Business Resilience System Integrated Artificial Intelligence System

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Abstract

*By definition, **"Business Resilience"** is the ability for an organization to quickly adapt to an unexpected disruption(s) and prevent any ongoing workflow(s) to come to a halt and yet maintaining continuous business operations and safeguarding people, resources, assets, and overall barns equity. By the same talking, a Business Resilience System (BRS) is a combination of intelligent software and hardware combined in an integrated system. Such an integrated combination of Business Resilience System goes a step beyond Disaster Recovery (DR) by offering post-disaster strategies to avoid costly downtime, shore up vulnerability and maintain business operations in the face of additional, unexpected breaches of the daily operation of workflow in any enterprise or organization. With recent technical progress in Artificial Intelligence (AI) augmented with Machine Learning (ML) and Deep Learning sub-systems, they present an Artificial Intelligence System (AIS) and now integrating these two systems of BRS and AIS, one can offer the most intelligent system that an organization or an enterprise can own, in order to have the best possible solution in place to have the best possible technique of predication and consequently prevention and adverse events based on collective historical data within Deep Learning of Artificial Intelligence. In this paper we are present and introduce each of these systems i.e., BRS and AIS and how they can be beneficial to each other by their integration as a holistic system along with their sub-stems of Software, Hardware, Machine Learning and Deep Learning.*

Keywords: Resilience System, Business Intelligence, Artificial Intelligence, Cyber Security, Decision Making in Real Time, Machine Learning, and Deep Learning, Big Data and Cloud based servers for repository and storage of Data.

Introduction

A few years ago in March of 2017, the authors Bahman Zohuri and Masoud Moghaddam wrote a book on the subject of "Business Resilience System (BRS): Driven Through Boolean, Fuzzy Logics and Cloud Computation: Real and Near Real Time Analysis and Decision Making System" (Bahman & Moghaddam, 2017) following a presentation in a Geoscience Conference that took place between November 8-9, 2017, in Las Vegas Nevada, U.S.A.

Later on the authors published a paper under the title of "A General Approach to Business Resilience System (BRS)" within SciFed Journal of Artificial Intelligence in Volume 1, Issue 3, September 15, 2018, PP 1-16.

All alone, these authors tried to introduce the concept of Business Resilience System (BRS) as a state of the art methodology, so that organizations and enterprises can implement such up to date Business Intelligence (BI).

However, such an innovative BI was lacking any integrated Artificial Intelligence System (AIS), given what we know and understand about Artificial Intelligence (AI) along with its sub-component systems that we know as Machine Learning (ML) and Deep Learning (DL).

With the fast-paced steps that AI is taking toward more intelligent yet unsupervised AI, we are technologically pushing it towards Artificial General Intelligence (AGI).

Combination and Integration of Business Resilience System (BRS) with Artificial Intelligence System (AIS), Enterprises and Organizations can enjoy existence of their presence in the market by being more robust and resilient in respect to day-to-day continuous workflow of their operations.

In this Technical Memorandum (TM), we are evaluating the integration of the above BRS and AIS complementing each other by augmenting their components. Thus we introduce the holistic description of either system or show how they can be interoperable as super, duper system for any organization.

Artificial Intelligence (AI) as an innovative standalone technology along with its sub-systems such as Machine Learning (ML) and Deep Learning (DL) is one of those technologies that seems to be expanding its reach in every direction including as a complementary approach to Resilience path.

This technology will take center stage at Think 2018. The Resilience thinking is inevitably systems thinking, at least as much as sustainable development is. In fact, "when considering systems of humans and nature Social-Ecological Systems (SES) it is important to consider the system as a whole".

Resilience thinking addresses the dynamics and development of complex SES. Three aspects are central: Resilience, Adaptability, and Transformability. These aspects interrelate across multiple scales. Resilience in this context is the capacity of a SES to continually change and adapt yet remain within critical thresholds. Thus, a combination of such a system along with AI system will provide its human partner (Bahman & Farhang, 2020) an unbitable technological edge of any organizations to maintain their continuity and workflow without any hostile interruptions of their workflow.

The term "Resilience" originated in the 1970s in the field of ecology from the research of C.S. Holling, who defined resilience as "A Measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables." *In short, resilience is best defined as "the ability of a system to absorb disturbances and still retain its basic function fidelity and structure".* Bottom line, the Resilience Thinking derived from Sustaining Ecosystems and People in Changing World and now combine that with Artificial Intelligence, give its innovative technological edge as well.

Overall, this is what we are presenting in this TM.

What is Business Resilience System

There is a sense that humans, at the dawn of civilization, were subject to, and seemingly inferior to, the world's more feral inhabitants. However, as human intellect grew, together with his ability to control or defend himself from wild beasts, so did his confidence. Many scholars believe that mixed images such as the Sphinx symbolize humankind's domination over wild beasts, and over chaos itself. Such images as the Great Sphinx may very well represent animal power tamed by human intelligence and thus, transformed into divine calm.

Early Egyptians were symbolizing the Sphinx with the symbolization of a human head on the body of a lion. As it is evident from the remaining of Great Sphinx today and as

illustrated here in Figure-1. show the human head and eyes, the presentation of Vigilant Eye of the Sphinx is to protect and guard a king and his/her kingdom against any adverse events that might have a threat to their kingdom. Such evidence can be, found in both ancient Babylon and Persia.

Figure1: Remaining of Great Sphinx in Egypt

Traditionally, mixed, or composite images were, always seen as divine. One way or another, what could be more dangerous and powerful, or more self-assured than the king of the jungle with the mind of a human king.

The magnificent gate, which was dedicated to the Babylonian Goddess Ishtar, was once included among the Seven Wonders of the Ancient World until it was replaced by the Lighthouse of Alexandria in the 3rd century BC. Today, a reconstruction of the Ishtar Gate, using original bricks, is located at the Pergamon Museum in Berlin.

All these symbols and beliefs from ancient civilization up to a modern world of technology are part of our resiliency symbology and now innovative technology that we are relying on.

Business resilience begins with an understanding that workflows must be preserved in order for organizations to survive unexpected events. An often-overlooked challenge of business resilience planning is the human element, whereby individuals in a chaotic situation must be prepared and educated on how to respond accordingly.

Business resilience planning is sometimes referred to as "Business Continuity Planning (BCP)" , thus holistically it can be described that, Business continuity is an organization's ability to maintain essential functions and stability, during and after a disaster has occurred as it is illustrated in Figure-2.
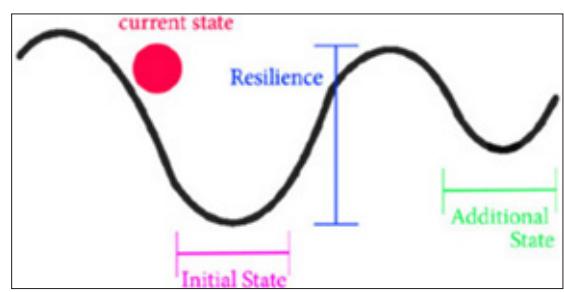
Figure 2

Business Continuity Planning establishes risk management processes and procedures that aim to prevent interruptions to mission-critical services and reestablish full function to the organization as quickly and smoothly as possible.

Business Resilience System (BRS) is driven by being Reactive to Proactive safety through resilience innovation.

In a world of finite resources, irreducible uncertainty and multiple conflicting goals, safety is, created through proactive resilient processes rather than through reactive barriers and defenses. Building a solid infrastructure based on different facets of resilience as the ability of systems to anticipate and adapt to the potential for surprise and failure, or unpredictable events, whether manmade or a natural disaster is a fundamental requirement for today's organizations and enterprises. These fundamental requirements guarantee the survivability of organizations and enterprises from the Business Process Management (BPM) and Business Continuity Management (BCM) perspective (Bahman & Moghaddam, 2017).

Until recently, the dominant safety paradigm was based on searching for ways in which limited or erratic human performance could degrade a well-designed and 'safe system'. Techniques from many areas such as reliability engineering and management theory were used to develop 'demonstrably safe' systems. The assumption seemed to be; once that safety is established, it can be maintained by requiring that human performance stays within prescribed boundaries or norms. Since 'safe' systems needed to include mechanisms that are guarded against people as unreliable components, understanding of how human performance which could stray outside these boundaries could become important.

According to this paradigm, 'error' was something that could be categorized and counted. This led to numerous proposals for taxonomies, estimation procedures and ways to provide the much-needed data either structured or unstructured, for error tabulation and extrapolation. Studies of human limits became important to guide the creation of remedial or prosthetic systems that would make up for the deficiencies of people and that is why with modern technology and innovation Artificial Intelligence System (AIS), we can overcome this deficiency (Bahman & Farhang, 2020).

As we know, Today, artificial intelligence (AI) is capable of learning from its experience through the element of its Machine Learning (ML) in conjunction with Deep Learning (DL) component and using them to adjust to new input and perform human-like performance, or at least to complement and enhance human abilities. Because of this capability, it pervades every aspect of the enterprise in the years to come. That is why we believe AI, Automation, and Analytics are central to the success of the enterprise and encompass critical business areas, including data, business processes, the workforce, and risk and reputation (Bahman & Farhang, 2020).

Again, a combination of Business Resilience System (BRS) integrated with Artificial Intelligence System (AIS) is the best possible combination that an organization or enterprises can possess in their arsenal in order to maintain their continuities, and consequently their survivability, going forward with their day-to-day operation. For that organization have to be on top of their massive accumulated historical and incoming data for their data analytics and consequently predictive analytics with help from Artificial Intelligence System (AIS) in place.

Such abilities and capabilities would allow the organization to become master of their (Bahman & Moghaddam, 2017). Data collecting (Bahman & Moghaddam, 2018) Information processing from these data and thus (Bahman & Farhang, 2020). The knowledge obtained would provide their stakeholders the (Bahman & Farhang, 2020). Power of decision making and thus with all these four capabilities one can establish a paradigm of forecasting as well, a tool that is essential for resiliency and survivability of their continuity operations (Bahman & Farhang, 2020; Bahman et al, 2022)

Note that Reference (Bahman & Farhang, 2020) has been replaced by complete references as Reference (Bahman et al, 2022) in the form of 4-Volumes by Academic Press publishing company.

With the Internet of Things (IoT) in place past few decades, companies, and organizations as part of their resiliency system, need to be very protective of their data and information within their repository and i-cloud servers in respect to any intelligent malware as well as any cyber-attacks. Today's campaign against any cyber-attack has put a huge demand on cyber security and on information security folks at different levels of any organization. Therefore, processing incoming data as sets of information becomes more and more critical.

Furthermore, the data are often, imprecise and include both quantitative and qualitative elements. For these reasons it is important to extend traditional decision-making processes by adding intuitive reasoning, human subjectivity, and imprecision. To enhance this process of decision-making, these authors have taken an unorthodox approach by applying a new growing technology known as neural network as part of driving infrastructure for artificial intelligent systems to take over from human being in order to satisfy the demand for real time decision making (Bahman & Masoud, 2020).

Bottom line, data is a basic driven factor of any organization's daily operation both from historical and present incoming activities in real-time, for BRS and AIS to function properly while being integrated and interoperable. These data would come in the form of both structure and unstructured format, thus augmented Deep Learning (DL) and Machine Learning (ML) have to be smart enough, to learn from the past to present real-time aspects of them, while making sure they are trustable data, yet they are not duplicated either, thus the information gained from these data are very up-to-date for the Business Resilience System to function accordingly and maintain the Business Continuity (BC) under its Business Continuity

Management (BCM) and Service Level Agreement (SLA) rules in place (Bahman & Moghaddam, 2017; Bahman & Moghaddam, 2018).

In conclusion of this section, we may define that first, Business Resiliency is that:

"The ability of an organization to absorb and adapt in a changing environment to enable it to deliver its objectives and to survive and prosper"

And secondly, for BRS to be effective in terms of business continuity we need to define BCM based within scope of the Plan, Do, Check and Act (PDCA) as described in next section, we can define Business Continuity (BC) as:

"The capability of an organization to continue the delivery of products or services at acceptable predefined levels following a disruption".

Business Continuity: The Plan Do Check Act (PDCA) Cycle

Business Continuity (BC) and Business Continuity Management (BCM) would come to play and matters of concerns in any organization rises from disruption workflow within their daily operation. So, a "disruption", may happen for any business and it could be anything from your top performer resource or employee damaging your computer or a virus attack as simple examples, or a drastic policy change due to new legislation that may impact your product line, or even an unforeseen event in the local or global economy that destroys what you have taken years to build and bank on your continuous existence.

Bottom line, Business Continuity (BC) means anticipating such disruptions and preparing a plan to ensure that you can continue business operations if the disruptions materialize and all these falls on implemented Business Continuity Management (BCM) rules and policy in place.

Thus, to have such management in place for an organization, one can utilize the Plan Do Check Act (PDCA) cycle as defined in this section and describes the activities.

Graphically, "The Plan Do Check Act (PDCA)" cycle depicted in Figure-3 here.
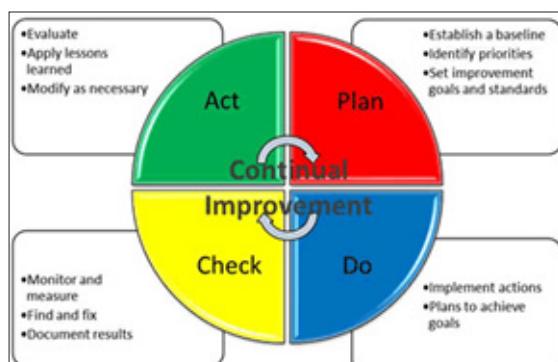

Figure 3: Plan Do Check Act (PDCA) Cycle Depiction

By definition, The Plan Do Check Act cycle is the operating principle of ISO's management system standards and as we know ISO means "In Search Of" as the most common definition as an acronym for the International Organization for Standardization, headquartered in Switzerland and from the point of view of this organization, ISO defines rules and standards to aid in tasks for virtually all products that people use, including rules and standards about how products are made and how quality control tests should be performed.

The International Organization for Standardization ISO sets the standards in many businesses and technologies, including computing and communications. The term ISO is also not an abbreviation originally, but instead derives from the Greek word īsos, meaning equal.

Its formal structure includes processes that regularly examine performance and ensure that the system continues to provide ongoing benefits.

In summary, the steps in each successive PDCA cycle are:

PLAN
Establish the objectives and processes necessary to deliver results in accordance with the expected output (the target or goals). By establishing output expectations, the completeness and accuracy of the specification are also a part of the targeted improvement.

DO
Implement the plan, execute the process, make the product. Collect data for charting and analysis in the following "CHECK" and "ACT" steps.

CHECK
Study the actual results (measured and collected in "DO" above) and compare them against the expected results (targets or goals from the "PLAN") to ascertain any differences. Look for deviation in implementation from the plan and also look for the appropriateness and completeness of the plan to enable the execution, i.e., "Do". Charting data can make this much easier to see trends over several PDCA cycles and in order to convert the collected data into information. Information is what you need for the next step "ACT".

In summary, the organization must continue to regularly check whether the control measures are working and remain relevant to meeting the organization's needs, especially as the environment changes. Testing will identify whether the continuity metrics can be met using existing measures or more is required.

ACT
Based on the results of the tests and actual disruptions, the leadership will need to take both corrective and preventive measures to ensure the business continuity plan remains effective for the ever-evolving context that the business faces.

What is Artificial Intelligence System (AIS)

While the main goal of Business Intelligence (BI) is to streamline the process of collecting, reporting, and analyzing data, Artificial Intelligence (AI) has a different approach to this goal. Using BI allows companies to improve the quality of the data they collect and the consistency with which they collect it. Thus, we need to know what the AI and its functionality and capabilities are and how it deals with data that is dumped on us with an overwhelming sheer volume and we need to have a better information in order to increase our knowledge thus having the power of a trusted decision making for our daily routine operations within our enterprise as stakeholders.

Modeling human intelligence is one of the primary goals of artificial intelligence. By modeling human behaviors and thought- processes, AI programs can learn and make rational decisions.

The technology professionals who build and operate AI programs are often trying to answer certain questions:

- Can machines learn and adapt?
- Can machines develop reliable intuition?

Exploring these questions can yield significant benefits for businesses willing to invest and experiment. Using AI-driven applications, like chatbots in the early days of AI technology, can drive greater efficiency and profits.

Beyond simply clarifying a messy picture, AI can provide human operators with prescriptions, and can act on those prescriptions autonomously.

Unlike BI, which makes analyzing data much easier but leaves decision-making in the hands of humans, AI can enable computers to make business decisions themselves. For example, chatbots can, without human intervention, answer customer questions. Beyond simply clarifying a messy picture, AI can provide human operators with prescriptions and can act on those prescriptions autonomously.

Considering what we have said about Artificial Intelligence (AI), the question now is what is AI? and how it works in a simple term.

Artificial intelligence (AI) is the ability of a computer program or a machine to think and learn similar to the way that the human brain does it naturally. It is also a field of study which tries to make computers "smart". However, there are key factors to know about AI and they are:

- It is very important to distinguish different types of Artificial Intelligence and different phases of the evolution of AI when it comes to developing application programs
- Without recognizing the different types of AI and the scope of the related applications, confusion may arise, and expectations may be far from reality
- In fact, the "broad" definition of Artificial Intelligence is "vague" and can cause a misrepresentation of the type of AI that we discuss and develop today

In depicted form, artificial intelligence can be illustrated in a simple form as Figure-5. This figure is a presentation of today's supervised artificial intelligence that we are accustomed to, and more sophisticated version of this AI is Artificial Super Intelligence (ASI) in the near future that will operate in an unsupervised mode and possibly may possess conscience capability of a human being. A simple form of different levels of AI is depicted in Figure5 here.
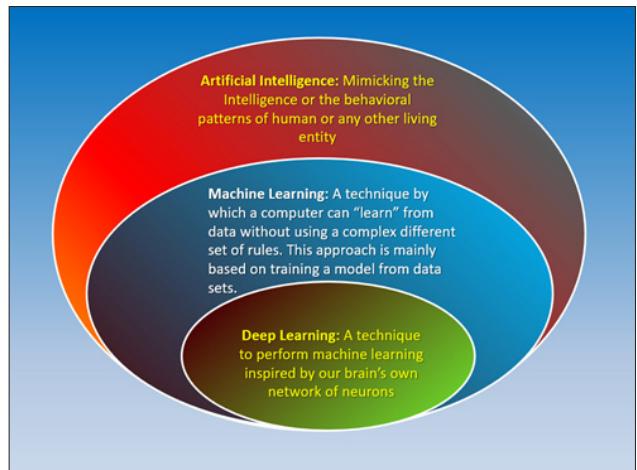

Figure 4: Presentation Artificial Intelligence in Relation with Machine Learning and Deep Learning
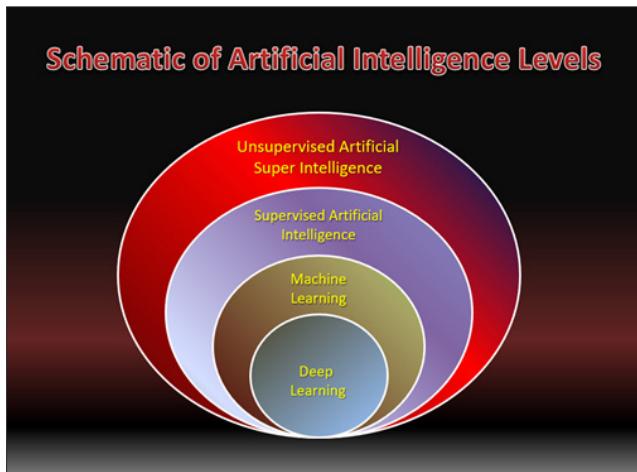

Figure 5: Schematic of Different Levels of Artificial Intelligence

Artificial Intelligence has grabbed the center stage of business intelligence, despite having been around for decades, due to the growing pervasiveness of data, the scalability of cloud computing, the availability of AI accelerators, sensors, processors and the sophistication of the ML and DL algorithms it has become the dominant talk of the industry and basis for next-gen revolution in IT. A company like IDC technology 6, predicted that by 2019, 40% of Digital Transformation (DX) and big data initiatives will use AI services; by 2021, 75% of commercial enterprise apps would use AI, over 90% of consumers will interact with customer support bots, and over 50% of new industrial robots will leverage AI.

Digital transformation (DX) is reaching a macroeconomic scale. Intelligent applications based on Artificial Intelligence (AI), Machine Learning (ML), and continual Deep Learning (DL) are the next wave of technology transforming how consumers and enterprises work, learn, and play. While data is at the core of the new digital economy, it's also about how you sense the environment and manage the data from the edge to the core cloud, analyze it in near real-time, learn from it, and then act on it to affect outcomes. The Internet of Things (IoT), mobile devices, big data, AI, ML, and DL all combine to sense and collectively learn from an environment continually. What differentiates winning organizations is how they leverage that to deliver meaningful, value-added predictions and actions for improving industrial processes, healthcare, experiential engagement, or any other kind of enterprise decision making. AI business objectives are balanced between tactical and strategic, and they can range from improvement in operational efficiencies to increasing competitive differentiation, from maximizing existing product revenue to launching new digital revenue streams.

AI along with its sub-sets of Machine Learning (ML) and Deep Learning (DL), presents a collection of multiple technologies utilizing Tensor Processing Unit (TPU) and Graphics Processing Unit (GPU) (i.e., See Wikipedia or Internet for more information) suggested by companies such as Google and Apple as a better and more enhanced processing units embedded AI Algorithms along with TensorFlow software interface hand-shaking with Python language written for command and control aspect of these algorithms are capable of enabling machines to sense, comprehend and act – and learn, either on their own and partner with its inventor human in order to augment human activities.

Artificial Narrow Intelligence (ANI) and subsequently, Artificial General Intelligence (AGI) driven by Artificial Neural Network (ANN) and their capability of cognitive and natural language learning someday may present a future matrix augmenting its human master and even surpass him/her by being Homo-Fabians and Homo-Sapiens not too far away from the present time (Bahman & Masoud, 2020; Zohuri & Mossavar Rahmani, 2019).

Artificial Narrow Intelligence and Artificial General Intelligence are using a capability that is known as Artificial Neural Network (ANN). It is a computational model based on the structure, functions of biological neural networks, and is one of the main tools used in machine learning. They are brain-inspired systems that are intended to replicate the way that we humans learn. ANN belongs to a group of information-processing techniques that can be used to find knowledge, patterns, or models from a large amount of data. In general, there are three classes of Artificial Neural Networks that one needs to focus on, and they are listed below:

1. Multilayer Perceptron (MLP).
2. Convolutional Neural Network (CNN).
3. Recurrent Neural Network (RNN).

These three classes of neural networks provide and augment a lot of flexibility to Artificial Narrow Intelligence (ANI) and have proven themselves over decades to be useful and reliable in a wide range of problems that are tasked to move towards Artificial General Intelligence (AGI) to handle. They also have many subtypes to help specialize them to the quirks of different framing of forecasting and prediction problems and different datasets at the level of Big Data both structured and unstructured (Zohuri & Mossavar Rahmani, 2019).

With this new technology on the horizon and rapidly growing among companies and startups in Silicon Valley in particular, one is wondering if this augmentation really helps humans or hurts it by taking over of so many traditional laborers work away from human by industry going toward full automation in their assembly line as an example.

Compelling data reveal a discouraging truth about growth today. There has been a marked decline in the ability of traditional levers of production—capital investment and labor—to propel economic growth.

Yet, the numbers tell only part of the story. Artificial Intelligence (AI) is a new factor of production and has the potential to introduce new sources of growth, changing how work is done and reinforcing the role of people to drive growth in business (Liew, 2007).

Conclusion

Artificial intelligence is the core for applications and enterprises which use the human intelligence for basic functionality. The human intelligence can be used as a symbol structure and symbolic operations which are primarily used in digital computers. Business intelligence focuses on reports to management and analyzing data with data mining and data warehousing procedures. The organization uses business intelligence to gain achievable insight of the data. This includes basic operational analysis or spreadsheet analysis. It is mandatory to analyze the requirements and select the suitable module for application development using artificial intelligence or business intelligence or a combination of both. In summary, Artificial Intelligence enables us to put our data in a perspective that will work for us rather than overwhelming us with its sheer volume.

By analyzing all the data that has been collected and delivering real time recommendations, AI enables you to actually use your data to your competitive advantage. If your competitors aren't using AI, they'll be stuck sifting through mountains of data on their own. By using AI, you'll be able to harness the power of the data you collect, identify more trends, build recommended actions based on those trends, and ensure that those actions and surrounding context are delivered to your end users exactly when and where they need them (Bahman & Mossavar, 2022).

Moreover, a magic position for an organization or enterprise to be a resilient operation is naturally implementation a Business Resilience System Integrating an Artificial Intelligence System.

An AI, including risk management and business continuity frameworks must evolve, make a paradigm shift, and take preventive measures by gaining information by analyzing data through data analytics of historical and incoming real-time data, where Deep learning and Machine Learning play roles.

These preventive measures will ensure organizational resilience via its smarter and unsupervised BRS system in place. In addition, more accurate monitoring and reporting will optimize the detections of possible risks that the organization would face.

Today, more than the past, Risk Assessment (RA) and Business Impact Analysis (BIA) rely on data management and analysis. Data collection can weigh up to 75% on Risk Management & Business Continuity processes; analytics solutions have also become strategic. AI and Machine Learning (ML) technology, applied to big data analysis, allows to creating scenarios in "real time". Risks are automatically integrated with each other - without more "silos", as it happened in the past – providing a holistic view and taking into consideration both vertical and transversal scenarios made of interconnections and dependencies.

While AI, like any technology, certainly has some limitations—most notably when it comes to cybersecurity or inherent bias and human consciousness, which is yet to be decoded—the potential benefits are enormous. In spite of this, many companies are lagging behind when it comes to recognizing AI as a trend in the future of business analytics and intelligence. Those companies that begin to implement AI will soon find themselves outperforming their competitors when it comes to improved overall business performance and higher revenue.

Risk & Business Continuity Managers, by using AI, can spend less time on repetitive tasks and use connected devices to improve Risk Management & Business Continuity processes. Furthermore, a greater interaction/integration between the two disciplines – together with a continuous communication/comparison with the various business functions - promotes the verification of the consistency of the work done in terms of Risk & Business Continuity management, organizational planning, and business objectives, inclusive the need to comply promptly with the stringent regulations.

Putting all these, in a simple perspective for our reader of this Technical Memorandum, we suggest, a smarter overall system that combines Business Resilience System (BRS) and Artificial Intelligence System as an ultimate and innovative Business Intelligence (BI) systems.

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