovery which led to major strategic changes across their ground operations. While the cockpit-definition process isn’t as well structured as most other things we call third-generation ABPs, it is supported by software administration tools, and it certainly is a lot more structured than the non-process it typically replaces.

Third-Generation Statistical Analysis

Consumer stats are widely available.

Statistical analysis requires data, preferably in mass quantities. And the quantities of consumer data available for analysis are growing explosively. OLTP (OnLine Transaction Processing) databases have long been accumulating consumer data in a variety of industries – catalog sales, ordinary retail, travel, phone service, consumer credit, and many others. Indeed, loyalty cards and similar reward programs are explicitly designed to generate consumer behavior data; industries that make heavy use of this tactic include gaming, retail, and travel. And of course web sites have created a data explosion just by themselves.

Data mining had some success.

These mountains of data have provided some very valuable nuggets, through *data mining* and other statistical techniques. (“Data mining” is one of those marketing terms whose meaning has shifted somewhat over time, but it has always referred to some kind of statistics-based information discovery.) *Market basket analysis* has suggested product cross-promotion ideas. *Psychographic clustering* has permitted better-targeted marketing programs. Nonetheless, this kind of analysis has provided less overall business benefit than early proponents predicted.

Repeatable processes are better.

The problem is that even successful statistical business processes usually share the standard second-generation flaw – they’re not repeatable. Instead, they’re performed with an air of research and discovery – which is actually implicit in the very name “data mining.” However, some happy exceptions have emerged. Two particular classes of third-generation analytic business process are providing great value for enterprises in the consumer area: *Inline analytics* and *campaign management*.

Inline analytics strike gold.

The ultimate repeatable process, at least in consumer marketing, is one that analyzes every single consumer separately. Inline analytics – specifically, analysis that happens at the moment of customer contact – is a good approximation of that ideal. Typical goals of inline analytics include making a sale, getting the best price or profit from a sale, preventing customer churn, or averting fraud. Typical venues for implementation are websites, call center representatives’ screens, or wholly automated credit approval systems. In a variety of high-volume, low-margin consumer businesses, inline analytics can literally make the difference between profitability and overall loss.

The underlying process is complex.

The basic process for making inline analytics work has a number of steps. First of all, one has to do all the data gathering and exploration needed for any kind of statistical analysis. The output is a statistical model predicting, for example, consumer response to a variety of possible offers. This model is then automatically integrated into a transactional application, affecting the offers that are made to consumers real-time. Results are then gathered, monitored, and evaluated. Often there will be further statistical analysis on the live results to test and refine the model, which is then reexported if necessary, and so on in an ever-repeating loop. This is a classic example of a third-generation analytic business process, supported by an integrated set of analytic and transactional applications, such as those found in mySAP CRM.

Campaign management also shines.

Similar third-generation processes are producing great results in the area of campaign management, often associated with direct mail campaigns. Here the customer analytics are done before the time of contact, determining exactly which offers and promotions will be provided to which customers. Direct mailers have long understood that they have to “test, test, test,” but modern campaign management applications allow them a much greater level of precision and sophistication.

Stats aren’t just about consumers.

Consumer marketing is an ideal area for sophisticated statistical analysis -- lots of data is available, and there’s a relatively low customer opportunity cost to testing a marketing program on a group of consumers. But sophisticated statistics also play a role in other areas, such as quality analysis. What’s more, simpler statistical concepts have very broad application – e.g. to almost any kind of exception-monitoring or risk analysis. So statistical analysis is, or at least should be, a key component of many third-generation analytic business processes.

Implementing Third-Generation Analytic Business Processes

There are three essentials for implementing 3G ABPs.

In the prior sections we've discussed the benefits of third-generation analytic processes, and illustrated how they've become practical across a broad variety of departments, in almost any kind of enterprise. Now we'll discuss what's specifically required – or at least highly desirable -- to make them work. You basically need three things:

1. The right systems technology stack, as well-integrated as possible
2. The right suite of applications, which in particular leverages and is integrated with the systems technology stack
3. Sufficient management commitment

Management commitment is indispensable.

Admittedly, early adopters have implemented valuable third-generation processes without having all the technology we're proposing. But having this technology available makes the implementation process much less costly and more likely to succeed. Most critical of all is management commitment – without top-level management commitment, sufficient to produce widespread decision-maker buy-in, it will be very hard for any new decision-making process to take hold.

Systems Technology

Enterprises have lots of BI technology.

Most enterprises have some kind of business intelligence infrastructure, starting with a data warehouse and/or set of data marts, plus the associated data cleaning/movement tools. Most enterprises also have several competing sets of business intelligence query/reporting/analysis/information delivery engines, and are considering consolidating these to a single (or at least small) set of enterprise standard BI technologies.

3G ABPs need a comprehensive, robust BI stack.

Moving to an integrated enterprise BI technology stack is perfect for 3G ABPs, since one of their hallmarks is integrated functionality. The three most basic requirements for this stack is that it be sufficiently functional and robust to meet application and administrative needs; that it be sufficiently integrated to support complex, integrated processes; and that it integrate well enough with transactional technologies to support integration of analytic and transactional business processes.

While not every enterprise needs every particular feature, here's a list of technology elements that are very valuable in supporting third-generation analytic business processes:

Data warehouse RDBMS are the foundation.

Relational database management system(s). Traditionally, the analytic technology stack starts with a relational data warehouse. There can be a single warehouse or a set of data marts. Analysis can be done directly against transactional data. These options can be combined in a variety of ways. But no matter what, there will be one or more relational database management systems supporting the rest of the technology stack.

ROLAP beats out MOLAP.

ROLAP capability. There's been a decade-long struggle between multidimensional online analytic processing (MOLAP) and relational online analytic processing (ROLAP). ROLAP is winning.* DBMS vendors are offering powerful ROLAP features such as star schemas, materialized views, and the like. BI vendors (a group that includes or should include every serious application suite provider) offer elaborate ROLAP capabilities. SAP's NetWeaver platform offers a particularly rich set of capabilities in this area.
* *Note: It is not considered wholly polite to say this. Serious analytic technology vendors – SAP most emphatically included -- are careful to support both ROLAP and MOLAP. Even so, the truth is: According to our analysis, ROLAP is winning.*

Query and reporting are central.

Integrated query and reporting. Report writers are one of the oldest kinds of analytic technology. Paper reports are still important, but reports are increasingly delivered online, with rich capabilities for users to navigate and drill down within long reports. In many cases these reports are tightly integrated with transactional applications, although transactional reports are often too limited to support third-generation analytic processes. BI vendors are moving to provide single, soup-to-nuts report writers that meet all query and reporting needs, but most aren't quite there yet.

Multidimensional navigation has a place.

Multidimensional analysis. In many cases it is desirable to analyze and navigate data in many more than the two dimensions naturally found in reports or in relational query results. Specialized multidimensional data viewing tools were accordingly invented. Increasingly, however, these are blending into integrated query/reporting technology. Such tools can be crucial to third-generation analytic processes, since they facilitate drilldown to very specific transactional data.

UIs are getting ever better.

Cockpits and graphical data visualization. A repeatable analytic business process needs a starting point, and specifically a starting point for the analytic part. A cockpit or dashboard is an excellent tool in that regard. For example, the process can start "If there's an exception, do X," with the cockpit providing a quick overview of possible exceptions. Cockpits provide easy access to a much broader range of analytic data than predecessor technologies did – and each kind of information is a possible process starting point. More generally, data visualization technologies are getting ever better, making analytic tasks ever easier.

Strong KPI management is required.

KPI management. The essence of a cockpit or balanced scorecard is the tracking of key performance indicators. In an enterprise-wide implementation, however, there can easily be such a proliferation of KPIs that they become hard to manage or navigate. So a robust analytic technology stack requires strong tools for KPI management.

Don't forget alerting.

Alerting. Traditionally, managers first find out that something is wrong by looking at a report and noting an anomalous number. Cockpits provide the same capability, but with more immediacy. Even more immediate yet is an alert that notifies a manager via email or instant message or phone call or text message – the modes of communication keep proliferating. Thus, a sophisticated alerting engine, such as the one in SAP's NetWeaver, is now an important part of the information delivery stack. Furthermore, just as KPIs can multiply to the point of being unwieldy unless there are good management tools, setting and managing alerts is easier when the administrative interface for doing so is carefully designed.

Planning technology is evolving.

Integrated planning and forecasting. For over two decades, the basic tool for planning and forecasting has been the electronic spreadsheet. But using a spreadsheet to build an integrated, enterprise-wide, multi-user plan or forecast is not a pleasant idea. Even true enterprise planning tools can have scalability issues, whether in model size, response time, or user interface. Thus, a solid analytic technology stack should include a state-of-the-art (or at least near-state-of-the-art) planning engine. And of course this engine should integrate nicely with the rest of the stack.

Statistics should be integrated.

Rich, integrated statistics. Statistical techniques are, by definition, approximations and estimates. Which kind of estimate works best depends greatly on the nature of the data – how sparse it is, how many independent variables there are, what kinds of hidden dependencies there might be, and so on. In practice, the most useful way to do statistical analysis is often just to try a number of different techniques and see what seems to work. So the statistical part of the analytic technology stack needs to be rich enough to support this extra level of trial and error. Also important is ease of use; there have been a number of recent enhancements to make statistical tools useable by people other than stat mavens.

Integration technology is essential too.

While this has already been a long list, we're only halfway done. What we've listed so far are the elements of analytic technology that exist more or less in an analysis vacuum. But to get to the third generation of analytic business processes, it is also essential to have the analytic technology be well-integrated into broader operational systems. Key components supporting that integration include:

Workflow and UI are key.

Workflow and UI integration. To support a step-by-step business process, you need an application that reflects the process workflow. Now that analytic tools are completely web-enabled, this is feasible. Workflow tools designed to knit together transaction elements from multiple applications can tie in analytic elements just as well. Sometimes it's even simpler -- in some cases, just a few dynamic hyperlinks between screens are enough to support a third-generation analytic process.

Integrated collaboration can be nice.

Integrated collaboration tools. Also interesting is the integration of analytic and collaboration tools. For decades, it has been a truism that reporting technology was often used to communicate information among colleagues as much as it was used to actually facilitate analysis. Collaboration technology takes reporting-based communication to the next level. However, perhaps because this approach lends itself more to ad-hoc than to wholly structured processes, collaboration tools haven't played a huge role in the early implementations of 3G ABPs.

Data integration is a must.

ETL and EII. The most basic integration technology for analytics is data integration. ETL (Extract/Transform/Load) tools have long been recognized as necessary for data warehousing, whether on standalone basis or, increasingly, integrated into BI stacks and even DBMS. One important buzzword is EII (Enterprise Information Integration), denoting tools that combine elements of ETL and EAI (Enterprise Application Integration), or else just add a near-real-time aspect to classical ETL. In the future, the center of data integration may be the emerging discipline of Master Data Management.

Service-oriented architectures are standard.

Service-oriented architectures.. Another area where analytic and transactional integration are coming together is in service-oriented architectures (SOA). The benefit of SOAs is to make different programs easy(ier) to integrate with each other. For a technology stack to be standards-compliant in the future, a SOA based on XML Web services is required. While most SOAs to date were specified with transactions in mind, they generally carry over quite nicely to analytics as well, with very little extension being needed (although XMLA support is a good thing to have).

Other features are worth noting too.

The above list covers most or all of the general systems technology stack at this time, both in the area of BI and in technology integration. But several further technologies are candidates for inclusion, including integrated metadata management, general application development, and app-server-like features.

- *Integrated metadata management* has been a dream since the 1980s, with substance lagging far behind marketing hype. It's probably best to look at the modules integrated metadata management strengthens – general administration, data integration, perhaps KPI management – rather than focusing on whether the “integrated metadata” feature per se has finally become real.

- The *application development* story for analytics is really confused. Arguably, every BI tool ever sold could be called an “application development tool,” but technology parallel to that of transactional development environments continues to lag. However, in what may well prove to be an important trend, process modeling tools and application assembly tools are being extended to analytics (see for example the Business Process Modeling and Composite Application Framework components of SAP NetWeaver).
- Finally, some high-volume BI tools added load-balancing and other *app-server-like features* before application servers were an established category. These features, along with some data caching capabilities, may or may not be called aspects of “app servers” at the whim of the vendors’ marketing departments. Thus, whether or not to have an application server in your analytics stack is now a matter of semantics more than it is a serious technology issue.

Application Suites

Packaged apps are ideal ...

With a technology stack containing enough of the elements listed in the prior section, it is possible to build applications that support almost any kind of third-generation analytic business process. But of course, whenever you can buy packaged applications instead of building them, that’s the better way to go. That rule has been true for decades, for many reasons. Nothing about the applications needed to support third-generation analytic business processes makes them an exception to the rule. And suitable analytic or hybrid analytic/transactional application offerings are increasingly becoming available.

... especially from your app suite vendor.

Every example we’ve offered in this paper is supported by SAP applications that either exist now, or else are forthcoming in the near future. Other operational application vendors may have similar offerings; indeed, any application vendor in this era that does not offer appropriate integrated analytics is doomed to a drastic and well-deserved loss of market share. Indeed, for some kinds of third-generation process, the need for tight integration between operations and analysis makes application vendors the only viable option for app support. Thus we arrive at a clear conclusion: For enterprises that have a well-integrated suite of transactional applications, their vendor for those applications is likely to be the best source for analytic applications as well. (Indeed, it is far from clear that the distinction between “analytic” and “transactional” applications will continue to be meaningful, any more than the distinction between “analytic” and “transactional” business processes will.)

Point apps are more limited.

Some of the more departmental analytic business processes can also be supported by point applications, whether from BI technology vendors or from traditional application providers. This is never an ideal solution, but realistically many enterprises integrate heterogeneous apps, for a variety of reasons. BI vendors are generally strong at data integration, but there are obvious limits to the process integration they can offer, making them inferior to the app suite vendor alternative when it is available. Small specialty app vendors generally lag both in systems technology and in integration, and hence should be viewed as a last resort.

Management and Cultural Issues

Managerial commitment is critical.

Technology is of course critical, but equally important to the successful introduction of structured business processes is managerial commitment. This is especially true in the case of analytic processes. Changing an operational process might involve little more than retraining a group of basically obedient clerks. But if you want to rein in managers' autonomy and provide structure to their decision-making, you face a much harder task – even tougher than, for example, the well-known challenge of getting salespeople to use sales force automation (SFA) technology. Only senior-level managerial attention will induce cultural change. This is true even if the new analytic processes are basically operational. It is even truer if you're trying to implement a new way of establishing budgets, plans, and strategies.

Start with easy wins.

When striving for a fundamental change in business process or organizational culture, it is best to start with “easy wins” – i.e., specific changes that will be fairly quick to implement, and that are likely to have a very high benefit:pain ratio. Specific candidates include:

- *Regulatory compliance.* Nobody likes to comply with regulations, but everybody has to do it anyway. If a third-generation process can get you into regulatory compliance more easily than less structured alternatives, project success is almost automatic. More precisely, project acceptance is almost automatic; you of course still have to implement successfully.
- *Consumer analytics.* Consumer businesses are often low-margin, so the profitability improvements from improved processes can literally make the difference between profit and loss. And often there is already a strong culture of analytic decision making among consumer marketers; thus, third-generation processes may be accepted as incremental improvement rather than being perceived as revolutionary change.
- *Enterprise budgeting and forecasting.* Everybody has to do budgets, and almost everybody hates doing them. So if there's one process which

people are happy to change, it's budgeting. Not coincidentally, budgeting and planning are today the most widely adopted of any truly enterprise-wide analytic processes. As long as you ensure that the new process causes less aggravation for line managers than the old one did, you will probably find third-generation budgeting and forecasting a relatively easy organizational sell.

- *Stakeholder reporting.* Large businesses and governments can seem to their stakeholders like faceless, impenetrable, hostile entities. Simply opening up more information to customers, partners, citizens, etc. can make them a lot happier, and may save you money dealing with them as well. Revealing this self-service information may require little more in the way of technology than a high-end report writer. Projects of this sort can be a big – and cheap – win. And they can lay the groundwork for more complex – and complexly structured – stakeholder interactions in the future.

Conclusion – Embracing the Third Generation

Analytic processes were chaotic.

For decades there was a sharp distinction between transactional and analytic business processes. Transactional processes were precise and highly repeatable, while analytic processes were disorganized and ad-hoc. This lack of structure made adoption of analytic processes easy, but also meant that many potential benefits of more robust processes remained unrealized.

Better processes are now possible.

This distinction was a technological necessity. As such, it admits of a largely technological solution. It is now possible to integrate analytic and transactional business processes, thanks to integration of the underlying software. This integration occurs both on the systems and, increasingly, on the application level. Significant improvements in pure BI technology are also contributing to the support of efficient, repeatable, well-designed analytic processes. We call these newly possible processes “third-generation,” to distinguish them from the disorganized second generation, the unautomated first generation, and the still unrealizable idealized fourth generation of the future.

Some are must-haves.

In some cases, third-generation analytic processes are simply essential. Compliance pretty much mandates them for outside reporting. Companies in certain consumer marketing segments can’t stay competitive without deploying inline analytics, especially if they have issues with fraud prevention or customer churn.

Many are should-haves.

Beyond the must-haves, there are many other analytic processes that should be adopted by a significant fraction of all enterprises. Integrated enterprise planning is far superior to spreadsheet chaos, and can improve every area of the business. Companies that make frequent inventory-related decisions should upgrade their monitoring/alerting infrastructure and processes. Strategic sourcing can save huge amounts of money for large or diverse enterprises. The list of beneficial third-generation analytic processes is already long, and it is rapidly growing longer.

Management commitment is vital.

Serious improvement in analytic business processes requires serious management commitment. The cultural change implicit in changing managers’ decision-making habits – and their corporate politics strategies! – exceeds that required for the original adoption of ERP, and even exceeds that needed for sales force automation. There are a few valuable third-generation analytic business processes that may be exceptions to this rule, but generally adoption is not the triviality it was for many second-generation ABPs.

So is packaged software.

Management will isn’t enough. You also need the tools. Where there are structured business processes, there needs to be application software – custom for some early adopters, packaged for most other enterprises. Also, whether

you pursue more of a packaged or more of a custom approach, either way you'll probably need an improved systems technology stack, in areas such as cockpits, alerting, integration/integratibility, relational OLAP performance, and perhaps even application development.

Integrate analytics into OLTP apps.

For all business processes, the ideal vehicle is the perfect packaged application. More precisely, it's the perfect and perfectly integrated suite of packaged applications. That ideal is of course hard to achieve in reality, especially for enterprises large enough to have unique business requirements. But in many cases, the best way to implement third-generation analytic business processes is indeed via app packages integrated with your primary suite of transactional applications.

Here's a simple roadmap.

While every enterprise's situation is of course unique, for most the best path to third-generation analytic processes is something like the following:

1. Determine a wish-list of third-generation analytic business processes. Some of the elements should be common to almost all enterprises, such as structured auditing, live budgeting and planning, or performance-based compensation reviews. Other candidates are only relevant to some enterprises – for example consumer analytics, high-end strategic sourcing, or channel-partner reporting.
2. Identify the specific applications and analytic systems technology needed to support those processes.
3. Pick one or a very small number of suppliers of integrated enterprise analytic technology. Ideally, your principal apps provider can do most of the job at a high level, via an offering like SAP NetWeaver.
4. Based on your needs and your core vendors' product offerings, pick your early projects. Focus on "easy wins."
5. Get iron-clad management commitment to the success of the easy-win projects, and general management commitment to the whole analytic process upgrade goal.
6. Pick your secondary vendors of analytic technology, if any are needed (one or more probably will be).
7. Succeed at the easy-win projects.
8. Plan more projects. By this point – and preferably much earlier -- analytics will be a central concept in your overall technology strategy.

9. Get iron-clad management commitment, at the very top level, to changing your enterprise. Nothing less will suffice.

Don't let the third generation pass you by.

But whether you follow this path or another one, it is imperative that you begin (or continue) to adopt third-generation analytic business processes. If you don't, you will soon find it impossible to remain efficient and competitive in this increasingly analytic world.