White paper

expecting the unexpected

business pattern management

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Why patterns matter

The economic recession has forced business leaders to look at opportunities for growth and competitive differentiation in a new way. A business Pattern-Based Strategy (PBS) is about seeking, amplifying and exploiting new business patterns. Implementing PBS successfully requires work in technology, processes, organization and people/culture. PBS therefore implies deep transformation to promote open innovation and transparency (internally and externally). IT architecture and processes also need to be modified to meet PBS requirements (extensive data processing, sometimes in real-time mode, and agile business processes). To succeed, companies will need partners with a PBS background and associated delivery capabilities.

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About the Atos Scientific Community

The Atos Scientific Community is a network of some 90 top scientists, representing a mix of all skills and backgrounds, and coming from all geographies where Atos operates. Publicly launched by Thierry Breton, Chairman and CEO of Atos, the establishment of this community highlights the importance of innovation in the dynamic IT services market and the need for a proactive approach to identify and anticipate game changing technologies.

Introduction

For many years, companies have been trying to setup mechanisms for the early detection of potential risks that can impact delivery of their service or product.

Early detection allows them to take necessary corrective actions to avoid damage to their image and/or profits. In the short term, many organizations are concerned with whether their strategy is the most suitable with regards to the evolution of the market and the business environment. Henry Mintzberg, a well-known business strategist, hypothesized in 1978[2] that organizations normally create a strategy that will help them achieve their organizational goals. He also proved that only part of that strategy is ever actually executed in practice. The other part remains unrealized and when looking back after a period of time, organizations will find that the strategy that was actually realized consists of some of the created strategy, but for a large part of an emergent strategy.

This is not surprising as CEOs are continually confronted with unexpected challenges, risks and developments in their markets. Whether that means cost cutting in healthcare, the consequences of the European debt crisis for trading companies, or negative publicity for an oil company, for example, due to environmental disaster or a change in market preferences, companies need an emergent, agile and opportunistic strategy to lead them through difficult times.

One of the main goals for companies, and especially the CEO, is making sure that the strategy defined is the most suitable for the medium to long term and, if changes need to be made, that they are able to detect where changes should be made and adopt them in a timely manner.

'Expecting the unexpected' is a key philosophy in understanding and indeed capitalizing on these challenges. This means making business intelligence more predictive in order to offer early warning signs. The detection of patterns from different sources is one way to achieve this.

This White Paper discusses the key steps to finding influential patterns and how to use these as a foundation for corporate strategy development.

The importance of patterns

Before delving deeper into the mechanics of pattern detection and leverage, it is useful to define the term pattern. In this sense, a pattern is a 'consistent and recurring characteristic or trait that helps identify a phenomenon or problem, and serves as an indicator or model for predicting its future behavior'.

According to this definition, an effective pattern detection and management strategy has significant importance in several areas, such as:

- Early detection of patterns that indicate a potential natural disaster is very important and can save many lives. For example, the creation of earthquake probability maps has become a commercial business over the last two decades. Purchasers are not only governments for national security reasons, but also companies that use the maps for corporate and industrial site selection. These maps combine many patterns: historical (frequency and weight of previous quakes), geographical (plate tectonics and movements), and social (number of inhabitants and their welfare to help estimate the firmness of buildings). These predictions are often not very precise. For example, there is a more than 62 percent probability that the San Francisco Bay Area will be hit before 2034 by one or more earthquakes of magnitude of 6.7 or larger.

- Another area in which pattern seeking and recognition is critical is in the early detection of cancer. For example, with techniques of pattern recognition in digital images some types of cancer can be detected well ahead of their advancement.

- Patterns are key in Command and Control Functions for Complex Systems. These systems are used to monitor the behavior of complex systems (like nuclear plants, power networks, ships, submarines, etc). They analyze the input received from different sensors and propose required actions to the operator (they may even execute the actions automatically) to make sure that the complex system is maintained in a desired/stable state. To interpret incoming data and determine the evolution of the system (keep stability or shift to an unpredictable/undesirable state), Command and Control Systems analyze data by using models aimed at identifying patterns in the myriad of data coming in. Depending on the system's state evolution as defined by the pattern, it may raise an alarm to the operator, giving them all the information available and taking the action needed or proposing options.

In the design of Command and Control systems, two models should be considered:

- Often the situation/problem identified by a pattern is a well-known/repetitive problem and a predefined procedure to manage such situation has already been established, either automatically or manually through a human operator.
- However, there are many situations where a predefined procedure is not available or cannot be defined as the evolution of the system cannot be predicted. In these cases, operator intervention is required and the Command and Control System helps by providing all the information available about potential solutions/actions, estimations about the evolution of the system, past situations, etc.
  It is critical for Command and Control systems to be as 'intelligent' as possible and able to react to as many situations as possible, whether or not a certain situation has already occurred or not. Several techniques can be used to achieve this, including simulations and neural network-based design. In all the cases, patterns are used to train the system and predictive models are also used to identify new patterns that have yet not happened in real life.

In a commercial context, the early detection of patterns indicating opportunities, collapsing demand, employee dissatisfaction or negative public image can give companies a sustainable competitive advantage by helping them capitalize on existing opportunities under challenging (and favorable) market conditions. An organization's increased powers of predictability will engender confidence from their stakeholders. Some examples of the application of Pattern Management in business environments include:

- Fraud/crime detection in payment systems. For example, monitoring that the same card is used to get money from different Automated Teller Machines (ATMs) in a short timeframe, or purchasing patterns outside normal parameters for an individual customer.

- Intelligent content providers that use patterns to identify and classify content coming from different sources that match subscribers' areas of interest.

- Recommendation engines in e-commerce sites. Creating patterns from users' previous navigations in such a way that they can identify affinity among different users and thereby propose items acquired by users with similar navigation histories.

- Pattern-Based Strategy is also important in Context-Aware Computing as contextual information often exists within and underpins the key events which define the pattern(s). For example, in the development of 'Smart Shopping' applications, trend and pattern analysis can be used as they relate to purchasing decision recommendations based on previous behavior/actions from other purchasers in the same context whose affinity with the current user can be established or based on recommendations from others within the Social Graph (connections of individuals within Social Networks). So (via mobile devices) a shop could be recommended to be visited based on the previous itinerary (pattern) of the user and comparing that itinerary with routes from other users in the same area.

- Patterns can also be used to optimize retailer sales strategies in an agile and near real-time manner, reacting to emerging and repeating patterns of consumer activity.

- For optimal operation in energy demand management, it is necessary to know not only the total energy consumption of all consumers, but also individual energy usage patterns. Individual users differ in the quantity of energy that they consume and the times of the day when they require energy. Energy usage patterns can be described in terms of 'how much' (average consumption level) and 'when' (usage profile) energy is consumed. Knowing the factors that determine these patterns makes the development of adequate measures for energy management easier and more accurate.

- In stock markets there are patterns that appear on the charts of stocks that provide forecasting tools of imminent price movement. They are one of the most dependable yet simple to use technical analysis tools. A number of patterns are more dependable than others for price forecasting. These chart patterns recur across varying timeframes and stocks because they are an end result of human nature and emotional reaction to a stock's price fluctuation. These patterns appear over and over again because humans do not change and their emotions will cause them to make the same (or very similar) decisions over and over again.

Analyzing trends, patterns and external developments has always been part of the business intelligence of organizations. Even the baker in Adam Smith's seminal 'Wealth of Nations' (1776) wants some insight into predicted next-day sales and whether or not there is an event in the city that might affect them.

In the current business environment, there are reasons to put predictive business intelligence and pattern seeking on the CEO's agenda:

- The environment in which organizations operate is becoming more and more motile and interactive, it is changing rapidly and has solid interactions between the virtual and real worlds. Customers (both business and private) are connected with and active on a lot of social (web) networks over which they discuss the performance and image of organizations, as well as potential purchases. Determining and analyzing patterns relating to how organizations are perceived in these networks uncovers corporate image and customer sentiment, and may be used to forecast future sales and highlight opportunities and commercial threats.

- New and innovative IT solutions make it possible to rapidly data mine more sources at the same time and find and analyze patterns inherent within the data.

- Following more deliberate and intended strategy based on detected patterns fosters stability and confidence in an organization. Control of organizational goals will improve the confidence of the stakeholders (including shareholders and clients).

Patterns in reinsurance: Munich Re[7]

Munich Re insures insurance companies. Together with its subsidiaries, the company employs about 47,000 people on all continents and more than a quarter of the world's population, or about two billion people, are indirectly insured through the company. The information around decisions these people make, the accidents they have, the circumstances of their births and deaths, is all transmitted to Munich Re, where data mining methods are used to examine the information, analyze it and constantly link it to other circumstances. The goal is to find patterns within chaos and probabilities in the improbable.

How great is the risk that a freighter accident in Germany's Midland Canal will cause a power outage in Italy? What might it cost to insure the entire supply chain of an international automobile manufacturer with a total of 4,000 companies scattered across all continents against every conceivable delivery problem, from strikes to volcanic eruptions? These are the sorts of questions researchers at Munich Re address. Their task is to assess the risks as accurately as possible, because the level of risk determines how often a loss can occur, and the frequency of losses, or claims, determines the amount of the premium. For instance, if a given house is at risk of being flooded by a river once a year, the insurance premium will correspond to the value of the house.

Benefits

Implementing a Pattern-Based Strategy (PBS) allows companies to derive benefits on two different levels:

- On a short-term or operational level, an effective PBS can help companies detect business events which impact their day-to-day operations so they can apply the actions required to mitigate that impact in every specific situation (an example of this PBS application is fraud detection in payment systems).
- PBS also helps companies in the medium/long term by providing the right input to define or adjust their business strategy. By mixing information from external sources (markets, analysts, etc.) and internal sources, new business opportunities can be identified for products or services. PBS can also help companies identify whether external events, which are seemingly unconnected to the business, may actually have a deep impact on the execution of a three-year plan or in the development or go-to-market plan of a product or service.

Working at these two levels, companies can obtain important advantages/benefits:

- Better management of operational risks due to an early detection system.
- Cost reduction derived from the early detection of operational risks, as later corrective actions/investments are less likely to be required.
- New business opportunities can be identified providing competitive advantage.
- Companies can better harness and drive change, rather than simply react to it.
- Adopting a PBS model helps companies become more agile and create a management model based on Key Performance Indicators (KPIs) that allows them to adapt their internal organization to this new model. Companies must have a clear understanding of all data sources that are involved/affect their business, both internal and external. In the current age of social networking, companies that can understand and manage input from different networks and communities will gain advantage over competitors.

Statistical pattern recognition

So what are the techniques that facilitate the analysis of huge volumes of data and identify hidden patterns within the data? Based on the identification of these patterns, how can the behavior/responses of the system be foreseen to effect appropriate actions? Methods of achieving these actions are primarily complex statistical techniques (as illustrated in the diagram below). They are introduced at a high level only in this paper. As this is a complex subject, a brief introduction to the key concepts is offered to guide understanding of both how Pattern Management Systems work and the inherent complexity that they entail.

Pattern recognition is the assignment of an output value (or label) to a given input value (or instance), according to a specific algorithm. Examples of pattern recognition are:

- Classification; the assignment of each input value to one of a given set of classes (e.g. determine whether a given email is spam or not).
- Regression; the process of investigating the relationship between a dependent (or response) variable Y and independent (or predictor) variable X.
- Sequence labeling; the assignment of a class to each member of a sequence of values (e.g. part of speech tagging which assigns a part of a speech to each word in an input sentence).
- Parsing; the assignment of a parse tree to an input sentence, describing the syntactic structure of the sentence.

Pattern-recognition algorithms generally aim to provide a reasonable answer for all possible inputs and to carry out 'fuzzy' matching of inputs, as opposed to pattern-matching algorithms that look for exact matches in the input with preexisting patterns. A common example of a pattern-matching algorithm is regular expression matching, which looks for predefined patterns in textual data and is included in the search capabilities of many text editors and word processors.

Pattern recognition is generally categorized according to the type of learning procedure used to generate the output value.

- Supervised learning assumes that a set of training data (the training set) has been provided, consisting of a set of instances that have been properly labeled by hand with the correct output (in other words, classification of models/patterns has been predefined against which input data can be compared in order to define its type).
- Unsupervised learning assumes training data has not been hand labeled and attempts to find inherent patterns in the data that can then be used to determine the correct output value for new data instances. The unsupervised equivalent of classification is normally known as clustering, based on grouping input data into clusters based on some inherent similarity measure rather than assigning each input instance into one of a set of predefined classes.
- A combination of the two that has recently been explored is semi-supervised learning which uses a combination of labeled and unlabeled data (typically a small set of labeled data combined with a large amount of unlabeled data).

How can it be applied in practice?

Preparing to support PBS will be a key element for companies operating in modern environments in which change is constant. Companies wishing to develop a PBS strategy face a number of key challenges, such as:

- In a 'world of patterns' where should the focus be?
- How can pattern quality and relevance be determined?
- Pattern search and evaluation are ongoing processes, how can corporate strategy be adjusted accordingly?
- What tooling and methodologies are needed?
- What are the short-, medium- and long-term predictors?
- How can new sources be identified?
- How can the success of the strategy be quantified and how can continuous improvement be built into a Pattern-Based Strategy?

To address these questions methodically, it is necessary to consider different dimensions: technology, organization, process and people/culture.

Technology

PBS requires both existing and new technologies depending on the type of patterns to be managed.

A PBS strategy will also require the integration of existing technologies with new or enhanced technologies that identify patterns of change in order to indicate opportunity or risk, as well as those that model the effects on the enterprise and enable an organization to consistently adapt to patterns and drive measurable results.

Technologies that implement PBS include:

- Data crawling/search engines. One of the main challenges in pattern analysis is the large number of sources of information available and the immense amount of data that could potentially be analyzed. Defining (and refining) candidate data sets is as important as determining the characteristics of the pattern being sought. Examples of sources are:
  - Public Internet:
    - Social network sites
    - Discussion forums
  - Other media
  - Corporate databases
  - Government databases (Chamber of Commerce, statistical office, EU, etc.)
  - Internal Systems
- Business intelligence (BI)/data cleansing. BI technologies and techniques are needed in order to manage the volume of information and form the basis upon which to build and execute complex pattern-seeking algorithms (see chapter 6).
- The intensive processing capabilities that pattern analysis sometimes requires necessitate the use of supercomputers (highly parallel processor configurations on optimized hardware platforms). Another option to addressing processing capability requirements is to use grid (distributed) computing where a 'super virtual computer' is composed of many networked, loosely coupled computers acting in unison.
- Neural network systems are widely used in pattern recognition, taking a different approach to problem solving than that of conventional computing. Conventional computers use an algorithmic approach, i.e. the computer follows a set of instructions in order to solve a problem. Unless the specific steps that the computer needs to follow are known, the computer cannot solve the problem. That restricts the problem-solving capability of conventional computers to problems that are already understood and have been solved. Neural networks process information in a similar way to the human brain.

  The network is composed of a large number of highly interconnected processing elements (neurons) working in parallel to solve a specific problem. Neural networks learn by example. They cannot be programmed to perform a specific task. The examples in the training sets must be selected carefully in order to avoid inefficiency and inaccuracy in the network's 'learned responses'. The disadvantage is that because the network finds out how to solve the problem by itself, its operation can be unpredictable. The latter concern can be mitigated through training sets and other reinforcement learning techniques which guide the network towards greater accuracy. Neural networks and conventional algorithmic computers are not in competition, but complement each other. There are tasks which are more suited to an algorithmic approach like arithmetic operations and tasks that are more suited to neural networks (e.g. facial recognition). More complex problems benefit from a combination of the two approaches (normally a conventional computer is used to supervise the neural network) in order to perform at maximum efficiency
- Complex Event Processing (CEP). CEP employs techniques including the detection of complex patterns made up by many events, event correlation and abstraction, event hierarchies, and relationships between events, such as causality, membership, and timing, as well as event-driven processes. A CEP engine can be seen as an ECA (Event Condition Action) rules-based system for the fusion of event-based information where rules are triggered when a condition in an event pattern is satisfied thereby creating a complex event (intelligence item), or carrying out an action or an alert. This allows companies to analyze operational and external data in real time to identify predefined patterns, raise signals/alarms and/or even take associated actions through Business Process Automation and BPM.

  Complex Event Processing can be considered as a technological building block of PBS and Context-Aware Computing solutions, and indeed it is also a potential input source for Command and Control Systems operating under a PBS.
- Business Process Management (BPM)/Business Rules. A flexible/adaptive architecture that supports the execution of business processes is needed in order to be able to modify processes in the event a business risk or opportunity is detected as a result of Pattern-Based Strategy analysis. Service Oriented Architecture (SOA) is a key design concept to develop such IT architecture.

Processes

Technology is the enabler, but there also needs to be a focus on people and processes. If the business cannot react to the pattern, there is no real advantage to PBS. So, in addition to a suitable IT architecture, business process design and management must be able to support change through agility. This means there must be a BPM culture within the company where processes are continually managed (modeled, implemented, monitored and improved).

Pattern Management processes should be continually defined and managed, integrated within the 'company DNA', and cover strategy definition in terms of identifying and managing operational events that may highlight opportunities or threats. This means that there must be mechanisms for continuous process improvement in place. Pattern-Based Strategy is by implication a 'moving target' and continuous analysis and 'capitalization of findings' is therefore required.

Organization

To define an effective PBS and implant it within the company, there must be organizational units/roles that lead and manage all aspects, acting as the glue that connects all company levels/areas. Like for SOA or BPM, this means defining an internal Pattern Management Competence Center (PMCC) that would assume, among others, the following responsibilities:

- Work with business areas to identify sources of information, and define indicators and the type of patterns to look for. The PMCC would help/support business areas in defining and looking for patterns. Business areas would define the elements/signals that should be looked for as patterns and the PMCC would shape those 'requirements' into an operational format.
- Starting from the requirements defined by business areas, the PMCC would work with the IT area to set up the architecture to support Pattern Management.
- Define and support (including training) an internal methodology for Pattern Management, from the definition of a corporate strategy to management of operational events.
- Analyze existing business patterns to check their suitability for use within the company.
- Manage the relationship with different partners involved in this area: content providers, specific IT solutions providers, business partners, external communities, etc.
- Continuously monitor patterns alongside business areas, In order to be able to manage these aspects, different types of profiles/competences must exist within the PMCC: business, technical (including statistical skills), management and change management.

People and Culture

Companies focused on creating an effective PBS require an internal business culture capable of dealing with:

- Open innovation; moving from a closed/silo approach (innovation is an internal process involving only the corporation) to an open approach, working with customers, partners and educational establishments through collaboration.
- Business change as a continuous process.
- Performance management.
- Transparency. This is a two-way concept:
  - Externally; transparency in terms of communication with external parties with which the business works that are a source of patterns and signals. Better prediction of business opportunities and the impact of new products/services and market strategies also allow the company to be more transparent to the market by openly anticipating expected results and achieving them. This represents both a demonstration of corporate health and the use of transparency for differentiation.
  - Internally; business processes and responsibilities must be well defined and clear within the organization. This is the only way through which the impact/potential of a pattern can be defined. In addition, the adoption of a new company model can be carried out effectively, with no 'surprises' later on.

All stakeholders must share these principles so that work in the other three dimensions yields the expected benefits. Change management capabilities are key in order to develop these principles in less mature companies.

Companies that have not established such a culture (taking into consideration the evolution and current requirements of the market), will generally underperform in relation to a competitor that recognizes and leverages the potential of PBS.

Challenges

Alongside the creation of an internal framework that allows a company to develop a PBS strategy, companies and their IT providers face challenges in terms of finding and managing patterns:

- Real-time analysis of significant volumes of data is still a challenge that needs to be addressed. Atos, for example, is working with a telecommunications company in Spain researching pattern detection-based applications for fraud detection in cellular telephony. Fraud detection is not entirely effective as it is not presently possible to perform real-time monitoring of call data. The current approach detects fraud patterns a posteriori with low effectiveness and at high cost. The platform proposed by Atos will make it possible to carry out fraud detection in real time with a high level of effectiveness and at a lower cost than the semi-manual process being performed today. For this to happen, however, the resulting data streaming platform should be highly scalable; able to process 1 million call description records per day.
- Companies have long been analyzing internal data to improve sales and productivity, but now the networked world in which we living allows for the expansion of data mining to include the analysis of social networks. This offers new opportunities, including:
  - Improving churn management for telecom operators by detecting which customers are so-called 'influencers' and creating retention campaigns to deter them from moving to a rival operator (to which they may take their 'friends' as well). As an example of the potential of this Social Network Analysis (SNA) tool and technique, Bharti Airtel, India's biggest mobile operator, which handles over 3 billion calls a day, has greatly reduced customer defections.
  - Crime/fraud calculations via the analysis of the social networks around suspects, such as dealings with employers, collection agencies and the Department of Motor Vehicles.
  - Identification of risky borrowers.
  - Network analysis also has a useful role to play in counterterrorism. Terrorist groups are often decentralized, so successfully mapping their social networks through traditional means and interference channel analysis may well yield previously undetected intelligence.

Customer Churn (turnover) prediction and management

Customer Churn (turnover) prediction and management is key for Telco Operators. This is important especially in the prepaid environments, where churn usually is defined as 90-days of inactivity. Just looking from present data that users start to be inactive during a certain week, is not good enough estimation about their churn propability as most users still return. But if a Telco Operator waits for several weeks to see if they remain inactive, then the opportunity to reach and retain them is pretty much lost as the return usually happens early. What is needed is a prediction of which of the users starting their inactivity will eventually also churn, and they should be the targets for retention campaigns.

The business problem we are solving in churn prevention area is this... Poorly targeted churn prevention campaigns destroy revenue!!!

With predictive social network analytics you can campaign the users at the right time. Starting from the Operator Information about users and call activity, the SNA tool applies different types of algorithms to look for patterns that enable the definition of different scores upon the operator's customers database:

Churn Propensity score	Identifies the most likely Churners
Churn Influence score	Identifies the customers with highest Churn Influence
Churn Alpha score	Identifies the customers likely to churn and influence others to churn
Social Network Metrics	Insight derived from the social network
Detailed Service Usage	Deep dive insight from call detail records (CDRs)
Summary Service Usage	Higher level insight form call detail records (CDRs)
Operator Input Data	Insight derived form the operator input data

- Predict the most likely churners in next N weeks
- Offer optimization; What is the minimum offer to prevent churn
- Value optimization - who are the most valuable customers?
- Identify different types of churners
  - Rotational churners & multi-SIM users
  - Sudden leavers & neighbor effect
  - Product & service churn
- Social Revenue per subscriber

The SNA analysis allows companies to get Churn campaign success through optimal campaign target selection and personalized campaign design. Following outcomes have been achieved in several projects/operators:

- 10% less churn within connections of retained customers
- Twice as many retained customers in group top 1%
- More retained customers with help of 70% better churn prediction accuracy in top 10%
- More retained customers with help of 185% increase in churn prediction accuracy in top 2%

The next step beyond mapping influence between individuals is to map influences between larger segments of society, even countries.

- As data availability increases, so does the need for processing capabilities and the ability to efficiently process information distributed across different sources. To address this, distributed computing must move from grid to cloud. To unlock the patterns in large data sets, exploratory analytics must be able to bypass bottlenecks in accessing and storing that data, allow analytics application workloads to run in the location where the data is stored, and provide faster and cheaper analysis. This is different from the traditional approach where data has to be moved to the application.

- Pattern mining commonly generates a huge amount of data related to the structure of patterns, but rarely provides sufficient contextual information to interpret their meaning. A new major challenge in pattern mining has therefore been raised by researchers; how to present and interpret discovered patterns in order to support the exploration and analysis of individual patterns. To meet this challenge and facilitate pattern interpretation, each identified pattern needs to be annotated with semantically enriched, in-depth descriptions of that pattern and its associated context.

  Recent research introduced post-processing techniques to summarize and compress a pattern set. Whilst this shrinks the size of the output set of patterns, it does not provide semantic information. A proposed solution is the generation of Semantic Pattern Annotation (SPA) for patterns. A semantic annotation consists of a set of strongest context indicators, a set of representative transactions, and a set of Semantically Similar Patterns (SSPs) for a given pattern. Algorithms have been proposed to exploit context modeling and semantic analysis to generate semantic annotations automatically. The method can be coupled with pattern-mining techniques as a post-processing step to facilitate interpretation of the discovered patterns.

- Beyond the specific application of SNA as outlined above, the networked global marketplace provides some compelling incentives for reinventing the business models of the last 50 years. There are new sources of information and influence available that have to be considered and exploited: the power of an individual blogger to impact a company's image, the fact that consumers now buy as communities, and the potential demise of classic functions, such as product design, because consumers can design their own products.

  Leading organizations are already using Social Network Analysis to gain a better understanding of interaction patterns among people and groups within their organization, as well as between business partners and customers. Social Network Analysis provides business intelligence on the ties, information flows and value exchanges that can be used to determine if these patterns represent opportunities or disruptions.

  Organizations can use this information to exploit patterns that offer new organizational insight; for example, to replicate the behaviors of their top performers when central connectors are uncovered in their social network. They can also use the results to unearth incongruence in goals that could lead to performance problems among business partners.

  Organizations that undertake Social Network Analysis will gain a new perspective of the impact of relationships on their corporate performance. They will have greater visibility of the relationships that are making their organization successful, as well as those that might be hindering progress. With consistent analysis of social networks in which clients participate (Facebook and LinkedIn, as well as professional networks and media forums), the key influencers of a client can be identified, public opinion of a company can be gauged, and how the marketing and communication activities of the organization are conceived can be seen. Social Network Analysis is not only about crime-prevention and fraud, but also about the influence of normal citizens on the turnover of fast-moving consumer goods.

- Open innovation is key in a PBS strategy as it leverages the flow of information with third parties, helping to feed pattern seeking with data. It also helps to ensure that new ideas/visions are taken into consideration internally and helps to identify/define new patterns that provide competitive advantage. However, implementing open innovation successfully presents challenges, including:

  - The mindset challenge: how can the 'closed' mindset be changed and people made open to work closely with external partners to identify new business opportunities?

  - The intellectual property challenge: how can rights/investment be protected in investigations, whilst sharing knowledge at the same time?

  - The tools challenge: how can the use of tools be optimized to support open innovation? Remember, collaboration can increase the chances of success through sharing ideas, accelerating implementation from the generation of an idea to the time it is implemented, and minimizing investment by sharing costs, risks and rewards and leveraging third-party assets.

- Social Network Analysis and the increased sharing and utilization of information coming from different

  - collectives imply two additional challenges:

  - Privacy issues concerning data from users required for effective analysis. When surveys are used for data collection, users may be reluctant to provide accurate responses. When automated tools perform the analysis, users may resent knowing that software is analyzing their behavior. A key challenge is to persuade users that it is 'safe' to reveal personal information and that this data will be handled sensitively to enrich user experience and utility.

  - How to make sure that the level of accuracy of the data is adequate and the information available is complete.

- A challenge for enterprise systems in the future Internet of services is to address the sharing of knowledge in virtual organizations

  The last decades show a clear trend away from big, comprehensive trusts which can cover all stages of a value-creation chain, and from long-standing, well-established and stable supply chains. Instead, companies are increasingly focusing on core business competencies and often enter into flexible alliances for value creation and production. The growing demand for flexible, interactive and efficiently integrated businesses and services has already led to a significant amount of scientific and technological research on enterprise interoperability, with promising results. These have been partly responsible for a number of first commercial products and service offerings, as well as operational, deployed applications. However, they remain at the level of data interoperability and information exchange and only partially reach the level of knowledge integration. They fall short of knowledge-based collaboration.

  Research on collaboration patterns in the event-driven future Internet has the potential to satisfy these needs and provide the underlying technological infrastructure for supporting adaptive enterprise collaboration through knowledge services.

Overcoming key challenges

Having explored the theoretical elements that make up a successful PBS, as well as the key challenges to be faced, it is important to understand the optimal approach to avoid the pitfalls and challenges set out above. There are many factors to be considered in successful implementation, the most important and how they should be addressed are:

1. Identify the business problem and the pattern required for identification and resolution.

2. Identify success factors, investment costs and key risks. Understand how success will be measured and seek to demystify the use of a PBS.

3. Identify tooling and key skills that will be required to successfully execute the PBS project.

4. Identify required data sets and information sources.

5. Engender a spirit of open innovation and collaboration within the PBS team and with key suppliers. Solicit input from all parties and encourage disruptive thinking and challenges to 'business-as-usual' processes.

6. Understand (at least as an initial hypothesis) how to first react to patterns. For example, in the churn management example focus was on retention campaigns for key influencers within the social network. Build in 'feedback loops' for continuous pattern refinement and improved accuracy in identifying the pattern's key traits.

7. Develop a project exit plan which takes the learning and new thinking into an ongoing line of business. This will provide a strong foundation for taking the PBS forward and developing it into a more central business function. This, in turn, provides low risk 'stepping stones' to progress through the various stages of the Maturity Model discussed below.

The implementation of a PBS management strategy is closely linked to the establishment of a PBS Maturity Model. This model can be used as the starting point (assessment) in the definition of a PBS for a company, establishing where they are and giving the input to define a roadmap for PBS implementation within the organization.

At the embryonic stage, the identification of patterns, data sources and target projects is the first step. Setting achievable goals and timescales, and putting in place mechanisms to measure success and return on investment are essential. This helps the organization identify 'quick wins' and will also highlight key areas where business change and business culture will need further examination.

PBS Maturity Model

Level/ Dimension	Management & Organization	Processes & Procedures	People & Culture	Technology
Level 0	Nothing Defined	Nothing Defined	Nothing Defined	Nothing Defined
Level 1	Accountability not fixed. Isolated departmental initiatives.	No formal procedures and limited attention to create a lean process for PBS. Business processes are not prepared to be modified as quick as it may be needed (not SOA/BPM).	Limited awareness and personal attention for PBS.	Spreadsheet/Desktop based and no automatic generation. Departmental initiatives isolated from global IT strategy.
Level 2	There is a Competence Center defined, but just with IT scope. Accountability is appointed in a person or department. Used for Decision-making support (Tactic).	Pattern analysis is well established, but just used within an Operational scope. Business process architecture is adaptive and flexible. Process Compliance monitored. Internal Transparency in processes achieved.	Management is aware of possibilities and advantages of PBS. Internally, staff assume a culture based on Change management and performance management. Internal transparency is established.	BI tooling and data mining techniques are used for detection of patterns. Collaboration tools used internally.
Level 3	Part of the meeting agenda of the highest management team. PBS, through PMCC, is an established function within the organization aligning both Business and IT. Used for defining corporate strategy, enabling Transparency. Open Innovation is supported.	Tactical and strategic management processes are aligned/based on PBS. Process is described and compliance monitored. Speed of creation is fast (day by day detection and analysis). Working closely with third parties (external Transparency).	Day-by-day management aligned with PBS. Use of PBS is broadly accepted within the organization and employees have a proactive attitude, looking and proposing patterns. There is a culture of transparency and cooperation with external players.	Beyond BI traditional tools, SNA tools and collaboration pattern seeking is implemented. Partnership with niche players. Collaboration tools used for Open Innovation.

Atos' position

Atos has designed and implemented systems covering the entire lifecycle of PBS, many of them at a research level. Some examples of Atos' experience include:

- Atos has a long and proven track record in implementing global I&C (Instrumentation & Control) systems (including Supervisory Control And Data Acquisition (SCADA), Simulator and PLC) in nuclear power plants (France, China, Russia, UK). Atos has developed ADACS: Advanced Data Processing and Control System, a SCADA for large systems. The ADACS Solution is the culmination of experience acquired from more than 200 control system installations, primarily in monitoring and operating nuclear power plants, as well as the supervision and centralized technical management of large systems.

- Atos has led the project for the development of DEWS (Distant Early Warning System), a system to detect tsunamis in the Indian Ocean. DEWS only takes 10 minutes to gather information from sensors spread across the Indian Ocean, analyzing and raising a tsunami early alarm if applicable.

- In the security domain, Atos has developed high expertise in Information and Event Management systems (SIEM). As IT Partner of the International Olympic Committee, during the Athens Olympics, Atos solutions recorded and automatically classified 4.7 million security alerts, identifying 425 serious and 20 critical threats – all of which were successfully isolated.

- Participation in research projects related to the management of risks like ORCHESTRA (http://www.eu-orchestra.org/), a pan-European platform for assessing natural hazards and MASTER (http://www.master-fp7.eu/) which deals with security hazards in distributed systems.

- Atos is working on the development of a semantic multimedia search engine (for the Spanish-speaking community), that, based on a multimedia, multi-language and multi-domain ontology (M3), allows patterns to be searched for inside any type of media format using natural language processing (http://www.cenitbuscamedia.es).

- Modeling of business process patterns for SMEs within the Commius project (www.commius.eu).

IT companies like Atos need to be prepared to be successful with PBS. They can play a very significant role in several ways:

- By helping companies to define, implement and operate the (potentially complex) architecture on which a PBS relies. To be able to provide this support, IT companies should first have a clear understanding of all the required elements and how they relate to each other (BI, BPM, CEP and SOA, as well as business change and strategic agility).

- Pattern management can be used by IT companies as an element to empower/enhance their existing solution offerings. For example, specifically for Atos:
  - Using pattern analysis in Demand Management to define/adapt services offered by Atos WorldGrid.
  - Creating a new offering around Social Network Analysis.
  - Offering cloud services to implement the processing capabilities that pattern analysis requires.
  - Enhancing the HTTS (High-Tech Transactional Services) offering with advanced pattern analysis (for example, real-time fraud detection in payments).

- Providers that work as an outsourcer of business processes (for example BPO of payment systems including network operation, operation of back-office centers, etc.) are in a very good position as they can act as an input provider of data for clients (they can manage the data silos on which a PBS operates). They may even provide early business event detection and notification or take the required actions in a SaaS model. This requires outsourcing companies to design and develop the elements that allow offering such services: data models, pattern analysis, notification systems, etc. Confidentiality issues must also be managed carefully.

In order to use pattern analysis and management strategically either internally or to empower their offerings, there needs to be a detailed analysis covering all aspects: specific business areas for application (Energy, Financial, etc.), HW/SW requirements and architecture configuration, niche partner selection (e.g., companies that offer complex statistical pattern analysis for specific business areas), etc. The challenge is complex, but the benefits can be huge.

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About Atos

Atos is an international information technology services company with annual 2011 pro forma revenue of EUR 8.5 billion and 74,000 employees in 48 countries. Serving a global client base, it delivers hi-tech transactional services, consulting and technology services, systems integration and managed services. With its deep technology expertise and industry knowledge, it works with clients across the following market sectors: Manufacturing, Retail, Services; Public, Health & Transports; Financial Services; Telecoms, Media & Technology; Energy & Utilities.

Atos is focused on business technology that powers progress and helps organizations to create their firm of the future. It is the Worldwide Information Technology Partner for the Olympic and Paralympic Games and is quoted on the Paris Eurolist Market. Atos operates under the brands Atos, Atos Consulting & Technology Services, Atos Worldline and Atos Worldgrid.

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