

WHITEPAPER:

ANATOMY OF AN INTELLIGENT ORGANIZATION: A CONSTRUCT BY DESIGN

by: Rajeev Sharma

ABSTRACT

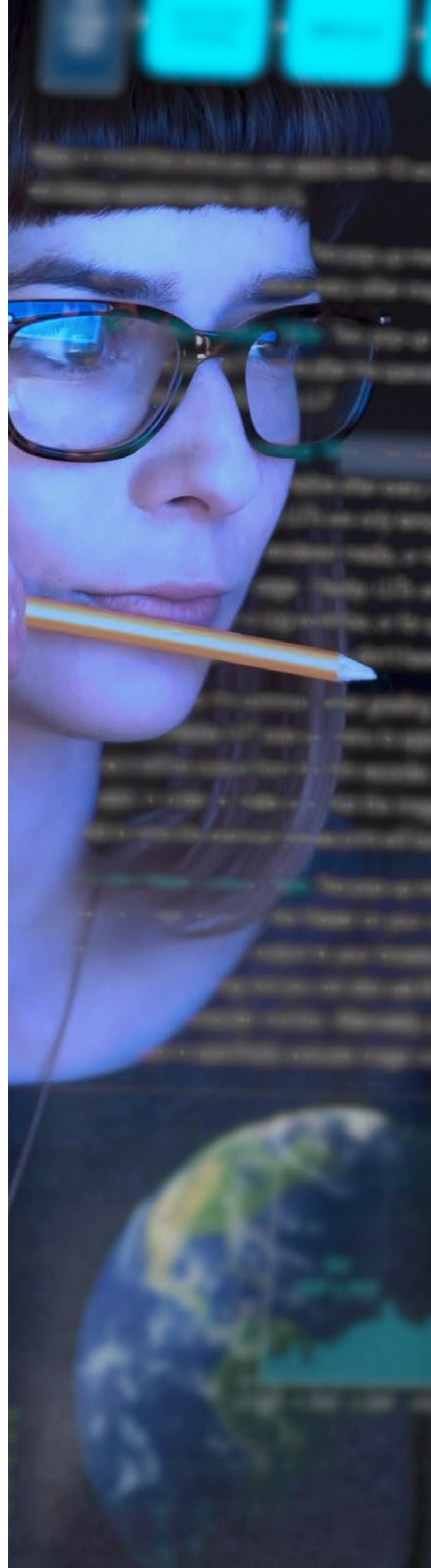
“Augmented Intelligence” is an all-pervasive phrase these days. This is both in the context of enhanced capabilities of an organization and also while underscoring the supportive role of artificial intelligence (AI) as a capable assistant to us humans (rather than a usurper of human jobs). Despite the very nascent stage of AI that we are in, numerous analyst reports have opined that in the near future, all digital products will be powered by some level of built-in intelligence. This paper rests on the hypothesis that intelligence-infused organizations are a result of a well-thought through leadership vision and strategy and that they possess a distinct technology, business process and a cultural footprint. These intelligent organizations aim at dominating the markets through the benefits that accrue from the emergent properties of Human-Machine combine. From a structural decomposition standpoint, we typically see a triad of dominant networks at play in intelligent organizations with a heightened mix of human-machine interactions. These are:

- a) Culture and Capability Hub
- b) Data Hub
- c) Infrastructure Hub

The elegance of all the three dominant networks comes alive as they blend together in a manner that makes it extremely hard to separate their impact. It is indeed an integrated narrative that is executed within the crucible of strong business and engineering culture and the emergent business outcomes exceed the sum of their individual outputs of each of these hubs by a large measure. This paper tries to uncover the normative elements in the structure of “Intelligent Organizations” that give them the ability to learn, adapt and respond faster than a pure human based system enabled by digital platforms. The term “Intelligent Organizations” in this paper does not necessarily allude only to an organization like Google with its “AI First” strategy but to all contemporary firms that are competing in the markets in an era of confluence between humans, digital systems and intelligent machines.

The eclectic web of nodes (humans and machines) and edges (read connections) created by mashing up machine and humans unleashes a very responsive organizational pattern that is capable of uncovering and executing novel business processes hitherto fore untapped by the competition.

Rajeev Sharma



PREAMBLE

“Augmented Intelligence” is an all-pervasive phrase these days. This is both in the context of enhanced capabilities of an organization and also while underscoring the supportive role of artificial intelligence (AI) as a capable assistant to us humans (rather than a usurper of human jobs). Despite the very nascent stage of AI that we are in, numerous analyst reports have opined that in the near future, all digital products will be powered by some level of built-in intelligence. Companies like Google have announced “AI First” as their foundational principle of serving the market thus clearly signaling a move to “Machine Intelligence” as a baseline strategy to serve its customers. One can reasonably expect that in a mash-up of human and intelligent machines, the dynamics of interactions, learning, decision making and competing are all likely to undergo a metamorphosis of sorts. This paper rests on the hypothesis that intelligence-infused organizations are a result of a well-thought through leadership vision and strategy and that they possess a distinct technology, business process and a cultural footprint. These intelligent organizations aim at dominating the markets through the benefits that accrue from the emergent properties of Human-Machine combine. Our approach in this treatise is to structurally decompose the constituent components of such organizations and understand the source of their business value.

In mid-80’s Marvin Minsky in his classic book **“The Society of mind”** stated that **adaptability through learning is the hallmark of the intelligent organization.** Yet another powerful construct of a learning organization defines it as one that is skilled at creating, acquiring and transferring the knowledge across the entire system and also the one that is adept at modifying its behavior to demonstrate new learning and capabilities. Entrenched within this cycle of learning and adaptation is the notion of new outcomes (resulting from new capabilities) that puts an organization at a much higher threshold in terms of competitive advantage, sustainability and profitability compared to others competing in the market. Hence one can argue that a clear emerging hypothesis about the characteristic attribute of an intelligent system would lie in its ability to assimilate, learn, adapt, take new decisions and respond to market externalities faster, better, cheaper than anyone else and in a manner that is most ambiguous to others (causal ambiguity), thus precluding the competition from mimicking and taking away the arbitrage.

One can opine that in a pure human based system, organizational intelligence is a social phenomenon typically captured in the collective outcomes effected by the decisions and actions of the designated leaders. From a pure sociological lens, one would view all decisions and actions within organizations as an emergent property (a complex one at that), resulting from the coalescence of hidden world views of its people, their lifetime experiences and their social conditioning operating under the forces of Business, Process, Technology and Governance. With well-trained machines (Artificial Intelligence or Machine Intelligence) now in the mix, many connections (edges) between people (nodes) would be re-organized as edges between people and intelligent machines and between two intelligent machines and so on. In such a heterogenous ensemble, many of the tacit aspects of decision making and downstream actions usually attributed to skilled humans, would now be executed autonomously by intelligent well-trained machines for a specific task or a role.

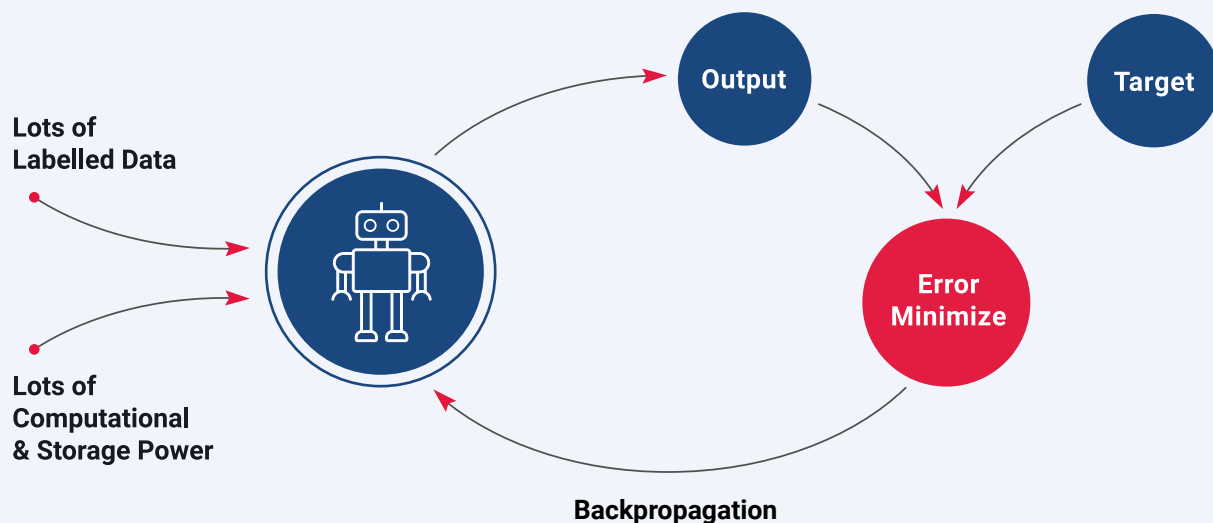
This paper tries to uncover the normative elements in the structure of “Intelligent Organizations” that give them the ability to learn, adapt and respond faster than a pure human based system enabled by digital platforms. The term “Intelligent Organizations” in this paper does not necessarily allude only to an organization like Google with its “AI First” strategy but to all contemporary firms that are competing in the markets in an era of confluence between humans, digital systems and intelligent machines.

INTELLIGENT YET NARROW AND OTHERWISE DUMB: LEARNING AND ADAPTATION

A human mind learns at multiple levels namely, conscious, subconscious and unconscious. In terms of the core learning, this flows along the value chain of Data, Information, Knowledge and Wisdom (attributed to Prof Russel Ackoff). Both, information and knowledge, rely on short-term and long-term memory whilst at the level of wisdom, its far more nuanced and deeply entrenched at a subconscious and unconscious level. For deep neural networks (supervised learning), learning happens through the cycle of training using as much data (with labels) with as much of variety (image, voice, text, sensors, quantitative, etc.) as possible. Thereafter, through the process of backpropagation (a technique to feed back the error in the neural network), the difference between target and the actual output is reduced using some form of a loss function.

Through many repetitive cycles we come to a point where the error between the target state and the actual state is tolerable or an absolute minimum (ideally zero). In the world of AI, this is known as “Representational Learning” which is way too different from the manner in which biological systems (read humans) learn a.k.a. “Submarines don’t swim.” The machines that are extremely good at one thing are darn stupid at something else; e.g. the AI engine that can drive a car cannot play chess and vice versa. In that sense the intelligence of a neural network is very narrow and does not have the benefit of thousands of years of evolutionary experience of the human race.

(Figure 1: Representational Learning Using Backpropagation)



Most of the AI systems we hear about these days falls under the category of “Narrow AI” which is different from the aspirational (human-like) “Artificial General Intelligence (AGI).”

A BLENDED ORGANIZATION AND ITS CAPABILITY TO ADAPT

There is huge body of literature that explains the notion of “Adaptability” of organizations to new ideas and learnings in a human-centric world. The general idea is that any adaptation happens in stages of **‘Noticing, Learning, Internalization, New Behavior’** followed by reinforcement of new actions through reward-penalty mechanisms and governance through policy frameworks. These steps are critical when dealing with a complex organism like a human being since we humans have many stated and unstated agendas, dogmatic beliefs and a huge wall of social conditioning that we all bring to our workplaces. When it comes to deep neural network-based systems, these constructs don’t really apply as it doesn’t notice anything unless that is what you want it to do. It learns based on what we as humans decide to teach it, and once trained, it does not need any further internalization nor any further reinforcement unless it needs to be trained on new set of data as part of a playbook. Without a **‘sense of being or consciousness,’** the machine-based intelligence will always look towards the humans to decide what it should and should not do (at least for a very long time). Hence the entire process of adaptation is instant when it comes to machines. It starts to execute its intended function under a given environment or system boundary conditions unless some human intentionally intervenes or terminates its functioning. The speed with which these machines learn depends on the complexity of the business use case it would handle, the amount of data that is needed to train and the time required to train the machine (this is non-trivial). Once trained, these machines are ready for prime time and when triggered into action, these well-trained intelligent machines perform their intended task without any fuss or second thoughts.

As we have discussed, machines learn differently from human (biological systems) in that they are not aware of their reason to do what they do, and their learning is confined to a very narrow business task. In such intelligent organizations, the learning is distributed between the human-machines connections (edges) and the capabilities of this web of connections gets better over time as machines keep learning through continuous re-training process. As one can imagine, the insertion of intelligent machines across many business processes eliminates a plethora of human behavior related processes that create delays and lags in the organization like passive resistance, deliberate time delay in execution, superfluous dialogues, skill-gap and other similar patterns. These behavioral patterns are totally absent in intelligent machines thus giving an organization with high human-machine mix, the heightened ability to respond to market dynamics perhaps much quicker than a pure human system. Over time, such hybrid intelligent organizations get better at utilization of organizational assets and deploying them at an attractive cost structure making it extremely difficult for competing organizations to mimic their performance.

DOMINANT NETWORKS AT PLAY IN INTELLIGENT ORGANIZATIONS

From a structural decomposition standpoint, we typically see a triad of dominant networks at play in intelligent organizations with a heightened mix of human-machine interactions. These are:

- a) Culture and Capability Hub
- b) Data Hub
- c) Infrastructure Hub

Fig-2: Macro-Hubs in an Intelligent Organization

Culture & Capability Hub	Data Hub	Infrastructure Hub
Senior & Mid-level leadership AI & Digitally savvy (beyond buzz words)	Focus on all types of data acquisition (image, voice, text, quantitative, IOT/sensor)	Training infrastructure based on GPU's/TPU's
Embraces innovation, open-collaboration, execution mindset with focus on individual & organizational growth & continuous learning	Newer data persistence approaches with focus not only on data storage but on labelled data for training many different types of deep neural networks	Possess components of scalability- API based, microservices driven operating in a containerized environment
Already working on an API driven digital foundation across all lines of businesses	Focus on building many pre-trained models to enable rapid learning of new AI systems and seamless ingestion/deployment in the organization structure	Served by Software-defined Infra (SDI), CI-CD pipeline, high levels of test automation and lean agile development practices
Business, Engineering, Sales, Marketing, Legal/Compliance, HR working collaboratively to share data and work with AI systems (machine SME's) across the enterprise	Building a data pipeline that is constantly shaped to create new inputs to train the AI engines (especially when the data change clock speed is high)	Integrated Engineering teams with Design-Dev-Release embedded under one umbrella for different Lines of businesses

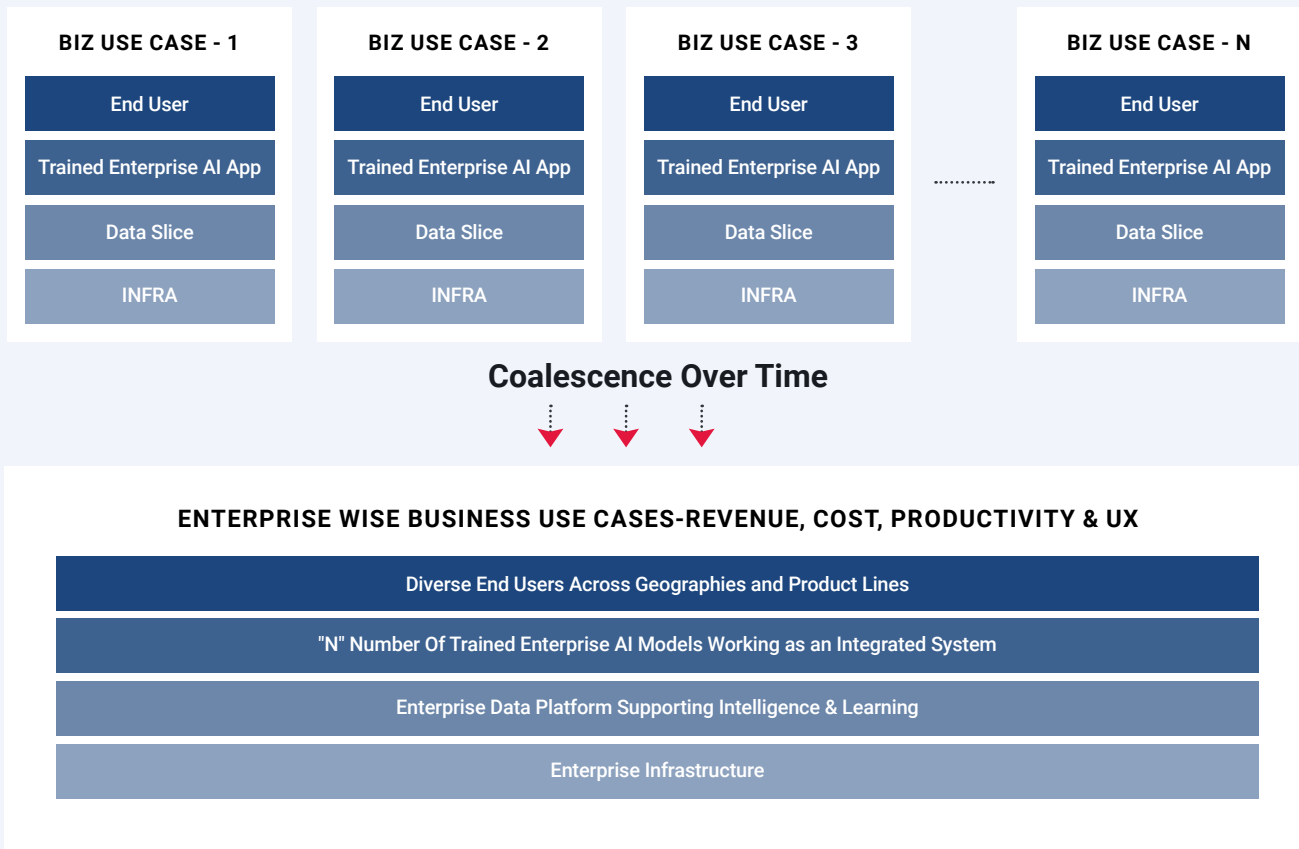
Culture and Capability Hub

There is an unmistakable cultural bent of learning organizations that is distributed across the enterprise and its extremely hard to place a finger on one dominant cultural attribute. It is built over time and requires the propulsive power of leadership vision and commitment to execute on that vision. At a cultural and capability level, learning organizations have a digitally savvy and an AI savvy leadership (knowledge levels way beyond usage of buzz words) that possess a good understanding of the nuances of rule-based systems and representational learning-based deep learning engines (neural networks). Leadership in such organizations systematically fosters a culture that is comfortable with exponential human-machine interactions. The leadership also strives to foster open innovations, collaborations and an environment that incentivizes continuous learning and skill-growth (see Table-1 depicting macro-hubs). Building a learning organization is essentially a top-down endeavor backed by middle and grassroot level leadership to take it forward. Each entity in such enterprises has a penchant for an **'enterprise capability view'** and every level of leadership looks for avenues to infuse intelligence across all the business processes (front, middle and back office). Learning organizations have a razor-sharp focus on hiring the best talent. This trait percolates the entire rank and file of the company. There are clear job descriptions for every role with well-designed coding challenges, hackathons and other assessments as needed. The talent is hired for cultural fit, problem solving and deep coding skills and ability to learn new skills.

Data Hub

An important cultural signature of intelligent organizations is the passion for aggregating data in all formats (voice, text, images, IOT, Natural Language, Quantitative) across all dimensions of business. The focus on building a data centric organization powered by data-driven quantifiable metrics is amply evident in such firms. They constantly look for opportunities to enrich the data with more internal and external data sources and use data as a source of competitive advantage. Learning organizations culturally are accustomed to taking a business use case and a process view that drives all their downstream efforts on data acquisition and training of AI engines that help in building formidable barriers to competition. The data teams are typically a shared services entity and may be structured as a "T-Model as one can easily imagine. They serve as a horizontal with all kinds of data but in the same breath they also provide data support to individual Lines of Businesses (LOB's) for their specific data needs. These organizations know extremely well that enterprise data pipelines for training AI models are best built along a roadmap and not as a "Big Bang" effort. You don't need to have a full-fledged data hub to embark on an AI journey. Ideally one can easily build a clear mapping between a large set of business use-cases and the corresponding data needs for model training. This can then be deployed in sync with the enterprise consumption needs via a scalable and fault tolerant infrastructure footprint. Intelligent organizations focus on building a robust enterprise data platform to support organization-wide AI engines as a flow embedded in the business processes that are best handled by intelligent machines. Over time, these data foundations coalesce into a consummate enterprise data platform. The figure below depicts such a construct.

Fig-3: Building an Intelligent Organization with Use Cases and Data on an Enterprise Roadmap



Infrastructure Hub

As the business, technology, design/creative and the AI teams build and experiment with models covering different archetypes (Supervised and Un-supervised, and Reinforcement learning) and other forms of AI engines that process natural language (for boosting the back-office productivity), the enterprise infrastructure team relentlessly focusses on organization-wide consumption of machine intelligence. This effort shows up in the form of a very resilient, scalable and fault tolerant infrastructure that houses all AI-based intelligent digital applications, platforms and products that can be easily deployed, continuously trained, and diligently monitored in an automated manner (a closed loop) with "Humans in the Middle" as needed. Such firms are a huge step above the artisan-like (heavy IT support to deploy and consume models) processes in Enterprises that struggle afresh each time they have a pilot or a POC to deploy. Both the AI engineers and the citizen data scientists along with the full stack engineers, QA automation team and the AIOps/MLOps team are all hooked to an integrated pipeline where each team can contribute to rapid development and deployment at scale with high degree of reliability. These Learning Organizations riding on the success of their digital transformation initiatives (a far-sighted leadership move) comprising of strong API-laced ecosystem, lean agile delivery in engineering practices, microservices based platform architecture powered by containerization and scalable infrastructure patterns using DevOps/AIOps/MLOps seamlessly, are best positioned to infuse machine intelligence at scale. They achieve such agility, productivity jumps and operational efficiencies with the most minimal energy footprint (given the heavy compute storage requirements in such organizations).

The elegance of all the three dominant networks comes alive as they blend together in a manner that makes it extremely hard to separate their impact. It is indeed an integrated narrative that is executed within the crucible of strong business and engineering culture and the emergent business outcomes exceed the sum of their individual outputs of each of these hubs by a large measure. The homogenous blending of all the dominant networks gives rise to a high degree of causal ambiguity thus making it impossible for the competition to break the distinct capability arbitrage (hard to mimic) that is created. The confluence of these hubs is almost always orchestrated by enterprise structures and leadership vision that helps in breaking and/or removing all silos especially in the data platforms where business realities reside.

CONCLUSION

The human-machine interfaces eliminate many of the coordination and principal-agent problems associated with human networks. Intelligent Organizations have a high blend of human-machine-laced business processes that give them the ability to learn and adapt swiftly and respond with speed at the most optimum costs. The leadership at all levels in these companies are capable of recognizing the most potent business use cases and the data that would be needed to train machines that execute many of them. The eclectic web of nodes (humans and machines) and edges (read connections) created by mashing up machine and humans unleashes a very responsive organizational pattern that is capable of uncovering and executing novel business processes hitherto fore untapped by the competition. This causal ambiguity is at the heart of their exponential success in creating barriers to entry for competition for protracted periods of time, wooing their end customers with hyper-personalized experiences in all modes of interactions (voice, chat and insightful dashboards) and across all channels and device aspect ratios. These blended organizations (humans + intelligent machines) develop the innate ability to learn continuously, assimilate rapidly and respond at speeds far beyond the reach of their competition. In all this, the ultimate winners are the consumers that benefit from the ensuing heightened productivity, reduced costs and economies of scale that accrue in an intelligent digital economy.



ABOUT THE AUTHOR

Rajeev is the SVP & Global Head of Enterprise AI Solutions & Cognitive Engineering Group at Pactera Edge. He is a former Lieutenant Colonel & a senior rocket scientist with a strong background in Quantitative Analysis, Algorithms & Mathematical Modelling, Software Product & Platform Design and Enterprise Architecture. Rajeev has a Graduate degree from MIT Sloan School of Management & the School of Engineering Systems and a Graduate degree in Space Engineering & Rocketry from India.

DISCLAIMER

The views expressed in this paper belong to the author and do not in any way reflect the overall views of Pactera Edge.

ABOUT PACTERA EDGE

Pactera EDGE is a global organization with offices in the US, Europe, India and Asia-Pacific. Clients include 100+ of the Global 500 companies, with industry concentration in Software and Technology, CPG, Retail, Logistics, Financial Services, Insurance, Healthcare, Food & Beverage, and Travel & Hospitality.

With a core focus on Data, Intelligence and Experience, Pactera EDGE helps clients achieve new levels of performance, while adding brand new digital business capabilities to drive relevance, revenue, and growth. With clarity of vision, technological expertise, operational excellence, and a global footprint, Pactera EDGE is the partner of choice for enterprises that want to run smarter – and for those that want to change the race.

pacteraEDGE



www.PacteraEDGE.com



pacteraedge@pacteraedge.com



+1.425.233.8578