A LOOK AT OBSERVE, ORIENT, DECIDE AND ACT FEEDBACK LOOP, PATTERN-BASED STRATEGY AND NETWORK ENABLED CAPABILITY FOR ORGANIZATIONS ADAPTING TO CHANGE

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ABSTRACT

The aim of this paper is to provide an overview on pattern-based approaches. At first, it introduces the pattern-based strategies. Then, it explores disciplines and technologies to enable business leaders to advance. Advancement refers to shift from traditional information disciplines to seeking patterns of change (from people, process and information) and acting on them. It presents theories, frameworks and the properties available for the achievement of successful leading of the businesses during times of rapid and unpredictable change: Observe, Orient, Decide and Act (OODA) cycle and Pattern-Based Strategy (PBS). Also, it explores ways in which they complement. Lastly, it compares decision loop based on OODA with military Network Enabled Capability (NEC). It discusses how senior executives, planners and architects can apply OODA and PBS. Aforementioned is needed to speed up organizational decision making. Paper explores the possibility of coordinated response to change as well. It relates to organizations that are striving to be adaptable and describes the underlying technology.

Keywords: *adaptive organization, decision loop, decision making, observe, orient, decide and act cycle, network enabled capability, pattern-based strategy*

1. INTRODUCTION

We live in a world of patterns - competitive advantage and survival are about recognizing and acting on patterns before others. Previous strategic planning models were strained to seek changes, predict outcomes, adequately guide decisions and assist leaders in defining governance models that embrace change. Through a focus on pattern-based strategy organizations will move from being ”reactive” to being ”proactive” [6]. The adaptive organization takes immediate action to exploit opportunities or mitigate threats by sensitizing itself to changing patterns. Meanwhile, the reactive organization ponders and waits until all the facts are in, while fast-changing events or circumstances quickly overtake them. It then tries to calculate the impact on operations, customers and partners. Successful organizations are those that adapt to change faster than their competitors, through the appropriate use of information technology (IT). The theories of strategist John Boyd - coupled with Gartner’s Pattern-Based strategy - will provide leaders with the insight and actions they will need to transform their businesses into adaptive organizations. These two approaches complement each other in the following ways:

- Examining the specific challenges facing today’s leaders and explaining how an adaptive organization meets such challenges.
- Learning Boyd’s strategic theories and frameworks - notably his OODA feedback loop - which organizations can use to make their decision-making processes faster and more implicit, empowering individuals on the front lines to adjust the tempo of operations (either speed up or slow down) before competitors.
- Four phases of OODA loop can be mapped to Pattern-Based Strategy, which enables the adaptive organization to quickly transition to a more proactive, ”seek, model and adapt” culture [13].

The topics of the article should be defined clearly and short review of published essential solutions and comparison with the authors results should be given.

2. PATTERNS AND ADAPTABILITY

A business pattern is a set of recurring and/or related elements (business activities, events, weak or strong signals) that indicates a business opportunity or threat.

Pattern-based strategy is defined as the discipline that enables business leaders to seek, amplify, examine and exploit new business patterns. A weak or strong signal is a piece of information, an activity, and/or an event that indicates an impending change that might have an impact on your business pattern.

The aim of business pattern recognition is to understand how elements (activities, events, objects and information) may form new patterns that represent an opportunity for innovation or a threat of disruption to business operations or strategies.

The term ”business pattern framework” refers to an organization’s focus on and its investment in a balanced diversity of business activities (in the defined, creative, collective and exceptions categories) that enable it to lead and respond to weak and strong signals of change (opportunity or threat).

Operational tempo is a focus on disciplines, activities, technologies and resources that gives organizational leaders the mechanisms and controls they need to understand how to enable consistent and repeatable organizational change

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in response to changing patterns [6].

The aim of business pattern recognition is to understand how elements (activities, events, objects and information) may form new patterns that represent an opportunity for innovation or a threat of disruption to business operations or strategy [4].

2.1. Adaptive organization

To become adaptive from today's organizations transition is required from reactive, "sense and respond" decision styles to more proactive "seek, model and adapt" environments. It is this ability to quickly find patterns, understand patterns and change patterns that becomes critical for success in today's highly competitive, highly interconnected environments, where risk and uncertainty often prevail [13]. Adaptive Organizations have the Following Characteristics [17]:

- Modular: Modular organizational units that meet top standards and plug in where and when needed. This enables the firm to introduce and quickly implement product and process variations, adjust resources where and when needed, and ensure that the firm's high standards are being met.
- Knowledge Flow: Organizations that are adaptive work towards having a culture that supports knowledge sharing and constructive debate needed for decentralized decision making to be successful. A free flow of knowledge is important for organizations to intelligently and quickly make changes.
- Guiding Principles: Detailed standard operating procedures (SOPs) are unmanageable for organizations needing to change and improve constantly. Instead, a few guiding principles outline how individuals and teams should interact with each other and make decisions.
- Leadership: Leaders no longer dictate from above. Instead, they provide the context needed to make decisions.
- Experimentation: Adaptive organizations encourage testing, refinement, and smart risk taking through experimentation rather than to simple avoid failure.

2.2. Intelligent Business Operations (IBOs)

Companies in many different industries are improving their effectiveness and efficiency by making certain aspects of their operations more intelligent. Intelligent business operations are a style of work in which real-time analytic and decision management technologies are integrated into the transaction-executing and bookkeeping operational activities that run the business. Intelligent business operations (IBOs) are becoming increasingly practical because of the growing amount of data generated by sources inside and outside the company, and because of the wide availability of software tools to process that data immediately. The relevant technologies include business activity monitoring (BAM) platforms, event-processing platforms, and interactive and graphical business dashboard tools. Many other kinds of business intelligence (BI) and analytic tools, including statistical libraries and math packages, report writers, spreadsheets and query systems, are also relevant when they are used in a real-time mode as an integral part of operational applications and processes. Finally, decision management technologies, including rule engines, constraint-based optimization (CBO) tools and simulation tools, are also applicable when used in real-time mode in operational decision making [15]. Intelligent business operations is also a real-time way of applying Pattern-Based Strategy. The patterns used in Pattern-Based Strategy are almost always patterns of business events, and many of these business events are tied to business operations. Pattern analysis is essential for understanding how events came about (causation), what they mean, how events relate to other events and what to do about them. Understanding the root cause of a situation is often helpful and sometimes essential to correcting or avoiding a problem, or capitalizing on an opportunity. This is a key linkage to Business Process Management [8].

3. INFORMATION AND EVENT-DRIVEN PROCESSING

A critical factor in deriving benefit from Pattern-Based Strategy is having a corporate culture and strategy that facilitates innovation and change. Event-based systems can provide the background information for faster and better decisions, but business leaders must be able to take timely and effective action. The evolution of enterprise and business architecture and IT is helping organizations to become more agile. The growing use of business process management, service-oriented architecture and REST provides the tools and techniques that make it possible to change application systems and business processes more quickly. A wide variety of security applications, including intrusion prevention systems, endpoint protection platforms and application control technologies, apply event processing and Pattern-Based Strategy concepts to apply protection in near real time. Many organizations are fostering a organizational culture driven by performance that can facilitate improvement in organizations behavior in response to change. Speed and flexibility are label of most management strategies of today:

- Time-based competition
- Real-time enterprise
- Zero-latency enterprise
- Agile enterprise
- Adaptive enterprise
- Predictive enterprise.

3.1. Big Data

"Big data" is rapidly becoming a recognized term for the growth in the volume of data in organizations. Understanding how to use Pattern-Based Strategy to seek, model and adapt to patterns contained in big data are a critical IT

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and business skill. It is a term generally used to acknowledge the exponential growth, availability and use of structured and unstructured information in the environment rich of data [5] (p. 39).

The value derived from access to traditional transactional (structured) data was significant, but has now largely become a mainstream activity. Business and technologists are aware that there is even more potential value in evaluating other types of data, some that currently exist in the enterprise as well as some new types of it. Many organizations have collected and stored data for years and have never attempted to analyze it or look for patterns, because the business need for doing so didn't exist. A few examples are:

- An engineering and construction firm with years of project data (documents/text) that could be analyzed to look for patterns to help current and future projects.
- An insurance company with a desire to analyze petabytes of claims information (text, video and image) seeking information.
- A U.S. Department of Defense (DoD) organization with a desire to analyze logistics information (text, image) to ensure that supplies reach critical locations.

In addition to the opportunity of data currently stored in enterprises, there is a new world of data emerging from sources like social media and mobile devices. In social media, the ability to connect with groups of external constituents (customers, suppliers, partners) becomes real. This new connection point goes beyond contact only; it provides access to information that can enable relationships, reach new prospects, tell organization how to improve customer retention, and give specific information back to individuals and groups.

Similar to social media, mobile devices are permeating business and personal lives. With mobile devices comes contextual information about individuals and their locations, desires and interests. Applications used on these devices often ask if they can access personal profile or contextual information that can, in turn, be used to target specific user wants and needs.

These additional sources of information (current unused enterprise information, social and context) represent big opportunities and also big challenges. The market at large has started to talk about big data as a disruptive force and an immediate problem that is already affecting traditional business models. By sweeping away current limitations derived from data constraints and exploiting existing enterprise data and publicly available data from external sources, a new era of digitally accelerated business models emerges that has the potential for competitive advantage:

- In general business, the opportunity to discover unknown and unused behaviors has led to better understanding about the boundaries of customer engagement, and the opportunity to influence relationships between individuals.
- In crime prevention/intelligence, better analysis of patterns and the incorporation of data from more sources have helped deliver more-accurate intelligence and reliable resolution.
- In online businesses, a better understanding of customer preferences and social interactions supports enhanced cross-selling, upselling and recommendation engines.
- In the public sector, real-time detailed information regarding traffic flows, vehicle locations and resource use (e.g. energy, water) supports the optimization of service delivery and efficiency across a wide range of public services.
- In retail, enhanced insights and understandings of customer likes, dislikes, influences and behaviors have led to increased sales and stock-holding efficiencies.
- In supply chain management, understanding patterns of opportunity or disruption across the demand value chain has improved ability to move goods and services between organizations.
- In healthcare, breakthroughs in understanding, diagnosing and treating diseases have come about through enhanced statistical knowledge, rather than individualized expertise.
- In utilities, enhanced understanding of individualized use patterns and the ability to better manage demand, rather than supply, have been enabled through personalized approaches and the broader incorporation of external demand influences [5] (p. 41).

Business leaders and technologists have traditionally focused structured data-seeking efforts on answering two questions - what happened and why did it happen? Mostly, investments in business intelligence delivered reports that helped in this area. But business leaders are asking three new questions: What is happening right now? What is likely to happen? What events could affect the future? Technology to help with these new questions exists. By connecting technology to business leaders' needs, there is an opportunity to improve the business. The deep technology basis of big data represents exactly the type of technology-enabled new business opportunity that offers an almost limitless platform to develop competitive advantage and new revenue. IT leaders must not become focused on the obvious issue of volume of big data alone. The ability to mine data with scale provides a quantitatively greater understanding of the underlying physical, societal, financial and business environment. Organizations that successfully master the technical challenges will find themselves better equipped with more-accurate data about their present situations, able to create more-accurate forecasts about the future and an almost prescient ability to spot subtle changes in dynamic and volatile markets, and make the right choices to benefit from their new knowledge. Such benefits may be realized by organizations that not only seek new information,

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but that understand how to adapt the organization - people, processes, information and technology.

Access to the information should lead to better, faster and more informed decision making and actions. Business leaders and technologists need a model to help with this cycle. For this reason, Gartner have introduced Pattern-Based Strategy, which explores the disciplines and technologies necessary to seek information from current and emerging sources (e.g., big data), model the impact of the findings, make decisions and adapt the organization. Many of the technologies and disciplines in PBS seek, model, adapt cycle cross large technology markets - business intelligence, analytics, context-aware computing, social media, business process management, performance management, complex-event processing, information management and other in order to perform a more efficient and more impactful information, decision and action cycle [5].

3.2. Event Processing

Complex event processing (CEP) software aggregates information from distributed systems in real time and applies rules to discern patterns and trends that would otherwise go unnoticed. This gives companies the ability to identify and anticipate opportunities represented by seemingly unrelated events. With CEP, businesses can map discrete events to expected outcomes and relate series of events to key performance indicators (KPIs). CEP gives businesses insight into which events will have the greatest operational impact so they can focus their resources to seize opportunities and mitigate risks [18].

- Companies that pursue PBS need to process event data in two different ways: Offline and ad hoc query business intelligence (BI) systems process events "at rest" in a file or database; Event-driven, continuous-intelligence systems process events that are "in motion" as arriving notifications.

- A continuous-intelligence application does more than receive information. It evaluates it, performs automated analytics, and either decides how to respond or passes information to a person for further analysis.

- Complex-events processing is the underlying technology used to implement the sophisticated, event-driven pattern detection aspects of business activity monitoring (BAM) and security information and event management (SIEM) systems [14] (p. 39).

Event processing encompasses a set of principles, reference architectures, design patterns, technologies and best practices directed at the use of event data. The patterns used in PBS are almost always patterns of business events. The concept of an event is general - an event is anything that happens. It can be something that happened in the past, will happen in the future or happens only in a dream, a simulation or in virtual reality (a "virtual" event). An event can also be described as a meaningful change in the state of any system. A business event is any event that is relevant for conducting commercial, industrial, government or trade activities. Examples include hiring a new employee, a change in bank interest rates, receiving a shipment, experiencing a power outage, making a bank payment, suffering a network security breach, a change in a competitor's price and detecting signs of attempted fraud.

The absence of an event is itself an event in some scenarios. A person might click through a sequence of Web pages (each page view is an event), but not buy anything. The absence of a purchase event within a defined time frame is an event that has business significance. Events are happening continuously within an organization, among its trading partners and in the larger world.

Events are abstractions, so computers can't deal with them directly. Computers deal with digital representations of events called event objects. Within a computer, an event object can be any form of data, such as an XML document, an HTML Web page, a database row, a one-bit semaphore or a complex data structure in memory. Event data is transmitted from an event producer (a person, program or device that emits the event object) to an event consumer (a person, program or device that receives it) in a notification. A notification is a signal that informs the recipient that something happened. It may contain a large amount of detailed data or no data at all, depending on how the architect has designed the application. Notifications can take the form of e-mail messages, Short Message Service (SMS) messages, other kinds of messages, (remote) procedure calls or shared data. E. g. Really Simple Syndication (RSS) news feed message that informs a person about a hike in interest rates is a notification. An e-mail that contains data about hiring an employee is a notification that signifies i.e. signals a hire event. Hiring an employee is considered to be a "complex" event, because it encompasses multiple related activities, whereas a change in interest rates would generally be treated as a "simple" event, because it is a single, apparently atomic, fact. A company that is pursuing a Pattern-Based Strategy will generally need to process event data in two fundamentally different ways:

- Traditional application reports and most BI systems, including most performance management and other analytical systems, process events that are "at rest" in a database, file or some other structure on disk or in memory. The event data is received, stored and then processed at a later time. Computation is triggered by a request from a person or application program (for example, an ad hoc interactive query), or by a clock (for example, a dashboard that is refreshed every hour or a daily report). These request-driven and time-driven systems are appropriate when the response to new data does not have to happen immediately. BI systems discover previously unknown patterns and detect new instances of (matches to) known patterns.

- Event-driven, continuous-intelligence systems process events that are "in motion" as notifications. Computation is triggered by the arrival of event data. Every time a new notification is received, the system recalculates. Continuous-intelligence systems pro-

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vide the situation awareness needed to make good decisions based on pattern detection in circumstances when a response is needed in minutes, seconds or milliseconds. Many continuous-intelligence systems are aimed at BAM. Both kinds of systems find pattern matches and apply other kinds of algorithms and rules to event objects, so both are ”event-processing systems” in a general sense. However, the terms ”event processing” and ”complex-event processing” are generally applied only to the second kind of system: event-driven, continuous-intelligence systems. The two modes of operation are complementary. For example, SIEM systems provide both continuous monitoring on events in motion and offline, ad hoc query analytic capabilities on events at rest. The continuous-intelligence monitor may alert a security practitioner that a user did something odd. The practitioner then issues a look-back query into historical event data to investigate what else this person did in the past and who else has done something similar.

Pattern-Based Strategy uses events to address unforeseen, as well as foreseeable, threats and opportunities [14].

3.3. CEP Technology

Event processing is a multifaceted phenomenon. In the context of a Pattern-Based Strategy, the relevant facet of event processing is its event-driven BI (BAM) facet, in contrast to its orchestration or minimally coupled software engineering facets. BAM uses CEP in situations that require sophisticated pattern detection and low-latency computation. BAM applications do not need CEP when the calculations are simple or when the results are not needed quickly. Almost all of SIEM systems implement CEP for parts of their operation, because the event data is collected, parsed and analyzed in near real time (via cross-event-source correlation rules or statistical correlation). The response in a SIEM system is typically an alert.

Event processing in a Pattern-Based Strategy context uses CEP software to do the following:

- Read through the incoming notifications and discard those that are irrelevant to the task at hand (filtering or screening the data).
- Enrich the event data by adding data from other sources.
- Calculate totals, averages, maximums, minimums and other aggregate figures.
- Detect pattern matches in the incoming notifications (this requires saving sets of events that are partial matches to patterns for a period of time that may be measured in milliseconds, minutes, hours, days or longer).

CEP, as with other kinds of BI, is used for both descriptive and predictive analytics in Pattern-Based Strategy. Descriptive analytics describe things that have already happened, while predictive analytics uses patterns and trends to foretell what will happen or might happen if nothing is changed. The advantage of predictive analytics is when, for example, a smart-grid CEP system may warn an electric utility that increases in power consumption correlated with a failed substation will lead to a brownout that will occur in an hour. The utility may be able to reroute power through an alternative part of the grid, or find another source of power before customers suffer a loss or degradation of service. Hundreds of thousands of smart meter readings from thousands of locations at four-second intervals are the base (input) events. CEP software distills the readings into a handful of complex (derived) events that summarize the total power consumption for the neighborhood and the larger region at 10-minute intervals. These complex events are fed into the next computing step that forecasts power consumption for the next few hours, taking into consideration historical trends and context information, such as the time of day and the weather forecast. Finally, the application correlates the substation failure event with the electrical power demand forecast to recognize a threat situation.

In Pattern-Based Strategy terminology, the meter readings, weather forecast and notification of substation failure are leading indicators, signals of a potential future - in this case, unwanted - outcome. In CEP terminology, the meter readings, weather forecast, substation failure and the potential brownout are all events, related by a known pattern. A complex event is an abstraction of one or more simpler contributing base events; a complex event evaluated in context is a situation. Information about this particular risk situation is conveyed to grid operators through a dashboard or some other communication channel. In CEP terminology, the message to grid operators is another event notification. A notification that intended to cause a response may also be called an alert.

One of the benefits of viewing all these things as events is that a model of one part of a company’s operations can be understood in relation to a model of another part of its operations. The model in the example given considered the alert sent to the operator as the endpoint culmination of the computation. However, that alert might also be a simple base (input) event for another CEP model that predicts profit problems for the utility company that week by correlating this brownout with other brownouts, blackouts and increases in fuel prices. Because everything that happens is just an event, each event can be output, input or both for the purposes of the event modeling and event computation.

Causation is a major issue in Pattern-Based Strategy and in the design of CEP systems, although the discipline of event processing uses a mathematical concept of causation that differs slightly from the concept of causation in everyday life. In event processing, an Event A is said to have a causal relationship with Event B if A had to happen first in order for B to happen. In the example given, the substation failure was causal to the brownout event, and the high power demand event was also causal. Brownout, on the other hand, would not have occurred if the substation failed in the absence of high power demand; similarly, the brownout would not have occurred if the substation had not failed despite the high power demand. In event processing, causation implies necessary (it had to happen), but not al-

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ways sufficient. This distinction is important when designing a CEP application. The pattern will only match if all the causal events occur. Nevertheless, CEP can accommodate circumstances where there are multiple possible ways to arrive at the same outcome by using multiple event templates or a template that includes "OR" operators. A brownout event could also occur if a tree falls on a power line - a separate pattern from the substation failure/high demand pattern [14].

As mentioned above, CEP is also effective in Pattern-Based Strategy where the absence of an event is significant. E.g. CEP-based, process-monitoring tool can be used to monitor the loan process in a large bank. The tool has a model of how the loan process works. It runs continuously, listening to events that report loan application events, credit check events, loan approval events, disbursement request events and disbursement events. If the CEP-based monitor tool receives a disbursement request event for which there was no associated loan application, credit check or approval event, then the expected pattern match is not achieved. The lack of a match indicates that a fraud situation is likely - a request for disbursement has been generated without the proper previous activities (the expected earlier events are absent). The application generates an alert to trigger investigation before the disbursement is allowed to take place. CEP systems can flag situations that are abnormal because of a pattern match, the absence of a pattern match or because a single value is above or below a certain threshold [14] (p. 47).

4. THE COMPARISON OF OODA AND PBS

Gartner's Pattern-Based Strategy is based on a set of disciplines and technologies for succeeding in environments dominated by rapid and unpredictable change. The core concept of "seek, model and adapt" complements Boyd's principles and practices. His theories on rapid decision making were derived from experiences and analysis of the split-second actions and survival tactics required of fighter pilots during aerial combat. His strategies were said to have revolutionized aerial combat and energy maneuverability. His teachings and theories on pattern recognition, rapid decision making and fast transitions greatly influenced military and government institutions, such as the U.S. Marine Corps (USMC) and the U.S. Department of Defense. Over the years, Boyd's teachings have been translated by leading business journals. Likewise, his models and theories for spotting patterns, using active feedback loops to speed up one's tempo, and promoting decision making at the edge of the enterprise have been applied by leading businesses when adapting to environments of rapid and unpredictable change [13].

4.1. OODA feedback loop

Originally developed by a United States Air Force Colonel, John Boyd, for aerial combat, OODA can be applied to competitive business scenarios where knowledge of an opponent's behavioral patterns can be exploited through fast and agile anticipatory action. For example, traders in capital markets use event-processing technology to evaluate competitors' trading strategies in the context of the market conditions and current economic data. They are able to modify their pattern-based trading strategies over night or, sometimes, even during the day. This style of trading implements many of the principles of OODA. The drive for faster and better event-processing and messaging technology in capital markets has been compared to an arms race. However, the nearly 1,000-point plunge of the Dow Jones Industrial Average within a few minutes on the afternoon of 6 May 2010 was the result of flaws in the way OODA was implemented by certain players in equity-trading markets. OODA is representative of one of the many ways that event processing can enable advanced Pattern-Based Strategy when implemented properly, but it is not appropriate for all circumstances, and it can be misused [14].

Boyd attempts to provide a philosophical foundation for his theories on warfare. In it he integrates Gdel's Incompleteness Theorem, Heisenberg's Uncertainty Principle, and the Second Law of Thermodynamics to provide a context and rationale for the development of the OODA Loop. He inferred the following from each of these theories:

- Gödel's Incompleteness Theorem: any logical model of reality is incomplete (and possibly inconsistent) and must be continuously refined/adapted in the face of new observations [2] (p. 42).
- Heisenberg's Uncertainty Principle: there is a limit on our ability to observe reality with precision. The Indeterminacy Principle uncovered by Werner Heisenberg in 1927 showed that one could not simultaneously fix or determine precisely the velocity and position of a particle or body. Specifically he showed, due to the presence and influence of an observer, that the product of the velocity and position uncertainties is equal to or greater than a small number (Planck's Constant) divided by the mass of the particle or body being investigated [2] (p. 43).
- Second Law of Thermodynamics: The entropy of any closed system always tends to increase, and thus the nature of any given system is continuously changing even as efforts are directed toward maintaining it in its original form [2] (pp. 43-44).

Boyd concluded from this set of considerations that to maintain an effective grasp of reality one must undergo a continuous cycle of interaction with the environment geared to assessing its constant changes. He suggests that natural selection applies also in social contexts (such as the survival of businesses in free market competition). He integrated these two concepts and stated that the decision cycle was the central mechanism of adaptation in social systems and that increasing one's own rate and accuracy of assessment related to one's counterpart's rate and accuracy of assessment provides a substantial advantage in many forms of competition. The most important for survival and autonomy is not perfect adaptation to existing circumstances but the ability to adapt to change. He noted that radical uncertainty is a necessary precondition of physical and mental

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vitality: all new opportunities and ideas spring from some mismatch between reality and ideas about it, as examples from the history of science, engineering and business illustrate [1].

Boyd's key concept was that of the decision cycle or OODA Loop, the process by which an entity (either an individual or an organization) reacts to an event. According to this idea, the key to victory is to be able to create situations wherein one can make appropriate decisions more quickly than one's opponent. The construct was originally a theory of achieving success in air-to-air combat, developed out of Boyd's Energy-Maneuverability theory and his observations on air combat between MiGs and F-86s in Korea.

Time is the dominant parameter. The pilot who goes through the OODA cycle in the shortest time prevails because his opponent is caught responding to situations that have already changed [9].

Boyd hypothesized that all intelligent organisms and organizations undergo a continuous cycle of interaction with their environment. Boyd breaks this cycle down to four interrelated and overlapping processes through which one cycles continuously:

- Observation: the collection of data by means of the senses
- Orientation: the analysis and synthesis of data to form one's current mental perspective
- Decision: the determination of a course of action based on one's current mental perspective
- Action: the physical playing-out of decisions

While aforementioned is taking place, the situation may change. Sometimes it is necessary to annul a planned action in order to meet the changes. This decision cycle is thus known as the OODA feedback loop. Boyd emphasized that this decision cycle is the central mechanism enabling adaptation and is therefore critical to survival.

Large organizations such as corporations, governments, or militaries possess a hierarchy of OODA loops at tactical, grand-tactical (operational art), and strategic levels. In addition, he stated that most effective organizations have a highly decentralized chain of command that utilizes objective-driven orders, or directive control, rather than method-driven orders in order to harness the mental capacity and creative abilities of individual commanders at each level. Such a structure creates a flexible organization that is quicker to adapt to rapidly changing situations. Any such highly decentralized organization would necessitate a high degree of mutual trust and a common outlook that came from prior shared experiences. Headquarters needs to know that the troops are perfectly capable of forming a good plan for taking a specific objective, and the troops need to know that headquarters does not direct them to achieve certain objectives without good reason [1].

A pilot is constantly going through OODA loops or cycles in a dogfight: he tries to observe the enemy as best he can, this observation being somewhat fluid, since nothing is standing still and all of this is happening at great speed. With a lightning-quick observation, he then must orient this movement of the enemy, what it means, what are his intentions, how does it fit into the overall battle. This is the critical part of the cycle. Based on this orientation, he makes a decision as to how to respond, and then takes the appropriate action. In the course of a typical dogfight, a pilot will go through maybe a dozen or so of these loops, depending on how complicated the fight, and how fluid the field. If one pilot can make faster decisions and actions, based on the proper observations and orientations, he slowly gains a distinct advantage. He can make a maneuver to confuse the enemy. After a few such maneuvers in which he is slightly ahead in the cycles, the enemy makes a mistake, and he is able to go in for the kill. Boyd calls these fast transients, and if you are ahead in these transients, the opponent slowly loses touch with reality. He cannot decipher what you are doing, and as he becomes increasingly cut off from the reality of the battlefield, he reacts to things that are not there, and his misreactions spell his death [7].

4.2. Observe

The first step in the Boyd loop, Observe, is the process of scanning the environment to find correlations, mismatches or disconnects to existing business patterns. It maps to the Seek phase in Pattern-Based Strategy, in which organizations spot strong or weak signals that could indicate new opportunities or threats. Signals can be found among machine readable sources (such as financial information, customer transactions and inventory data) or emerging sources (such as text, speech, video, social media, blogs, news feeds and context-aware devices). Examples of Pattern-Based Strategy processes and technologies to improve pattern-seeking include:

- Predictive analytics and fraud detection technologies that identify strong or weak signals, indicating possible patterns that could have a positive or negative impact on strategy or operations.
- Business activity monitoring (BAM) that provides real-time situational awareness, along with access to, and analysis of, critical business performance indicators. Using event-driven sources of data, BAM keeps track of what is happening now and raises awareness of issues as soon as they are detected.
- Social-network analysis tools that analyze patterns of relationships among people in groups.

4.3. Orient

The second element in the Boyd loop is the process of making sense out of observations and recognizing new patterns within the environment. During this step, teams put observations into context, combine signals with other information, form new perspectives, and generate new patterns for analysis and synthesis. Hypotheses are developed about emerging patterns, including the intentions of competitors.

The Orient step maps to the Model phase in Pattern-Based Strategy. Pattern generation and recognition activities analyze indicators of change based on prior models,

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lessons, insights or experiences. Since any new pattern could potentially signal new opportunities or threats, organizations must establish the appropriate governance mechanisms and metrics to quickly analyze and synthesize the impact of such patterns. This is a cultural change for many organizations. Historically, decision making and recommendations were based on the retrospective analysis of lagging indicators of change (for example, what happened in the context of prior performance). In Pattern-Based Strategy, decision cycles are accelerated through prospective and predictive analysis of leading indicators (for example, what is happening now and why). This organizational shift in mind-set is called the performance-driven culture. The concept of a performance-driven culture is a change in management style that shifts from a "rearview-mirror perspective" that is focused on financial measures, to a perspective focus that uses leading performance indicators and weak signals to actively seek and then act on patterns. For Boyd, the Orient phase is the most important part of the OODA loop because it shapes the way we observe, the way we decide and the way we act. However, this is also the most-difficult portion of the OODA process for many organizations. The OODA feedback loop was initially developed to aid the individual decision maker (in Boyd's case, the split-second decisions, actions and survival tactics required of fighter pilots during aerial combat). However, most business decisions involve groups of creative individuals observing and orienting, each bringing his or her viewpoint, experiences, biases and perspectives. Consequently, this is where organizations may get bogged down in the Boyd loop. To avoid potential bottlenecks, the adaptive organizations build environments that support trusted and transparent sharing of enterprise information. These organizations develop information-sharing environments (following the principles of Web-oriented architecture) to make information more interpretable and shareable, and to speed up pattern recognition, pattern matching and decision making. Information-sharing environments "grow the pie" by ensuring that the right information is shared among those who have it and those who need it [7]. Pattern-Based Strategy advocates an information-sharing environment and performance-driven culture that includes the following technical capabilities:

- Visualization technologies are critical to pattern recognition, enabling users to see patterns that they otherwise would not have recognized.

- Predictive modeling solutions (a form of data-mining technologies that work by analyzing historical and current data) generate new models to help predict future outcomes.

Next is the fusion of orientation results - an amalgamation of analytical efforts, a synthesis and evaluation of generated patterns, and a consensus-building exercise for determining how best to adapt to new patterns in the environment. This is necessarily a collaborative process to build buy-in for the resulting decisions and actions.

4.4. Decide

Decide is the process of knowing what to do. This involves developing the best possible action plan that can be carried out in a timely manner. Here, teams must incorporate any learning from past decisions. Knowing how successful (or not) previous actions were requires keeping track of past decisions and their outcomes. This step in the Boyd loop is the first part of the Adapt phase in Pattern-Based Strategy. Teams make decisions and take actions, which speed up or slow the tempo of operations. Their goal is to seize new business opportunities or counter new threats before competitors. The adaptive organization gains advantage by matching "pace" (how operations are run on a daily basis) to "purpose" (how operations support strategic objectives). Examples of techniques and capabilities within Pattern-Based Strategy that influence the tempo of operations are:

- Business pattern frameworks, which enable organizations to focus their decisions on a balanced diversity of organizational activities (in the defined, creative, collective and exceptions categories). This enables teams to decide which opportunity or threat is most critical.

- Collaborative decision-making platforms, which combine business intelligence with social networking, collaboration, decision tools and workflow. This enables teams to make and capture higher-quality decisions and actions.

4.5. Act

Act is the fourth element in the Boyd loop. This is the process of carrying out decisions - decisions that have buy-in and accountability generate actions that are easy to align with specific decisions made. The opposite is also true: If a decision is made, but not followed, the problem must be traced back to earlier OODA steps.

Act is the second part of the Adapt phase of Pattern-Based Strategy. The following tools and disciplines enable organizations to implement actions to drive adaptive change:

- Operations planning and modeling tools analyze new patterns to determine potential outcomes, shifts in resource demands and the accompanying financial transformations. These tools help to simulate and implement changes in business conditions, allowing them to dynamically optimize their resource allocations (personnel, materials, financial capabilities and organizational design).

- Business process management (BPM) is a discipline and set of technologies that treats processes as assets, which can contribute directly to enterprise performance. BPM achieves operational excellence through process effectiveness and other measures of agility and adaptability.

Once the result of the action is observed, the cycle is repeated again and again in a continual process of proactively monitoring the environment for new opportunities or

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threats. Through the ongoing process of finding patterns, understanding patterns and changing patterns, adaptive organizations achieve advantage over their competitors - who can only react to conditions after they occur, and may lack a shared awareness about emerging patterns.

4.6. Appliance of OODA and PBS

The concept of "implicit guidance and control" is shown in Figure 1 at each step in the OODA loop. Boyd pleaded for decentralized form of management, even though he was a product of the military's command-and-control organizational structure. Leadership means providing direction and setting the right tone, or context, for behavior.

To become an adaptive organization, senior executives must ensure that the values of trust and accountability are embedded into the culture of the entire organization. Leaders empower the creative abilities of people at each level of the organization. The goal is to establish a more flexible, "organic whole" that will quickly maneuver and adapt to change. This requires mutual trust and authority and a shared commitment to strategic objectives. In the adaptive organization, senior leaders need to trust that people at all levels in the organization are perfectly capable of forming a good plan for accomplishing strategic objectives. In addition, individuals in the organization need to know that senior leaders do not direct them to achieve certain objectives without good reason.

Figure 1 maps Boyd's OODA loop to Gartner's Pattern-Based Strategy. Reviewing this mapping will help organizations gain insight into the underlying processes required to transition from reactive, "sense and respond" decision styles to more proactive "seek, model and adapt" environments. It is this ability to quickly find patterns, understand patterns and change patterns that becomes critical for success in today's highly competitive, highly interconnected environments, where risk and uncertainty often prevail.

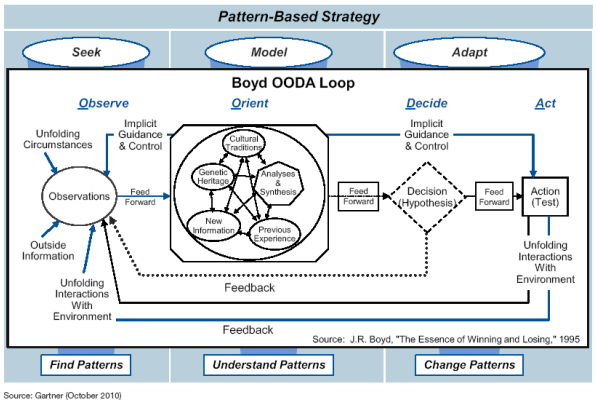

Fig. 1 OODA steps and PBS phases mapping

By examining the phases of Boyd's loop in the context of Seek (finding potential patterns), Model (understanding and generating new patterns) and Adapt (changing patterns through right actions), organizations will gain a deeper understanding of how his teachings and theories complement Gartner's Pattern-Based Strategy.

4.7. Decision Loop and Network Enabled Capability (NEC)

North Atlantic Treaty Organization (NATO) NEC is the linking of sensors, decision makers and weapon systems so that information can be translated into synchronized and overwhelming military effect at optimum.
For example, NEC will enable NATO to operate more effectively in the future strategic environment through the more efficient sharing and exploitation of information within the Alliance and with coalition partners [10].

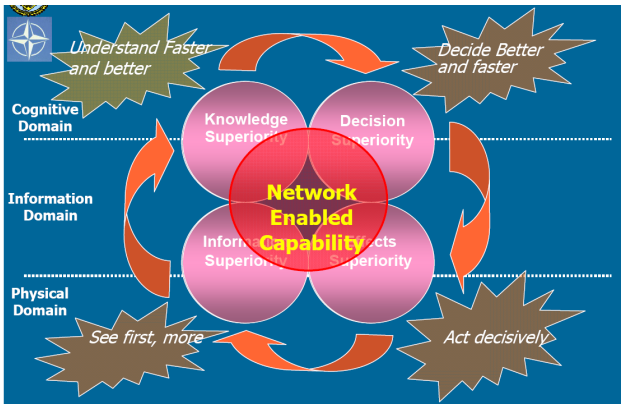

Fig. 2 NEC and the Decision Loop based on OODA

This will lead to better situational awareness across the board, facilitating improved decision-making, and bringing to bear the right military capabilities at the right time to achieve the desired military effect. In this case (figure 2) information superiority, knowledge superiority, decision superiority and effect superiority correspond to observe (understand faster and better), orient (see first, more), decide (better and faster) and act (decisively) elements of OODA, respectively. Above mentioned occurs within cognitive, information and physical domain [10].

5. CONCLUSION

In this contribution we presented Boyd's OODA loop and strategies (which are, in part, based on the air-to-air combat experiences of fighter pilots during wartime) and Gartner's Pattern-Based Strategy. The difference between Boyd's approach and Pattern-Based Strategy is that Gartner chooses to emphasize the social and collaborative value of teams that interact, create insights, share information, recognize and generate patterns of opportunity, make decisions, and contribute meaningfully to the attainment of strategic goals.

Authors contribution in this paper is in exploration of the ways in which decision loop based on OODA and PBS complement to each other. Also it explores the complementation of OODA and military NEC. Taking into account the people as one of the most important resources within organization authors discuss how senior executives, planners

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and architects can apply OODA and PBS. As a contribution authors explore the possibility of organizations coordinated response to change which they are faced to. As final contribution, authors describe underlying technology.

In their breakthrough book "Competing Against Time," authors George Stalk and Tom Hout summed it up best: "A time-compressed company does the same thing as a pilot in an OODA loop. It's the competitor who acts on information faster who is in the best position to win [16].

Gartner agrees with Boyd's teachings that being time-competitive is critical to success when operating in environments of rapid and unpredictable change. As Boyd noted several times, doing things at the right time is more important than doing them at the right place. For organizations implementing Pattern-Based Strategy, there are many lessons to learn from Boyd's work.

One of the most sophisticated techniques for applying event processing to operational behavior is the observe, orient, decide, act (OODA) loop [14]:

- Observe is comparable to the seek and listen stages of Pattern-Based Strategy.
- The combination of orient and decide is comparable to the model and compute stages.
- Act maps to the adapt and response stages of PBS.

Pattern-based approaches enables business leaders to seek, model and adapt to new and emerging business patterns that could represent opportunities and threats. Pattern detection is not new. Any human activity involves pattern seeking and modeling - for example, making a business decision or identifying a potential problem are all about pattern seeking and modeling. What's different today is that a growing number of information technologies can be used for certain types of pattern matching (finding new instances that match a known pattern) and pattern discovery (finding a new pattern), which leverage the growing volume of data and events available that otherwise would be impossible for people to seek and model in an effective manner. Gartner introduced Pattern-Based Strategy as a new discipline in 2009, with a focus on helping business leaders to move from reacting to events that had major effects on business strategy and operations, to proactively seeking and adapting to patterns that might indicate an emerging event (threats and opportunities) [4].

Because of its event-driven nature, event processing is particularly relevant to Pattern-Based Strategy that deals with short-range operational decisions that are carried out in minutes, seconds or milliseconds. Event processing is less relevant to tactical and strategic PBS where decisions are made and put into action over days and weeks. Traditional performance management and other BI approaches are more appropriate for those kinds of issues [14].

The ability to quickly find patterns, understand patterns and change patterns is critical in today's highly competitive, highly stressful environments, where risk and uncertainly often prevail. OODA feedback loop makes the decision-making process implicit: Empowered individuals adjust the tempo of operations (either speed up or slow down) faster than their competitors. Pattern-Based Strategy enables organizations to quickly recognize and generate patterns, and it provides the disciplines and technologies for doing so. Boyd's theories on strategy, including his famous OODA loop, complement Pattern-Based Strategy's seek, model and adapt cycle of change. Pattern-Based Strategy complements Boyd's emphasis on the need to quickly identify, analyze and synthesize patterns to gain competitive advantage. Trust and accountability are essential for an adaptive organization. Leaders who empower individuals with implicit guidance and control will establish organizations that proactively seek, model and adapt to patterns of change better than their competitors.

The adaptive organization gains advantage by matching "pace" (how operations are run on a daily basis) to "purpose" (how operations support strategic objectives) Gartner originally labeled this concept as "optempo advantage" - a discipline for improving an organization's competitive rhythm, so that it can consistently and dynamically respond to patterns of change. Gartner is renaming this aspect of Pattern-Based Strategy as "operational resilience." Future research will explore how operational resilience supports Pattern-Based Strategy [13].

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REFERENCES

[1] ALBERTS, D. S. – HAYES, R. E.: Power to the Edge: Command...Control...in the Information Age, http://www.dodccrp.org/files/Alberts_Power.pdf, Command and Control Research Program (CCRP), 2003.

[2] BOYD, J. R.: Destruction and Creation, U.S. Army Command and General Staff College, 1986.

[3] BOYD, J. R.: Patterns of Conflict, U. S. Army Command and General Staff College, 1976.

[4] BURTON, B. – GENOVESE, Y. – RAYNER, N. – CASONATO, R. – SMITH, M. – BEYER, M. A. – AUSTIN, T. – GASSMAN, B. – SOMMER, D.: Predicts 2011: Pattern-Based Strategy Technologies and Business Practices Gain Momentum, Gartner Inc., 2010.

[5] GENOVESE, Y. – PRENTICE, S.: Pattern-Based Strategy: Getting Value From Big Data, Gartner Inc., 2011.

[6] GENOVESE, Y. – SRIBAR, V. – PRENTICE, S. – BURTON, B. – AUSTIN, T. – RAYNER, N. – POPKIN, J. – SMITH, M. – NEWMAN, D.: Introducing Pattern-Based Strategy, Gartner Inc., 2009.

Unauthenticated | 194.138.39.60
VERSITA | EMERGING SCIENCE PUBLISHERS

[7] GREEN, R.: OODA and You, Power, Seduction and War, http://powerseductionandwar.com/ooda-and-you/, 2007.

[8] HILL, J. B. – SCHULTE, R. W.: BPM Suites Evolve Into Intelligent BPM Suites, Gartner Inc., 2011.

[9] HILLAKER, H.: John Boyd, USAF Retired, Father of the F16, Code one magazine, July 1997.

[10] KEEFE, J. – BAILEY, I.: Extending the NATO Architecture Framework to Support Service Oriented Architectures, Cornwell Management Consulting, May 2006.

[11] MITCHELL, W.: Agile Sense-Making in the Battlespace, International C2 Journal, Special Issue: "Agility and Interoperability for 21st Century Command and Control", Vol. 4 no. 2, Command and Control Research Program (CCRP), pp. 1-35, Aug. 2010.

[12] NATO RESEARCH AND TECHNOLOGY ORGANISATION (RTO) RESEARCH GROUP (SAS-026): NATO Code of Best Practice (COBP) For C2 Assessment, http://www.dodccrp.org/files/NATO_COBP.pdf, Command and Control Research Program (CCRP), 2002.

[13] NEWMAN, D. W.: The Adaptive Organization: How Boyd's Decision Cycle and Pattern-Based Strategy Drive Rapid Change, Gartner Inc., 2011.

[14] SCHULTE, R. W. – GASSMAN, B.: Using Event Processing in Pattern-Based Strategies, Gartner Inc., 2010.

[15] SCHULTE, R. W. – HILL, J. B., RAYNER, N.: The Trend Toward Intelligent Business Operations, Gartner Inc., 2011.

[16] STALK, G. JR. – HOUT, T. M.: Competing Against Time: How Time-Based Competition Is Reshaping Global Markets, Free Press, pp. 180-181, 1990.

[17] STRATEGY-KEYS.COM: "People Advantage" Review http://www.strategy-keys.com/Business-Strategy-Formulation—People-Advantage.html, 2012.

[18] TIBCO Software Inc.: Complex Event Processing, http://www.tibco.com/products/business-optimization/complex-event-processing/default.jsp, 2012.

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