

A VUCAA-Mindset and VUCAA-Model for Project Business Management in the 4th Industrial Revolution ^{1, 2}

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INTRODUCTION

The new norm is a business environment where the challenges caused by Volatility, Uncertainty, Complexity, and Ambiguity (VUCA) are accelerating. The 4th Industrial Revolution is entering its exponential-change phase which is accelerating the disruptive VUCA forces that business, portfolio, program, and project leadership must address. This has created the VUCA-*Accelerated* (VUCAA) business conditions within today’s marketplace. This Fourth Industrial Revolution, the era of Digital Transformation commonly called “Industry 4.0,” arrived with the advent of the 21st century. Klaus Schwab, in his 2016 book, *The Fourth Industrial Revolution* ^[36], has opined that digitalization, emerging technologies, and broad-based-innovation will revolutionize everything. He noted that “major technological changes are on the brink of fueling momentous change throughout the world.”

Industry 4.0 refers to the current trend of extensive automation and data exchange in communications, manufacturing, production, and services, and the increasing miniaturization of technology. It is driving the integration of digital and physical technologies across all areas of business, society, production, mobility, and communications. This technological revolution is blurring the lines between the human, physical, digital, robotic, and biological spheres. It includes a wide range of current and coming changes, such as: cyber-physical systems; Internet of Things; Internet of Robotic Things; Internet of Systems; cloud computing; cognitive computing; predictive analytics; device interoperability; information transparency; decentralized decision-making; artificial intelligence; cognitive technologies; consumer software applications; smart manufacturing; ubiquitous mobile supercomputing; intelligent robots; self-driving cars; neuro-technological brain enhancements; genetic editing; technological convergence; integration of operational technology with information technology; combining big data and materials science; and bi-directional assistance between humans and machines ^[21].

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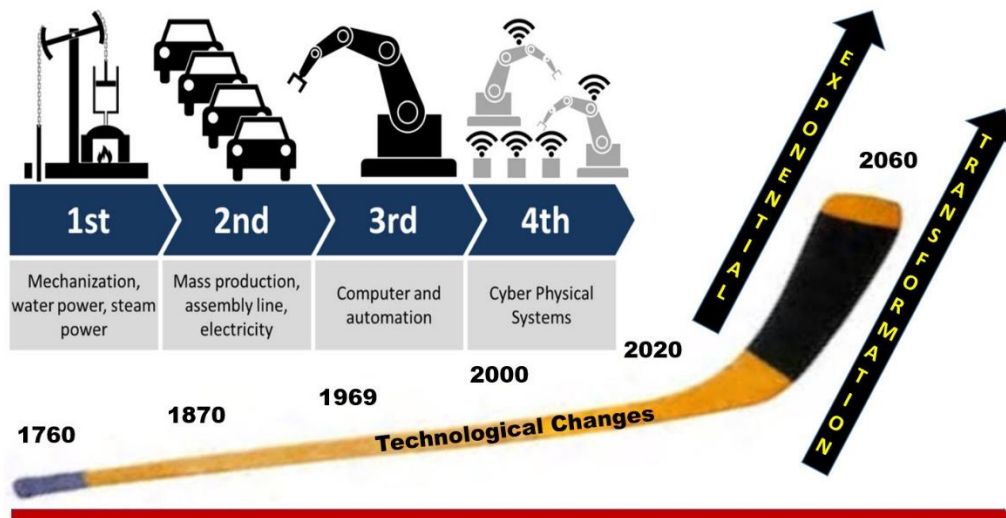
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Leaders in most industries are finally becoming aware of the emerging technologies that will drive disruptions within their marketplace. Those businesses are working on being able to function in the new digital economy that is driven by knowledge, powered by technology, and fueled by information. Fred Rogers, in his 2013 book *Ride the Wave: How 12 Technologies Will Change the World and Make You Rich*, and subsequent presentations at the Harvard Business School, has given his view on how information technologies will transform every aspect of people’s lives, and business and project management operations. Four of his points are:

- Moore's Law will “keep rolling along” improving price-performance by at least 6400% before jumping on a totally new and steeper [*exponential*] performance curve;
- Over a trillion devices will be accessible on the world-wide-web by 2030 transforming virtually everything in our lives;
- By 2030, Artificial Intelligence (AI) combined with the Internet of Things (IoT) and robotics will grow the real American economy by roughly 80% – while the workforce will grow only 5%; and
- Information technology will provide transformative solutions to the mega-challenges of our age: health care, potable water, elder care, national security, transportation, global poverty, etc.

The speed of current breakthroughs has no historical precedent. When compared with the relatively linear changes brought by the three previous industrial revolutions, Industry 4.0 is evolving at an exponential rather than a linear pace – change and its related disruptions are accelerating as indicated below in *Figure 1*.

Figure 1: INDUSTRY 4.0 Disruptive Transformative Forces



The breadth and depth of these changes foreshadow the transformation of entire systems of production, management, governance, line-organizations, and whole enterprises. Moreover, major disruptions are happening in almost every industry in every country, and no enterprise is too big to fail. It used to be about the big eating the small; now the fast and agile annihilate the slow and ponderous. An International Data Corporation (IDC) report “FutureScope: Worldwide CIO Agenda 2016 Predictions [22]” emphasized that, “One-third of the top 20 firms in industry segments

will be disrupted by new competitors within five years," and that it is a matter of "transform or perish."

By creating, applying, and embedding smart and connected technology, Industry 4.0 is transforming enterprises, economies, jobs, and even society and countries. Changes and innovation within the multilateral worldwide marketplace are now accelerating and this acceleration will be sustained. The related impacts can be seen in the multiple interrelated demographic, entrepreneurial, sociological, geo-political, structural, operational, economic, and technological disruptions that are continually occurring within the global marketplace.

These business disruptors are keeping project and business management operations in flux and demand timely, proactive, agile, and adaptive responses. This requires business analysis, systems thinking, active-listening, leveraging various forms of increased diversity, and a different mindset to move from reactive to proactive agile leadership within the operations, development, and project management disciplines.

DISRUPTORS as DRIVERS of VUCA and Change

The 4th Industrial Revolution will continue to generate technological changes. These changes are coming on an accelerated basis and are creating impacts on various business, logistical, cultural, and societal aspects of human life. These accelerating innovation changes within all technical fields, when combined with their impacts, become the disruptors in the operations of businesses and the management of projects. This plethora of disruptors are generating the Volatility, Uncertainty, Complexity, and Ambiguity (VUCA) being experienced by operations and project management, which are affecting and changing how enterprises and their functions are led, managed, and operated.

Change has always been hard to manage, but now the management of change is becoming a constant necessity. However, just defining the actual changes needed and then identifying the new strategies, business models, or processes the organization needs to retain market share is difficult. But, developing the operational and project management leadership needed to lead the enterprise through the related transformational changes in a timely manner will be even harder. Jack Welch, a prior CEO of General Electric, once famously said, "If the rate of change on the outside [*external environment*] exceeds the rate of change on the inside [*internal environment*], then the end [*of the business*] is near."

A few easily identifiable disruptors, that are drivers for transformational change, can be viewed as world-wide forces driving the VUCA conditions and transformational changes within businesses, and require leadership attention by operations and project management. Some of those conditions and changes, and whether they may be viewed as drivers of Volatility (V) and/or Uncertainty (U) and/or Complexity (C) and/or Ambiguity (A), include:

- *Workforce Demographics [C, A]*: Accelerating changes in ethnic diversity, religious diversity, cultural diversity, and age diversity—five generations now functioning within the labor-force.
- *Diversity in Employee Attitudes [V, A]*: Increasing diversity within the workforce is generating increased diversity in the workplace employment and attitudes of personnel. This includes job changing, worker rights, decreasing loyalty to a company, reducing

interest in longer-term employment, demanding a say in operations, mobile-pension options, etc.

- *Global Workforce [V]*: Personnel being used to perform work are steadily becoming more distributed across multiple nation-states.
- *Independent Contractors [V]*: Number of independent contractors is increasing and the number of company personnel transitioning to becoming independent contractors is increasing and this trend has just begun.
- *Individual/Group Entrepreneurship [V]*: Increasing number of startup businesses is driving innovation in general and also the speed of products and services to market.
- *Interconnected Humanity [U, C]*: Billions of people are being connected by mobile devices, with unprecedented processing power, enormous storage capacity, and unbridled access to information and knowledge.
- *Cultural Revolution(s) [C, A]*: The millennial generation and generation-Z are driving ongoing cultural changes within nation-states, industries, and individual businesses.
- *Political Fluctuations [V, U, A]*: Political situations and related economic realities are shifting rapidly and exposing enterprises to fluctuating levels of risk and vulnerability.
- *Societal Norms [U, C]*: The societal norms within every aspect of personal life, and within every area of business within the larger society, are consistently being modified by the ongoing cultural revolutions taking place world-wide.
- *Distributed Office Locations [C, A]*: Personnel performing work are distributed across multiple offices, with some locations in different cities and countries, and some with different communication styles, cultures, and procedures.
- *Globalization of Supply [C]*: Components and parts are being increasingly manufactured and sourced on a global basis.
- *Distributed Manufacturing [C]*: Major component manufacturing and final assembly are being distributed, and parts and assemblies are being shipped worldwide.
- *Tariffs (Trade Imbalances) [U]*: Trade imbalances and nation-state product/service protectionism tariffs are constantly impacting the ability to price and deliver components, products, and services in various markets world-wide.
- *Currency Rates [A]*: Varying rates of exchange and the relative value of currencies affect the ability to predict and maintain cost-structures and assure a profit upon sale.
- *Capital Availability [V]*: New money and major venture capital investment have already created, and will continue to create, financial volatility and accelerated competitive conditions for both companies and worker-employment.
- *Data Security [U, A]*: System breaches and lapses in data security are a constant and increasing threat to business operations and even to the ability to stay in business.
- *Disruptive Commercialized Technologies [V]*: A specific technology, or combination of technologies, employed and commercialized in such a way as to create a new product or service, which then disrupts an existing market or creates a new market (Examples: Uber, AirBnB).

- *Digital Transformations [U]:* Move toward a paperless society and economy. Digitization of all data and information. Elimination of data/information silos. Move from local computer servers and data-storage to cloud data-storage and cloud-based Platform as a Service (PaaS) and Software as a Service (SaaS) computing.
- *5G Wireless [U]:* The impending ubiquitous use of 5th Generation (5G) telecommunications, from board-room to person in the street, that began in April 2019 will impact every current form of data communication and transmission, including services, products, and end user devices such as self-driving cars and augmented reality. 5G data transfer speeds are projected to be about 1,000-percent faster than is possible with existing 4G. 5G technology will promote the move toward total wireless connectivity from existing wired intranets within facilities. The U.S. communications regulator will hold a massive auction of up to 3,400 megahertz to bolster 5G service and will spend \$20 billion for rural internet.
- *Internet of Things (IoT) [U, C]:* The interconnectivity of business and personal servers, computers, and hand-held devices is expanding and is pushing the sharing of information and data through the internet, into the “cloud,” and across nation-states and cultures – and the addition of 5G communications will produce further and more profound changes globally.
- *Augmented (Artificial) Intelligence (AI) [U, C]:* Augmented intelligence is the result of combining human with machine intelligence within a set of software programs. AI is not perfect, but it will be better than humans at performing routine and repetitive tasks in all areas of business. It will provide superior analytical outcomes when applied within specialized technical arenas and its application will impact both business and society. However, there are some cultural aspects around the use of AI, which will change the way people perceive their environment and will have profound effects on their behavior and attitudes.
- *Industrial Internet of Things (IIoT) [U, C]:* The implementation of the IoT within the industrial setting is adding control systems, industrial devices, robotics, and augmented intelligence, thereby enormously expanding the possibilities in autonomous manufacturing and production – and the addition of 5G communications will further change things that are just now being imagined. The IIoT can also be seen to contain the Internet of Robots (IoR).
- *Artificial Intelligence of Things (AIoT) [U, C]:* The use of artificial intelligence (AI) technologies will enhance the Internet of Things (IoT) infrastructure and will transform operational data into information that can be used to make decisions in real time.
- *Virtual and Augmented Reality (VR and AR) [V, C]:* The 3-dimensional computer-generated representation of a graphic image or environment, whether computer created and/or real physical setting, is changing how media and games are consumed and how warfare will be conducted.
- *Industrial Transformation [V, U]:* The proactive and coordinated approach in leveraging digital technologies, such as the IoT, the AIoT, the IIoT, and 5G, are going to create step change improvements (versus continuous improvements) in industrial operations from the laboratory, to the machine, to the whole plant.

- *Cloud Based Media [V, U, C]:* Media, such as movies, music, etc. are completing their transition from physical hardware to digital downloads and streaming, with the traditional video-game industry currently shifting to have all gaming occur within cloud-powered streaming platforms.
- *Breaches of Trust [U, A]:* Theft and embezzlement, aided by the greater use of technology, are rising within small businesses.
- *Geo-Security [U]:* Geo-Security uses geographical and time dependent information, such as position on the earth, as a factor in an authentication process to verify who a person, device, or machine is and what their authorization is related to being granted access to a specific program or system. These features will transform security applications on a global basis.
- *Nanotechnology [U]:* Nanotechnology is the current physical ability to manipulate and manufacture materials and devices on the scale of atoms or small groups of atoms. Nanoscience and the resulting nanotechnology are developing and creating extremely small things that can be used across all industries that desire or require specialized materials and very small components and machines (robots). Those components and robots can be smaller than a humming bird down to sub-visually small. [On a visual comparative scale, if a marble were a nanometer, then one meter would be the size of the Earth.]
- *Artificial Neural Networks (ANN) [C, U]:* Generally, they are deep-learning neural-network computing chips which loosely model the synapsis-and-neuron type parallel-cognitive processing of a biological brain, developed using neuromorphic engineering, and are effective in spotting patterns in data. Examples are IBM's True North and Intel's Loihi computing chips.
- *Blockchain Technology [U]:* Allows digital information to be distributed, but not copied, creating an incorruptible digital ledger of digital transactions that can be programmed to record virtually any transactions of value, creating a time-stamped series of immutable data records. Blocks of data (i.e. block) are secured and bound (i.e. chained) to each other using cryptographic principles. Usable to replace all processes and business models which rely on charging a small fee for a transaction, such as auction houses and any other business entity based on the market-maker principle.
- *Global Warming [A]:* Changes in the earth's atmosphere and climate occur over time, and the current changes, whether man-made or not, are impacting all countries and the quality-of-life for individuals. These changes are affecting, either directly or indirectly, all countries, societies, businesses, and industries.
- *Professional Sports Operations [U]:* Technology meets sports: In hockey, the wireless tracking of a microchipped-puck and players in real-time. In baseball, robots calling balls and strikes. In basketball, the tracking and reporting of the arc, left-right position, and point of impact of a shot.
- *Vehicle Usage [U, A]:* Augmented functionality in the operation of all automotive systems, with artificial intelligence in many systems. Self-driving trucks and cars. Transportation as a service. Car sharing. Move from sedans to SUVs. Transition from combustion engines to hybrids to fully electric.

- *Electric Vehicles [U, A]:* Electric vehicles are becoming main stream within societies on a global basis. Matching the range of combustion-engine vehicles, Shanghai automaker GAC began, in April 2019, offering its Aion LX SUV that can travel 600 kilometers (370 miles) on one charge.
- *Delocalization of Competition [U, A]:* Consumers can use the internet to get educated about and select the best value in products and services, which allows competition to come from anywhere world-wide.
- *Potable Water [V, U]:* Safe drinking water is becoming scarce. Increasing water use is depleting freshwater resources worldwide. In addition, a list of organic, inorganic, radiological, and microbiological contaminants are turning once potable water into a health hazard, while other contaminates are simply making it unacceptable based upon taste, smell, and appearance.
- *Price of Oil [U]:* The supply of oil and therefore its price is constantly exposed to technical, geopolitical, and regulatory changes, causing unexpected effects when the pricing impacts businesses, and when it more heavily impacts enterprises outside the individual nation-state economies that produce or refine oil.

According to an in-depth report by the Project Management Institute, 91% of organizations are feeling the impact of disruptive technologies and those that are not yet experiencing such impacts are preparing for emerging disruptive technologies to change their businesses over the next five years. “Disruptive technologies are the new reality for every organization across every sector in every geographic area. Artificial intelligence, the cloud, digitalization, blockchain—they all offer up seemingly endless possibilities for organizations to transform themselves and their industries [33].” The rush of emerging technologies has spurred even reluctant enterprises to undertake a digital transformation, thereby creating the digital economy. Since most products and services are produced using various project management methodologies, this rise of the digital economy is also giving rise to what can also be called the project-based economy.

“The increasing digitization of work is rapidly shifting the nature of work for most professionals and managers away from routine operational work (i.e., “running the business”) toward more dynamic project-based work (i.e., “changing the business”). Not surprisingly, this shift means we are in the midst of a growing project-based economy with an estimated 20% growth in project-based roles over the next 10 years [37].”

Therefore, project leaders and project management organizations (PMOs) are now playing key roles in this transformation [17, 18]. “Project leaders will play an important part in embedding the culture of innovation, transformation, and change, and in evangelizing new technologies and methods across the organization [33].” Project management leadership can drive this transformation by tying people, technology, innovation, and processes into a cohesive whole. As organizations continue to face increased disruption, effective project management practices are more valuable than ever, with leading organizations now elevating the business roles of project professionals and elevating the PMO to address, and take advantage of, the disruptions within their marketplace.

Summary – Disruptors as Drivers

Each of the above disruptors has one or more business implications for every industry and enterprise. Leaders are struggling with how to address these disruptors—all are of vital importance

to their enterprises, project sponsors, employees, and stakeholders. To be effective, the leadership of operations management and project management must develop a means to understand how these disruptive forces are impacting their business and project management operations. In addition, leadership must identify and employ management approaches to proactively address how various disruptors can be handled across all the functions within their enterprise's operations.

VUCA CHALLENGES – DISTINCTIONS and RELATIONSHIPS

The business and societal disruptors being generated by the 4th Industrial Revolution are creating the VUCA conditions, the challenges, under which leadership and management must now modify strategies, make decisions, manage risks, plan events, and solve problems. The VUCA challenges can be viewed from various perspectives or contexts, such as social, religious, geopolitical, business, etc. with the types of managerial approaches needed to address the challenges being dependent upon the perspective from which they are viewed. The perspective taken within this paper is that of the project management discipline within a business management context.

Meaning and Relevance of VUCA to Business and Project Management: Today's entire human society is experiencing the beginnings of an unfathomably rapid and expansively impactful information technology revolution—one that promises to have profound disruptive and transformational effects upon businesses and the livelihoods of current and future generations. Market disruptors, such as labor mobility, changing consumer preferences, and technology advancements are pushing, if not forcing, companies to change by evolving and adapting faster to market conditions than ever before. This pervasiveness of rapid technological and cultural changes, digital work, and focus on customer value, has also made it necessary for enterprises to transform (change) how strategies are developed, decisions are made, and projects are accomplished.

The particular meaning and relevance of the various elements of each VUCA challenge within project business management often relate to how leadership views the enterprise's conditions under which they operate. In general, management's understanding of the VUCA challenges tends to shape an enterprise's leadership's capacity and ability to:

- Anticipate the issues that shape the future of the business;
- Understand the consequences of identified issues and related actions;
- Appreciate the interdependence of variables;
- Prepare for the emergence of alternative realities and challenges;
- Interpret and address how much they know about any broader situations and relevant opportunities; and
- Determine how well they can predict the results of their decisions and actions.

The four elements of VUCA also present a context in which management can view their enterprise's current operational state and establish predictions of their future states of operation. The meaning and relevance of the elements can:

- Present identifiable boundaries for strategy, planning, and policy management;
- Come together in ways that either confound decisions or sharpen the capacity to look ahead, make decisions, plan, take actions, and move ahead;

- Set the business stage for managing and leading; and
- Establish a basis on which to interpret and address relevant opportunities.

Acceleration-Aware and Contextually-Aware VUCA Perspectives: Leadership needs to develop an acceleration-aware perspective of VUCA forces within a business management context. These forces are being enabled by a series of powerful accelerations in intelligent technologies, advanced automation, and cloud computing. These transformative changes and innovations being wrought by Industry 4.0 are also continuing to accelerate. This is creating the *VUCA-Accelerated* (VUCAA) business conditions for many enterprises where day-to-day operations will exponentially become more Volatile, Uncertain, Complex, and Ambiguous than in any prior period of history.

To proactively manage the four VUCAA challenges facing business, portfolio, program, and project managers, each enterprise must contextually understand and address those forces and the speed at which they are impacting their business and project management operations. The four elements of VUCA, each of which represent a distinct challenge to business and project management, are often blended together by the perceptions of most general-business leaders. This blended view ignores the need for each challenge to have a distinct set of operational and project management approaches for each specific business and marketplace. These garbled perceptions make it difficult for leadership to understand how to appropriately address each challenge for a specific situation or event and makes it easier for project management and a PMO to use VUCA as an excuse for failure.

Technology Spawned VUCA Business and Project Management Environment: New technologies, new business models, globally expanding competition, and other business disruptions are combining to create a VUCA environment that is challenging even the best enterprises as well as most business and project management professionals. While many established businesses are trying to address the challenges from the technological revolution, newly minted companies are offering products and services that were non-existent just a few years ago, thereby completely modifying the then existing business marketplace. This accelerating marketplace disruption is exemplified by companies such as: Facebook, Amazon, Netflix, and Google. This disruption is also being driven by hundreds of new billion-dollar startups, and venture-capital funds that are driving the early expansion of new technology startups.

Future disruptive technological breakthroughs are taking place world-wide in the research and development centers of major corporations, as well as in the basements and garages of future innovators. A number of researchers and subject matter experts are voicing opinions that one of those new-businesses may replace one or more of the current globally-dominant technology leaders. Pundits are also concerned that a global entrant may be created by using multiple emerging technologies that will both combine and feed-off-of other future technologies. It is also possible that the leadership role in these emerging technologies may be distributed around the world among global competitors and new and existing strategic partnerships.

Therefore, the economic survival and prosperity of most enterprises are now intertwined with, and heavily dependent upon, how operations and project management deal with the threats, opportunities, and disruptions from emerging technologies. This environment demands developing

a number of critical management capabilities, if an enterprise is to survive and management is to function at the highest level of global operational success.

Summary – VUCA Challenges - Distinctions and Relationships

By carefully assessing the VUCA-spawned disruptive conditions external to, and within, an enterprise, and by determining what drove them, leadership can more strategically and tactically respond to the risks, opportunities, and unpredictability that those conditions bring. Reducing down-side risk, increasing understanding, and improving predictability requires different business and project management approaches and related strategies, depending on which of the VUCA challenges are creating the disruptive conditions being faced by the enterprise.

The following section provides a generic *VUCA-Accelerated* (VUCAA) analytical framework and model that leadership can adapt and use to develop their enterprise-specific model for performing this type of analyses to address their VUCA challenges. This framework and model can also lead to management's ungarbling of their perceptions of VUCA and thereby add to their understanding of how to address each challenge.

VUCAA ANALYTICAL FRAMEWORK and MODEL for MANAGEMENT

The business operating and project management environments and functionality that enterprises are employing need to be changed to respond at the same speed as, and in concert with, the technological, sociological, and political changes and the associated VUCA challenges being generated by Industry 4.0. This requires company leadership within a given industry to more proactively address those changes and challenges by: (1) Increasing their focus on envisioning the changes they need to address based upon what business analyses predict their potential marketplace might be like tomorrow; and (2) Planning the necessary related operational changes needed to produce and compete in that near-future marketplace.

To do this, business and project management must formalize and modify their leadership's perceptions of, and potential responses to, each of the four VUCA challenges. This will require documenting the specific drivers of VUCA related to their business, and identifying the operations and project management approaches necessary to handle each VUCA challenge within their enterprise's marketplace.

One common management technique, useful in dealing with how to adapt and modify current operations, is to implement a framework and model with a supporting analytical methodology. That technique can be used to assist management in analyzing the potential impacts of the four distinctive VUCA challenges and assist in developing a set of operational and project management approaches that specifically address their company's operations and marketplace. This approach can also help leadership and management improve their ability to identify, understand, predict, and prepare for the conditions, situations, and events being generated by worldwide events.

Nathan Bennett and G. James Lemoine in their Jan/Feb 2014 Harvard Business Review article^[1] "What VUCA Really Means for You" proposed a useful framework for identifying, getting ready for, and responding to situations and events within each of the four VUCA elements.

Their two-by-two VUCA graphic-model emphasized developing a basic means of understanding: (1) How much do you know about the situations and events – which improves as

efforts reduce complexity and ambiguity; and (2) How well can you predict the results of your decisions and actions – which improves as efforts reduce ambiguity and uncertainty. This acknowledges that volatility can exist even with better knowledge about a situation/event, or how firmly based any decisions or actions might be for a given situation/event.

Figure 2: VUCA-Accelerated (VUCAA) Four Element Analytical Framework for Project Management

+ RANGE OF HOW WELL ACTION RESULTS CAN BE PREDICTED -	COMPLEXITY	VOLATILITY
	<p>General Characteristics: Situations/events are composed of multiple, and possibly some interconnected, parts, and variables. Limited relevant information is available, but some can be assumed/predicted. Overall volume of information available may be overwhelming, and/or the nature of it may be too intricate and/or compound, to adequately process or analyze.</p> <p>General Approaches in Managing: Make management-oriented changes in various internal positions, resources, structures, systems, and processes to assist in unraveling the complexities of external situations/events and to reduce or eliminate internal complexity-generating situations/events. Restructure internal organizations and operations to reflect the determinable effects of internal and external complexities.</p>	<p>General Characteristics: Situations/events/changes are unexpected, may be relatively unstable, and/or may be of unknown duration. Changes are frequent and may be unpredictable. Situations/events may be understandable with what relevant information is then available. Number of possible actions/decisions are constantly changing in relationship to the stability and/or duration of situations/events.</p> <p>General Approaches in Managing: Narrow the number of possible management actions/decisions based upon risk/reward and timing of actions. Make changes in various structures, systems, and processes to increase agility adaptability and innovation to reduce internal volatility. Redirect resources to build slack and flexibility. Modify inventory and supply chains.</p>
	AMBIGUITY	UNCERTAINTY
	<p>General Characteristics: Situations/events present as unknown-unknowns – no precedents exist for making predications. Cause and effect relationships with, or among, situations/events unclear. Available information does not clarify situations/events and represents a lack of knowledge. Former ways of conducting operations no longer apply.</p> <p>General Approaches in Managing: Generate situations/event hypotheses and test them to determine and understand the various causal relationships. Experiment, analyze, and generate related information to enhance and enlighten potential management decisions/actions.</p>	<p>General Characteristics: Situations/events underlying causes and probable effects are generally known – or are unknowns that can become known. Basic lack of relevant information related to the situations/events causing a lack of clarity. Nature or volume of any information may be inadequate to successfully process. Unknown whether situations/events will drive changes or produce ramifications.</p> <p>General Approaches in Managing: Make focused changes in various information systems and processes, and add sources to acquire, collect, produce, analyze, and disseminate needed relevant information. Consider, view, and analyze any information from different perspectives.</p>
	- RANGE OF HOW MUCH IS KNOWN ABOUT A SPECIFIC SITUATION +	

Our VUCA-Accelerated (VUCAA) version of a general project business management graphical analytical framework looks more towards developing an understanding of: (1) The range of how much information is available and what can be known about any specific situation/event; and (2) The range of how well decision results can be predicted, or possible actions can be managed, for any specific situation/event. The resulting graphical framework is given in Figure 2 above.

This generic VUCAA Analytical Framework can allow management to develop a more detailed model of the specific drivers of disruption within their marketplace and to determine the appropriate and specific business management and project management approaches needed to address those specific disruptors. Each VUCA element can be seen as having a primary way in which it can be effectively addressed by management. Those ways are:

- *Volatility* – Enhancing operational and managerial agility and operational flexibility are management’s key means of coping with and adjusting to unstable changes.
- *Uncertainty* – Increasing information acquisition and interpretation is the means of increasing the knowledge needed by management to make informed decisions and take related actions.
- *Complexity* – Restructuring of internal processes, systems, and functional organizations, and also mirroring/matching the complexities within the enterprise’s marketplace, are the means by which management can reduce internal operational complexities.
- *Ambiguity* – Performing intelligent experiments and tests to support management in determining what business methods and strategies might be effective in current situations and events where the prior rules of conducting business no longer apply.

Given below is a generic example of a VUCAA-Model for project management to identify, get ready for, and respond to drivers of disruption related to each of the four VUCA elements, and which management could modify for performing this type of analysis within their enterprise. The fundamental descriptions of some relevant current-day drivers that are used in the model examples within this section are given above in the “Disruptors as Drivers of VUCA and Change” Section beginning on Page 2. The “Business Perceptions” characteristics for each element within the VUCAA-Model are meant to be more specific than the “General Characteristics” given on Page 8 in the VUCAA-Framework and are focused on a combination of business operations and project management.

THE FOUR ELEMENT VUCAA-MODEL FOR PROJECT MANAGEMENT

Leadership needs to identify and develop those management approaches that can be used to address the business drivers causing the disruptive forces that are impacting their enterprise’s specific business and project management operations. To meet the challenges of a complex world, leaders, strategic planners, and project managers need to understand the differences between the four elements of VUCA—Volatility, Uncertainty, Complexity, and Ambiguity. The operational effects of each element: (1) lead to different management and business perceptions; (2) are driven by different business disruptors, or factors of a disruptor; and (3) require different management approaches to resolve. Therefore, treating the four VUCA elements as a single concept will usually lead to poor decision making and ineffective actions. The ways and means by which an enterprise’s leadership addresses each of the four VUCA challenges will determine if that enterprise and its projects survive and thrive within the digital age of the 4th Industrial Revolution.

VOLATILE Forces (Perceptions/Drivers/Approaches)

Business Management’s Perceptions of Volatility – These views can include:

- Leadership’s inability to differentiate between urgent and important, for a given situation or event;

- A dynamic instability and disruption in operations brought about by frequent, violent, and rapid shifts in challenges and events, which require immediate attention;
- Leadership seemingly being overwhelmed and unprepared to lead effectively;
- A sense of increasing risk and limited understanding and predictability;
- The unpredictable nature and dynamics of a change, of the speed of changing-forces, and of identified change catalysts;
- Conditions being nonlinear, with sensitive dependence on inputs and on nonintuitive, disproportionate outputs;
- Fluctuations in conditions, which can be increasingly rapid, chaotic, or extreme, thereby increasing down-side risk and limiting understanding and predictability;
- Undesired changes within a business dynamic, and a resulting change in either the internal or external associated forces upon a set of situations, conditions, or structures inside the enterprise; and
- Shifts in the functional operational dynamics due to shifts within specific situations, conditions, or structures, whether those shifts are social, demographic, economic, or technical.

Business Drivers as Disruptors Creating Volatility – These drivers can include:

- Industrial transformation;
- Global workforce;
- Independent contractors;
- Individual/group entrepreneurship;
- Virtual and augmented reality;
- Augmented (artificial) intelligence; and
- Disruptive Commercialized Technologies.

Project Business Management Approaches to Volatility – These approaches can include:

- Seeking, selecting, and combining meaningful data into usable information, which can lead to understandings that are useful in decision making;
- Employing and modifying risk/reward management processes and systems;
- Building in schedule slack and devoting resources to preparedness;
- Enhancing and modifying resource management processes and systems;
- Stockpiling project-related inventory and/or overbuy resources;
- Making resource investments match the level of risk challenges;
- Communicating decisions and directions clearly with direct declarative statements;
- Streamlining decision making processes;
- Minimizing number of decision makers;
- Reducing and eliminating systemic failures and behavioral failures;
- Streamlining functional organizational structures and eliminate organizational silos. According to the American Productivity & Quality Center (APQC-2019) 73% of organizations feel that breaking down silos is vital to their success;

- Shifting corporate strategy in concert with, and in advance of, anticipated global market-shifts;
- Employing leadership agility to quickly change direction and adjust scope and modify timing of portfolios, programs, and projects; and
- Establishing flexibility within organizational operations.

UNCERTAIN Forces (Perceptions/Drivers/Approaches)

Business Management's Perceptions of Uncertainty – These views can include the:

- Basic lack of predictability of when changes or challenges are going to occur;
- Limited understandability of new or changing conditions (situations and events), which are generating forces that create instability in project operations;
- Lack of knowledge or information that is impeding the ability to determine the course of future events;
- Lack of predictability – dulling leadership's sense of awareness of situations and events;
- Structure of an existing complex system, as well as its outputs, being unclear, and/or conflicting, and/or unknown;
- Causal inputs to situations/events being unclear, conflicting, or maybe unknown;
- Many possible outputs that are dependent upon assumptions and inputs, thereby increasing risk and limiting understanding and predictability;
- Not understanding the larger causes of an uncertainty and the possible knock-on-effects being unknown;
- Instability being experienced in project operations; and
- Relevant information not being available and/or being unknown.

Business Drivers as Disruptors Creating Uncertainty – These drivers can include:

- Geo-security;
- Nanotechnology;
- Delocalization of competition;
- 5th Generation wireless;
- Digital transformations; and
- Industrial Internet of Things (IIoT).

Project Business Management Approaches to Uncertainty – These approaches can include:

- Implementing or upgrading knowledge management processes and systems;
- Modifying business and project plans to incorporate flexibility and management options;
- Investing in information – collect, interpret, and share;
- Adding information analysis networks;
- Employing Business Intelligence processes to generate and analyze disparate information;
- Identifying what could be done more effectively and/or efficiently;
- Performing structural changes on information and data storage and retrieval processes and systems;

- Streamlining the delivery and modifying the packaging of business-intelligence and decision-making information; and
- Challenging – what if’ing – the suitability of existing business and project management models, both individually and collectively.

COMPLEX Forces (Perceptions/Drivers/Approaches)

Business Management’s Perceptions of Complexity – These views can include:

- Being impossible to predict the outcome of an action or decision;
- Environment being complex in structure and involving unanticipated interactions;
- Multiplexing of disruptive forces – many existing challenges which cannot be dealt with separately;
- Many interconnected parts and variables;
- Existing interconnectivity and interdependence of multiple forces within a system;
- Confounding of issues;
- No discernable cause-and-effect chain or chains;
- Confusion surrounding basic functional organizational operations;
- Many actors, variables, and degrees of freedom in structures and functions;
- Many projects to manage at the same time;
- Some events that can only be predicted; and
- Stakeholder management being complicated and overwhelming.

Business Drivers as Disruptors Creating Complexity – These drivers can include:

- Interconnected humanity;
- Globalization of supply;
- Societal norms;
- Distributed manufacturing;
- Internet of Things (IoT); and
- Cloud based media.

Project Business Management Approaches to Complexity – These approaches can include:

- Addressing threats and opportunities from the viewpoint of their being interactive;
- Employing thinking in a non-linear fashion;
- Restructuring functional organizations to reduce complexities;
- Establishing Organizational Project Management and an executive-level PMO;
- Eliminating stovepipe communication that filters much of what personnel need to know;
- Developing information and data handling specialists;
- Building-up resources adequate to address the identified complexities;
- Developing top-level integrated planning and budgeting;
- Formally linking all projects to a program, and to a portfolio, and to a strategy;
- Employing and developing leaders with the ability to identify and tackle the larger issues;

- Embracing and addressing complexity with a focus on maximizing value;
- Seeking potential opportunities or solutions within the complexities at hand; and
- Enhancing cross-project visibility with portfolio dashboards.

AMBIGUOUS Forces (Perceptions/Drivers/Approaches)

Business Management's Perceptions of Ambiguity – These views can include:

- Having a haziness of reality that exists with the potential for misreads;
- Getting mixed meanings from conditions and conflicting interests;
- Having an inability to understand a situation or event;
- Having an inability to accurately conceptualize threats and/or opportunities;
- Systems having many possible outcomes;
- Conditions lacking a frame of reference;
- Situation/event being open to two or more interpretations;
- Cause-and-effect confusion with causal relationships being completely unclear;
- General meaning/impacts of situations/events being unclear, even when an appropriate amount of information is provided;
- Having a lack of visibility over projects and resources; and
- Having relevant information available, but with the overall meaning still unknown.

Business Drivers as Disruptors Creating Ambiguity – These drivers can include:

- Cultural revolution(s);
- Workforce demographics;
- Distributed office locations;
- Data security;
- Diversity in employee attitudes;
- Electric vehicles; and
- Breaches of trust.

Project Business Management Approaches to Ambiguity – These approaches can include:

- Binding project-portfolios to corporate strategy;
- Approaching solutions or alternate opportunities from multiple perspectives;
- Developing and testing functional responsiveness and change impact models focused on reducing ambiguity;
- Listening to all voices, particularly diverse voices representing valuable, if different, perspectives;
- Designing tests in ways that lessons learned can be broadly applied;
- Setting and achieving incremental small gains to tangibly demonstrate that a solution is moving in the right direction;
- Modifying methodologies, processes, and systems to drive from ambiguity to clarity;
- Striving to communicate more efficiently and collaboratively;

- Vetting personnel with access to company assets;
- Being open to new ideas and seeking out the possible opportunities that can be inherent in equally attractive solutions; and
- Providing clarifying information and explicit directions to personnel so that assignments and goals are not as ambiguous.

Summary – Four Element VUCAA- Analytical Framework and Model

The VUCA-Accelerated (VUCAA) Analytical Framework and VUCAA-Model given above could be used by any enterprise to create a learning VUCAA-Model for project management's VUCA preparedness, anticipation, evolution, innovation, intervention, and associated actions. However, although this VUCAA-Model lays out a basic example from a project management perspective of the drivers and project management countermeasures for each separate VUCA element, the four aspects of VUCA also have to be seen as, and therefore treated as, one interconnected non-homogeneous business reality. Therefore, overall but loosely-integrated operations and project management strategies will also have to be developed to simultaneously address all four aspects of VUCA.

Employing this type of framework and model and the associated analyses can support operations and project management in identifying:

- How to effectively modify their leadership;
- How to enhance their innovation-ecosystem and experimentation techniques used to create and develop newer systems, processes, products, and services;
- How to optimize the ways they innovate, produce, promote, and sell; and
- How to continuously and agilely adapt and modify their management techniques, methods, systems, structures, skills, and cultures.

VUCAA-RESPONSIVE CULTURES, STRUCTURES, and SYSTEMS

VUCAA-Responsive Cultures: Industry 4.0's digital transformation is not just about devices and software. It must be accompanied by a shift in culture—one that trusts its personnel, empowers them with technology, and enables users to become the creators of change and innovation ^[9]. This cultural shift reflects the decline in the utilization of functional management's supposed expertise and the ascendance of skilled worker empowerment. Since organizational culture is something that characterizes an enterprise, it can therefore be manipulated and altered to the enterprise's advantage depending on the executive management's leadership and personnel resources ^[28]. In addition, the design of the organizational structure must also be manipulated to reflect the requirements set by the desired changes in the organizational culture to address the VUCA challenges.

The latest McKinsey research finds many companies are striving to have an agile culture, but only four percent of survey respondents have completed an organization-wide transformation, and the number-one problem McKinsey cites, is culture: "Culture Can Make or Break Agility ^[26]." Also, Satya Nadella, Microsoft CEO, quoting Peter Drucker, said "Culture eats strategy for breakfast." Since both statements are dependent on strategy and agility, by extending those thoughts it can be said that culture eats both creativity and innovation for breakfast and that culture eats market-position for breakfast.

A central finding from McKinsey's survey of global executives highlighted three digital-culture deficiencies: 1) functional and departmental silos; 2) a fear of taking risks; and 3) difficulty forming and acting on a single view of the customer ^[25]. In a digital world, solving these cultural problems is no longer optional. Leadership must be proactive in shaping and measuring culture, approaching it with the same rigor and discipline with which they tackle operational transformations. This includes changing those structural and tactical elements in an enterprise that run counter to the culture change they are trying to achieve ^[25]. Shortcomings in organizational culture are key barriers to company success in Industry 4.0.

Organizational culture is generally viewed as encompassing those values and behaviors that contribute to the unique social and psychological environments within an organization. It affects the enterprise's productivity and performance. Organizational culture is unique for every enterprise and one of the hardest things to change ^[23]. Often called corporate culture, it manifests itself in four ways:

- 1) In how an organization conducts its business, including how it treats its personnel, customers, contractors, suppliers, and the wider community;
- 2) In how personnel are involved in decision making and developing new ideas, and in how they are given freedom in personal expression;
- 3) In how power, communications, and information flow throughout the hierarchy of the organizational structure; and
- 4) In how committed personnel are towards the enterprise's strategic objectives and innovation processes.

Organizational culture includes the enterprise's vision, values, norms, systems, processes, symbols, language, assumptions, environment, location, beliefs, and habits. Organizational culture is a product of multiple factors such as: history, product, market, technology, strategy, employee types, employee religions, management style, national culture, and positive or negative responses to marketplace forces. Current research shows that diverse teams, and companies that embrace diversity and develop a cohesive company-culture, perform better, are more creative, and are more adept at solving problems.

A 2003 Harvard Business School ^[11] study examined the management practices at 160 organizations over ten years and found that culture has a significant effect on an organization's long-term economic performance. Culture can either enhance or prove detrimental to performance. The study reported that organizations with strong performance-oriented cultures witnessed far better financial growth. Without exception, those companies that outperformed their industry peers also excelled at four primary management practices—strategy, culture, structure, and execution.

Additionally, a 2002 Corporate Leadership Council ^[6] study found four cultural traits are important drivers of business performance, namely: (1) risk taking; (2) innovation; (3) flexibility (agility); and (4) internal communications. They also affect individual and leadership performance, including both direct and indirect effects. The combination of these four culturally based traits can be viewed as providing an emerging definition for a high-performance culture, which creates a community of openness where employees are encouraged to experiment and try new things without fear of reprisal for mistakes.

An organization's culture affects the way the company's personnel and the functional organizations within the enterprise interact and cooperate with each other, sponsors, stakeholders,

and internal and external clients. Although a smaller company may have its own unique culture, a larger enterprise may have differing cultures throughout the company as well as co-existing subcultures. These differing cultures and subcultures may conflict with each other and the broader culture of the enterprise. The primary reason is that each subculture is linked to a different management team, leadership style, and is associated with a specific functional organization, which may be a stove-piped business unit within the enterprise ^[15].

Generally speaking, most leaders and managers recognize the need for anticipating, predicting, and controlling the impacts of the four VUCA challenges in order to manage risks, ensure the long-term viability of their enterprises, and assure project, program, and portfolio success. They intuitively understand that to succeed, they must; (1) accelerate the pace of change and innovation; (2) take more managed risks; (3) become more agile in their management practices; and (4) change their business culture to one of entrepreneurship.

However, the leadership and management, within most mature enterprises, are dealing with fairly fixed cultures. Most leaders and managers should, but do not, have a full grasp of the impact and meaning of culture in today's business environment. Culture needs to be understood, within a business management context, as the customary beliefs, social forms, behaviors, and material traits of an enterprise and its personnel. This includes the set of shared attitudes, conventions, values, goals, and social practices that characterize the features of the everyday existence shared by individuals within their business enterprise.

Leadership needs to consider the various ways that changes to organizational culture can be brought about within their enterprise to address the VUCA challenges. These include: (1) the application of soft-skills; (2) managed and directed growth; (3) controlled evolution of the organization; (4) process and procedure reform; (5) worker retraining; (6) operations modernization; and (7) management directed transformations of systems and structures.

VUCAA-Responsive Structures: Leadership and management within most mature enterprises are dealing with fairly hierarchical organizations and other structures that are not fully supportive of either the changes needed, or the innovation required, to address the accelerating VUCA challenges.

These enterprises have: (1) siloed functional operations; (2) knowledge, information, and data that are siloed; and (3) lack of project management representation at the executive level. However, to be successful in this 21st Century and to minimize creating negative impacts on project and business management operations from the VUCA challenges, an enterprise must eliminate: (1) siloed organizational structures; (2) siloed information technology and other resources and services; and (3) siloed data, information, and knowledge repositories and storage.

“The rapid emergence of disruptive technologies combined with short times to market will certainly continue to reorder the rankings of top disruptors [*those companies who are now disrupting their marketplace*]. But what remains constant is the need for PMOs to: Adapt swiftly to the changes brought by these technologies; Support initiatives grounded in disruptive technologies; and Learn how to apply these technologies to the PMO functions themselves ^[35].”

Another key structural modification that supports the management of change is implementing Organizational Project Business Management (OPBM) as an integral part of the enterprise's operations ^[5, 19, 20]. Research ^[13, 16] has also shown the establishment of an Organizational Project

Management strategy, structure and culture employing an Enterprise PMO ^[17, 18] situated at the executive level promotes innovation and the acceptance of change. This change in organizational structure can promote business strategy realization through project management's addressing the VUCA challenges across the enterprise and by being the overall function that directs and manages the necessary related changes.

The 2017 and 2019 Gartner Trends Reports state that “Organizations now appear to want the benefits of both a distributed PMO and a centralized PMO. This is giving rise to models that are somewhat integrated — creating distributed or disparate business and IT PMOs connecting into an enterprise-wide PMO (EPMO). This is a logical consequence of digital business, which is network-oriented. Essentially, EPMOs are evolving into change hubs for business networks that are constantly in flux ^[10].” Those reports also predict that 50% of enterprises will have integrated their disparate business PMOs and Information Technology (IT) PMOs into an Enterprise PMO (EPMO) hub by 2021, and that 80% of enterprises will have an EPMO by 2023 to enable their digital transformation. Digital transformation is an exercise in business model innovation. With more and more companies using capability-based-planning and business architecture as the lens through which to execute business model innovation. “Digital transformation doesn't just happen on its own. Organizations need a well-designed strategy, smart technology choices, and project management prowess—the trifecta of digital transformation success ^[34].”

“The massive ripple effect of disruptive technologies is proving to be a powerful catalyst in accelerating how PMOs adapt to new methods of value delivery and assert their relevance. High-performing PMOs are embracing the disruption—reimagining their mission with a keen eye on bridging the costly gap between strategy-design and delivery ^[35].”

Research ^[13, 16] shows OPBM organizationally, through an EPMO, facilitates the business-based selection and prioritization of innovative and change ideas. Its function is to execute innovative and change projects to effectively, efficiently, and agilely accomplish the enterprise's strategic initiatives—and support establishing a sustainable competitive business posture and organizational culture.

The concept of Organizational Project Business Management ^[17, 18] is based upon the idea that a correlation exists between the enterprise's capabilities in project management, project-program management, and project-portfolio management, and the enterprise's effectiveness in innovation and change management. OPBM, therefore, drives obtaining value and benefits from the innovation and change related work performed and resources expended ^[19].

VUCAA-Responsive Innovation Ecosystems: The PMI 2018 Pulse of the Profession[®], In-Depth Report: Next Practices: Maximizing the Benefits of Disruptive Technologies on Projects ^[31], based on a global survey conducted by PMI, identified two key performance levels among responding organizations – innovators and laggards. Innovators will be the business winners of tomorrow.

The collision of technological disruption, the rapid growth of emerging-markets, and widespread impacts of demographic shifts is upending long-held business and market assumptions that underpin strategy setting, decision making, and management (McKinsey Quarterly - September 2014). The changing nature of the business world is resulting in increased pressure on enterprises to continuously innovate and experiment with:

- Modifying operational and project management processes and methodologies;
- Trying new products and services;
- Improving the customer’s experience—how customers feel when they interact with a company and its offerings; and
- Transitioning different offerings to market.

Although 84% of executives agree that innovation is critical to their business, 94% were not happy with their innovation performance ^[24]. Few companies have a disciplined and repeatable approach to innovation.

Within business, the management of an enterprise’s innovation processes and change management processes need to be integrated. The management of innovation must allow the enterprise to respond to both external and internal opportunities and challenges. This process needs to generate something that can be introduced into and adapted for the enterprise or launched into the marketplace ahead of the business competition. Seventy-nine percent (79%) of the most innovative companies have well-defined innovation strategies, as compared with 47% of the least innovative companies ^[29].

Innovation is a driver of rapid growth and profitable revenue growth and is an integral process for long-term business success ^[29]. Therefore, an enterprise’s leadership effectiveness, the overall leadership styles within the organization, the enterprise’s business culture and structure, and the company’s profitability are closely related to management’s and leadership’s ability to lead and manage innovation.

Most companies think innovation is mainly for research and product development. Innovation needs to occur everywhere throughout the enterprise and involve personnel at every organizational level in contributing creatively to move the enterprise ahead of its competition. Companies need a culture of innovation and associated risk taking that supports performance and marketplace dominance. “Building a culture of innovation requires freedom to experiment with new ideas and ways of working—without the fear of being reprimanded if something does not go to according plan ^[33].”

The most innovative and agile companies do not predict the future; they make it. They generate a brand-new market by simply creating and offering something people did not consciously know they needed or wanted.

Therefore, every enterprise needs an *innovation ecosystem*, which is the environment required by the enterprise within which creativity and innovation can thrive. That ecosystem is composed of principles and practices, and related specific tools and processes interacting inside the environment of the organizational culture and structure. Those specific principles and practices must foster a creative mindset for innovation, within both the operations management and project management disciplines ^[21].

Summary – VUCA-Responsive Cultures, Structures, And Systems

The lack of VUCA-responsive cultures, structures, and systems are key reasons why mature enterprises are not responding appropriately to the VUCA challenges and are competitively losing ground to startups.

Conversely, from both a business management and project management viewpoint, a startup company can be seen as growing out of a project-managed innovation-ecosystem—as most products do. Most business startups at their core represent a basic model for the 21st Century enterprise. They exhibit the leadership styles, business culture, and organizational structures that foster change, innovation, and entrepreneurship, while mature business enterprises generally do not. They customarily utilize various management methodologies, that are supportive of different types of work, including agile-scrum project management techniques, while mature business enterprises generally may not.

If leaders in businesses want to more consciously create the business-world they wish for themselves and their personnel to work in, then they must begin shifting their mindset. Startups inherently have a VUCAA Mindset and are, by their structures and cultures, established addressing the VUCA challenges. A VUCAA Mindset is needed by leadership to recognize the need for anticipating, predicting, and managing the impacts of the four VUCA challenges to manage risks and assure project, program, portfolio, and business success.

DEVELOPING a VUCA-ACCELERATED (VUCAA) MINDSET

The capacity for VUCAA leadership in strategic, technical, and operational terms depends on a well-developed mindset for gauging the social, political, market, technical and economic realities of the prevailing business and market environment. A leader's mindset plays a critical role in how they cope with business challenges. That mindset is reflected in their collection of experiences, beliefs, and thoughts that make up their mental attitudes, inclinations, habits, and dispositions, which then predetermines how that leader interprets, reacts, and responds to events, circumstances, and situations within their enterprise and marketplace.

Viewed in simpler terms, within business a mindset is deeply held beliefs, attitudes, and assumptions an individual creates about who they are and how their business world works. In business decision theory, a mindset is a set of assumptions, methods, or notions held by one or more people or groups of people that is so established that it creates a powerful incentive within those specific people or groups to continue to adopt or accept prior behaviors, choices, or tools.

Leaders need to understand that mindsets shape the business lives they and their employees lead, the actions being taken, and the future possibilities of their business. Mahatma Gandhi said, “Your beliefs become your thoughts, your thoughts become your words, your words become your actions, your actions become your habits, your habits become your values, your values become your destiny.”

A significant number of leaders and managers have a predeveloped fixed mindset. As leaders and managers, they see their business world through the filter of their mindset. If that mindset is fixed, it creates blind spots that provide a fragmented way of viewing situations so that view is always incomplete and stifles innovation and creativity. The key way to avoid the far-reaching negative effects of a leader's fixed mindset's influence on decision making is to change that mindset.

A mindset is a powerful management lever for cultural and systemic changes within business. A leader's mindset shapes their business' day-to-day work environment and that of their employees. The collective mindsets of leaders and managers create the shared operational world

within their enterprise. If leaders want to change their business operations, such as to become more creative or improve project success, they must also be open to shifting their mindset. As organizations become more global, networked, and complex, the skill sets required to execute on projects successfully are less about technical skills and more about adaptive leadership skills. Eighty-three percent of respondents in a 2019 survey by TwentyEight Strategy Execution see the lack of adaptive and creative leadership mindsets as the biggest barrier to success ^[37].

Research ^[7] shows that a mindset can be developed to be more complex, flexible (agile), and adaptable. With intention, a leader's mindset can evolve from simple to complex, from static to dynamic, from ego-centric to socio-centric, and from functional silo-centric to enterprise-centric. Therefore, a leader can willingly modify and control their mindset, which improves their ability to understand different perspectives and enhances their capacity to embrace volatility, complexity, uncertainty, and ambiguity, and thereafter, their new mindset will control how they manage.

Businesses are operating in turbulent times and are facing the increasingly urgent and deeply interrelated VUCA challenges, which they haven't faced before. This is creating a business-driven need to develop a VUCAA Mindset to instill the adaptability required by executive management to agilely and quickly adjust to the unforeseeable, but not unexpected, changes in their business environment. Those changes can impact, and thereby force significant changes in, day-to-day business operations, project delivery goals, and the ways in which functional organizations perform their innovation, project and production work, and related services.

An important aspect of organizational and human agility is the ability to make intentional shifts within the operations management and project management functions. This is necessary to be effective and efficient in the changing contexts being created by transformational innovations. An organizational shift to agility is the intentional development of competence, capacity, and confidence to learn, adapt, and innovate in changing contexts for sustainable and executable success ^[27]. "Organizations with high agility [*flexibility*] know that technical skills are not enough to meet the challenges inherent in today's global marketplace. They advocate training to develop soft skills and business knowledge to support long-range strategic objectives. The ideal skill set combines technical, leadership, and strategic and business management expertise ^[30]."

In business and project management, this "VUCAA-Mindset" integratively blends the attributes of a "Growth Mindset," as described by Carol Dweck, in her book *Mindset* ^[8], with the attributes of an "Innovation Mindset ^[21]," and a set of four soft-skills and one semi-soft skill. This approach also requires that leadership develop their ability to understand, identify, predict, and prepare for the conditions and events being fostered by each of the four VUCA challenges within their specific marketplace.

Growth-Mindset: Carol Dweck refers to leaders, people, and organizations with a "growth mindset" as those who enjoy challenges, strive to learn, take risks, and consistently see potential to develop new capabilities, products, and services. This mindset is in stark contrast to individuals who have a fixed, also called crystalized, mindsets. Leaders with a growth mindset understand that their talents and abilities can be developed and enhanced through effort, training, and persistence.

A growth mindset among the leaders and managers of an organization needs to be a part of the organizational culture and is a prerequisite for employing soft-skills and developing an organizational innovation-mindset. Employees in a "growth mindset" company are ^[12]:

- 49% likelier to say that the company fosters innovation,
- 65% likelier to say that the company supports risk taking,
- 47% likelier to say that their colleagues are trustworthy, and
- 34% likelier to feel a strong sense of ownership and commitment to the company.

In leadership, a growth mindset can contribute to greater achievement and increased effort. When facing a problem, leaders with growth mindsets show greater resilience. They are more likely to persevere in the face of setbacks while those with what can be considered a fixed mindset are more likely to give up or default to the cultural and/or operational status quo. A leader with a growth mindset will work at achieving their leadership and managerial potential – this is one key to a VUCAA-Mindset.

Innovation-Mindset: Innovation as a business concept and managed process is a key factor in the future growth of any current or proposed business venture. Innovation is, and needs to be, part of a VUCAA-Mindset. It is a way to think about innovation related to the enterprise's business strategies, practices, and talents that can lead to future growth. This is the concept of an organization's and an individual's tendency toward innovativeness, and the propensity of a business to produce new value. An Innovation Mindset enables business and project leaders to:

- Recognize patterns of thinking and behavior that promote innovation, as well as the patterns that undermine innovation;
- Shift their mindset to become a more effective innovator and optimize the way they and their team think about their current challenges;
- Utilize actionable research-based insights into how to maximize value through innovation; and
- Make their team more adaptive, resilient and resourceful, as they both enhance, rather than compromise, their efficiency.

All people and companies are capable of being innovative, but some are more predisposed to value creation than others. Developing an innovation mindset to create and capture new value will vary from enterprise to enterprise, and individual to individual. In practice, there are no generic answers. For the enterprise to have an enduring capacity to innovate, innovation must function as mindset. This mindset must be an individual and organizational behavior that leadership perpetuates, rather than simply a corporate-defined strategic initiative. The primary source of the power to innovate, in any enterprise, exists in the minds of its leadership and employees. For an innovation mindset to flourish the enterprise must:

- Understand that innovation is as much about attitude and perspective as it is about process, because perception separates the innovator from the imitator;
- Create an environment in which employees can focus on outcomes instead of getting caught in an activity trap. Make time in employees' daily schedules for creativity and innovation;
- Embrace challenges, setbacks, and obstacles with creativity and imagination;
- Invite constructive feedback from employees;
- Assist employees in mastering new skills, acquiring new capabilities, accessing additional information, and committing to continuous learning and experimentation;

- Create an environment where resourcefulness is encouraged and rewarded;
- Have leadership walk the talk of innovation;
- Encourage innovation, expect failures, and foster the resulting learning; and
- Make decisions without all the answers.

To be effective, an innovation mindset must exist within leadership and management, must permeate and be integral with the enterprise's organizational culture, structure, and strategy. An innovation mindset must be supported by management's utilization of soft skill in their day-to-day operations.

Soft Skills (Forms of Intelligence): The PMI Pulse of the Profession 2018 report notes that four in five respondents say that soft skills, including communications and negotiation, are culturally more important today than they were just five years ago ^[32]. To manage the VUCA challenges, leaders must embrace and become competent in employing four specific culture-related soft-skill factors, which will affect an enterprise's ability to maintain the dominant position it may have achieved, or is trying to achieve, in its marketplace. These skills are related to how the enterprise's leadership interacts with and comes to be viewed by the media, marketplace, regulators, employees, stakeholders, sponsors, contractors, and customers. Those four soft-skill-sets for leadership and middle management that have gained prominence and import in today's world-wide marketplace are: Cultural Intelligence, Social Intelligence, Agile Intelligence, and Emotional Intelligence.

- ***Cultural Intelligence in Management***: Leadership's culturally-based ability and capacity in business to interpret someone's unfamiliar and possibly ambiguous mannerisms, speech, and gestures in the same way that a person's compatriots and colleagues would. Companies have cultures, often distinctive ones, and within any large enterprise there are also competing technical or ideological subcultures. The actions, gestures, body language, mannerisms, and speech patterns a leader or manager encounters in an unfamiliar, especially a foreign, business setting can be subject to a wide range of interpretations, including ones that can make business understandings less likely and cooperation almost impossible.

Cultural intelligence is the soft-skill mental-capability required to successfully and respectfully relate, adapt, and work effectively in an organizationally complex cultural context and multi-cultural business environment. A culturally intelligent leader displays the ability to:

- Show a level of motivation, interest, perseverance, and confidence during multicultural interactions;
- Both sense and mentally register all the ways that the various personalities being interacted with are different from their home and business culture and in what ways are they similar;
- Mentally develop definable cultural patterns that will enable them to anticipate how different people might react in various situations;
- Demonstrate a capability to mirror the customs and gestures of the different culture by physical actions and personal demeanor; and
- Effectively adapt, relate, and work in culturally diverse situations.

Leaders employing this soft-skill foster tolerance in the workforce and enhance positive cross-cultural interactions. Enterprises with culturally intelligent staff are more likely to accomplish their strategies in a global-multicultural marketplace.

Cultural intelligence can be seen as being related to social intelligence and emotional intelligence but going beyond them with respect to addressing organizational culture and interpersonal cultural relationships.

- ***Social Intelligence in Management:*** Leadership's socially-based competence in business. On an individual level, it is the capacity to know oneself and to know others within a social context and it also involves some self-insight and a consciousness of one's own perceptions and reaction patterns. Social intelligence is generally a learned skill from interpersonal experiences with other people and learning from successes and failures in social settings. It is basically the ability to get along well with others, and to get them to cooperate with you. More commonly referred to as *tact, common sense, or street smarts*.

It is the soft-skill mental-capability required to facilitate interaction and communication with people and communities, both internal and external, where social rules and relations are created, communicated, established, and changed in verbal and nonverbal ways. Its development and application promote leaderships' ability to:

- Perceive the multitude of social elements in the internal and external business environments;
- Have an awareness of business situations and the social dynamics that govern them;
- Be versed in the informal rules and prevailing social norms that govern social interactions;
- Comprehend various societal situations and regulations;
- Have a knowledge of interaction styles and strategies that can help them in dealing with others;
- Project those understandings onto the current and future status and needs of the enterprise and its staff;
- Engage in active listening, be an acceptable speaker, and be a conversationalist who talks in a tactful and appropriate way;
- Understand and manage complex social change;
- Act with integrity in the best interests of the company and its personnel; and
- Feel emotionally comfortable with all types of people and feel socially self-confident.

- ***Agile Intelligence in Management:*** Leadership-agility, also called fluid or flexible intelligence, is a soft-skill capability of operations and project management to quickly change business directions and adjust the scope and modify the market-timing of their enterprise's projects, programs, and portfolios. Flexible intelligence also helps in navigating tough negotiations and embracing challenges on the fly. Leaders with fluid intelligence are adaptive and reflexive. They change their approach to suit the requirements of the environment and situation. Agility in leadership can be learned. In a 2014 White Paper presented by the Centre for Creative Leadership, Adam Mitchinson and Robert Morris suggested that there are five facets of learned agile behavior:

- Innovating: Agile leaders are not afraid to challenge the status quo.
- Performing: Agile leaders remain calm in the face of difficulty.
- Reflecting: Agile leaders take time to reflect on their experiences.
- Risking: Agile leaders purposefully put themselves in challenging situations.
- Defending: Agile leaders are simply open to learning and resist the temptation to become defensive in the face of adversity.

To flourish in the digital economy, leadership and the management within the overall enterprise need to become more agile. They must develop and release new products and services quickly, as soon as or even before the market demands them. Further, in a business context, leadership's agility determines an enterprise's ability to rapidly respond to, in both proactive and reactive ways, and then adapt to, both internal innovative ideas and related changes occurring in their marketplace.

Leadership's agility is also reflected in their functional personnel's ability to become agile in their day-to-day work. When leaders and personnel become more agile, then their teams and organizations also become more successfully agile. However, agility is not something leaders can either incentivize or directly force upon their personnel. Therefore, leaders as part of their role must train and coach personnel in how to harness the power of using a VUCAA-Mindset to also enhance their personal agility within their teams and organizations.

- ***Emotional Intelligence in Management:*** Emotional intelligence, sometimes labeled Emotional Leadership, is the essential capability of persons to identify, understand, and manage their own emotions while also appropriately interacting with the emotions of the people around them. A manager with high emotional intelligence grasps what makes each of us unique and at the same time what makes each of us different from one another. It is generally understood to include the ability of leaders to discern between different feelings and label them appropriately, to use emotional information to guide thinking and behavior, and to manage and adjust emotions to adapt to various business environments.

Leaders with a high degree of emotional intelligence know what they're feeling, what their emotions mean, and how those emotions can affect other people within the enterprise. This ability to understand and manage emotions and human behavior can greatly increase a leader's chances of success. It is basically common sense that a leader who stays in control and calmly assesses situations is more likely to succeed than a leader, when under stress, shouts at or demeans his or her team.

According to psychologist and science journalist Daniel Goleman, who helped popularize emotional intelligence, in his 1995 book by that title, there are five key elements to emotional intelligence that need to be mastered.

Each of these five elements is covered below in more detail and is examined with respect to how each attribute can make a manager into a leader:

Self-awareness: Emotional intelligence requires a combination of self-awareness and social-awareness, which requires self-reflection. Leaders who are self-aware, always know how they feel, and know how their emotions and actions can affect the people around them. Being

self-aware in a leadership position also means having a clear picture of one's own strengths and weaknesses, and it means behaving with humility. Authentic leaders will say what they mean, mean what they say, and remain true to their values and principles.

Self-regulation: Leaders who regulate themselves effectively rarely verbally attack others, make rushed or emotional decisions, stereotype people, or compromise their values. Self-regulation is all about staying in control. This also covers a leader's flexibility and commitment to personal accountability. A leader, as a human-being, doesn't have much direct control over an emotion they experience in a given moment. But, they can control their response to that emotion by focusing on, and striving to control, their thoughts, thereby resisting becoming a reactive slave to that emotion.

Motivation: Self-motivated leaders work consistently toward their goals, and they have extremely high standards for the quality of their work. Emotionally intelligent leaders exhibit a growth mindset.

Empathy: For leaders, having empathy is critical to managing a successful team or organization. Leaders with empathy have the ability to put themselves in someone else's situation. They help develop the people on their team, challenge others who are acting unfairly, give constructive feedback, and listen to those needing to be heard. Negative feedback has great potential to hurt the feelings of others. Successful leaders realize this and reframe criticism as constructive feedback, so the recipient sees it as helpful instead of harmful. But leaders also know that criticism is a chance to learn, even if it's not delivered in the best way. and it gives a leader a window into how others think. When giving or receiving negative feedback, leaders will first keep their emotions in check and then strive to improve the situation.

Steven Covey in his various “*Seven Habits*” books says, “Seek first to understand.” Empathy includes a leader's understanding of others' thoughts and feelings, thereby helping them connect with others. Empathy in a leader doesn't necessarily mean agreeing with another person's point of view. Rather, it's about the leader striving to understand, thereby enhancing the possibility of building a deeper and more connected relationship. All humans crave acknowledgement and appreciation and when leaders commend others, they satisfy that craving and build trust in the process. By sharing specifically what a leader appreciates, that leader inspires others to become the best version of themselves.

Social Skills: Leaders who do well in the social skills element of emotional intelligence are great communicators. They are just as open to hearing bad news as good news, and they're expert at getting their team to support them and be excited about a new mission or project. These leaders make a habit of keeping their word and developing a strong reputation for reliability and trustworthiness.

Leaders who have good social skills are also good at managing change and resolving conflicts diplomatically. They're rarely satisfied with leaving things as they are, and they don't sit back and make everyone else do the work. They set an example with their own behavior. These leaders positively impact the emotions of others by helping them. A leader's readiness to give help builds trust and inspires others to follow their lead when it counts. These leaders also demonstrate strength and courage by saying they are sorry. Apologizing,

whether or not they are directly at fault, also demonstrates humility, a quality that will draw others to a leader.

Emotional intelligence Summary: Emotional intelligence focuses on a leader's ability to process emotional information and use it to navigate the cultural and social environments within their enterprise. The more a leader manages each of the emotional intelligence elements, the higher their emotional intelligence. Fortunately, these skills can be honed, thereby assisting leaders in learning conflict resolution, improving their communication skills, and learning how to praise others.

An emotionally intelligent person is both highly conscious of their own emotional states, even negativity, frustration, sadness, or loss, and are able to identify and manage each emotional state. These persons are also more tuned into the emotions that other personnel are experiencing.

Emotional intelligence can also be misused—such as when either a manager or staff-person attempts to manipulate the emotions of another person to promote a personal agenda or cause. Leaders need to protect themselves when those manipulation attempts are made toward them, and guard against doing that themselves.

Sensitivity to internal emotional signals from the social environment can also make for a better leader. Leaders need to forgive and forget, to prevent others from holding their emotions hostage, and thereby allow themselves to move forward. To be effective, leaders must have a solid understanding of how their emotions and actions affect the people around them and how the emotions of others affect them. The better a leader relates emotionally to and works with others, the more successful they and their enterprise will be.

Business Intelligence Usage by Management: Business intelligence comprises the strategies and technologies used by enterprises for the data analysis of business information. It is an essential feature in the management directed usage of processes employing descriptive analytics to provide a description of a past or current state within a business. It produces information from a combination of data derived from the enterprise's marketplace and data from the company's internal sources, which then provides managers with detailed intelligence about what was and what is going on within the business. The processes include software applications, infrastructure and tools, and best practices that enable access to and provide analysis of information. These business intelligence tools streamline the effort required to search for, merge and query data to obtain information management needs to make good decisions.

Leaders in business need to use the analyzed data to do their jobs better. Management needs it to transform data into actionable intelligence that can inform their strategic and tactical decisions, which can then be employed to improve and optimize a wide range of specific business decisions and operational performance. Leaders are empowered by business intelligence tools, which allow them to gain insight into new markets, to assess both demand and suitability of products and services for different market segments, and to gauge the impact of innovation and change efforts.

A unique aspect of Business Intelligence is that the decisions need to be made, and the management directions need to be performed, in Emotionally Intelligent and Agilely Intelligent ways.

Summary – Soft Skills

Business and project managers need to have a *VUCA-Accelerated* (VUCAA) mindset that enables management to embrace accelerating change and to employ adaptability, soft-skills, innovation ecosystems, and flexibility to agilely perform and manage the predicting, strategic-planning, innovating, adapting, forecasting, and change processes needed within their enterprises.

The VUCAA-Mindset, which employs a range of soft-skills, is a 21st Century business attitude that is now required to successfully lead projects, manage business operations, reduce risks, and enhance outcome predictability when executing projects, programs, and portfolios under accelerating VUCA disruptive forces. The most successful portfolio, program, and project managers will be VUCAA-Leaders.

When an enterprise's management's soft-skills are combined with supporting culture, structures, and systems, then that enterprise will demonstrate superior capabilities and execution effectiveness and it will begin outcompeting in its marketplace. However, even in this digital-age it will still be human beings, the VUCAA-Leaders, their talents and how they utilize the new management related technologies, that will address the VUCA challenges and transform and guide their enterprises.

THE 21st CENTURY VUCAA-LEADER

Business schools taught existing leaders in the usual managerial techniques of business administration, operations management, project management, control systems, financial forecasting, strategic planning, tactical planning, decision making, etc. These techniques have not fully prepared today's leadership to actually lead within this 21st Century's VUCA environment, and those teachings are no longer sufficient to address the range of decisions and changes needed today within most enterprises. Therefore, conventional project management approaches clearly are also not working.

The command and control leadership style practiced during the 20th Century is fading into history and is being replaced by a more holistic form of leadership in the 21st Century. Deeply layered hierarchical and siloed organizational structures are being supplanted by flatter organizations with some semi-autonomous groups supporting the whole. As an example, the president of Ford Motor Company in May 2019 announced the elimination of 7,000 positions – 20% of which will be “white-color” employees. In addition, he announced the flattening of the company's overall organizational structure from 19 to 14 layers – a 20+% reduction in the business' hierarchy.

Communication is now being promoted upward to management, across all functions, and down through the whole enterprise. Today the open transmission and sharing of knowledge are now promoted across and throughout the enterprise. Leaders must now set and promote the vision of what the purpose of the enterprise is. Leadership must then implement that vision through defined supporting strategic initiatives that can be accomplished through distributed empowered decision making.

Leaders need to put the VUCA challenges and disruptors that impact the execution of their critical initiatives at the center of their enterprise's strategic thinking and embrace a “VUCAA-Mindful” attitude. The challenges exemplified by the accelerating volatility, uncertainty,

complexity, and ambiguity in the business environment are constantly putting increasing pressure on business managers to lead very differently in the changing worldwide marketplace. Project leaders and project management organizations need to seize opportunities to develop their capabilities to adapt in real-time. They need to modify the boundaries, especially around Agile-Scrum, change-enabling innovation-ecosystems, and the functional foundations of sponsorship, stakeholders, and project management. The time has come in this digital-age for more VUCAA-Leaders, the VUCAA Mindset leaders, to step up and lead in ways that business schools have just begun teaching.

In the increasingly VUCA-world of business, project management in conjunction with operations management needs to develop strategic adaptability and better foresight, which makes strategic thinking an imperative and leadership a crucial skill. This requires modifying and adapting the way leadership thinks about strategy, and how enterprises approach the execution of and implementation of strategic initiatives.

Many views are being promoted on what leadership should be in a VUCA world. However, the following are the key attributes that distinguish the effective VUCAA-Leaders from the mediocre leader in the 21st Century's marketplaces. This strategic oriented leader, this manager with vision, will demonstrate their ability to:

Utilize Vision with a Strategic Focus to:

- Have an in-depth understanding of their enterprise's strategies and related capabilities;
- Display the capacity in operational terms to gauge the technical, social, political, market, and economic realities of the enterprise's business and market environments;
- Engage directly with customers and employees to ensure they are attuned to shifts within their marketplaces;
- Continually see through the VUCA created chaos to create a clear vision and business strategy for their enterprise;
- Comprehend where and how the fundamentals of their current operations could be unsettled by new innovative market-entrants or new business models;
- Shift corporate strategy in concert with, and in advance of, anticipated global market-shifts;
- Establish the formal means to make the necessary strategic changes in culture, structure, and processes;
- Manage and execute projects, project-programs, and project-portfolios to accomplish the enterprise's strategic initiatives [2, 3, 4, 5, 13, 14];
- Bind project-portfolios with their related corporate strategies;
- Continue to strategically deploy strong technical project management skills in tandem with the new leadership soft-skills that are resulting from having to address the VUCA challenges;
- Promote geostrategic future planning to strategically reduce the impacts of the VUCA challenges;
- Know what needs to change while also knowing what not to change;
- Exhibit both an adaptive concept of strategy and an alignment of all project elements to support the enterprise's strategic initiatives; and
- Adjust their mindsets to handle changes to strategy, while continuing to lead effectively.

Show Determination and Courage to:

- Be engaged with, be aware of, and empowered by the VUCA challenges;
- Step up to the VUCA challenges and have the courage to make decisions that embody risks and may go against the prevailing views;
- Display the grit, passion, fortitude, determination, and perseverance to accomplish their enterprise's established goals;
- Accept the responsibility of working towards developing the larger strategic initiatives while also architecting their personal strategies for executing work;
- Consistently walk the talk so changes can be advanced and innovation ecosystems can function;
- Model leadership principles to individual champions and stakeholders who can make a positive and lasting difference within their organizations; and
- Demonstrate the capacity and capability for managing the VUCA challenges by promoting new and more effective value systems, assumptions, and management methods for the enterprise.

Exhibit Adaptability with Agility to:

- Anticipate those changes needed, which could result from identifiable VUCA challenges;
- Take advantage of rapidly changing circumstances using adaptability to optimize their enterprise's strengths while minimizing its weaknesses;
- Be flexible in adapting to the rapidly changing VUCA environment;
- Be flexible in employing the tactics required for rapidly adapting to changing external circumstances, without altering strategic course;
- Create multiple contingency plans while preserving strong balance sheets to cope with unforeseen events;
- Seek new and unexpected internal and external business partners, and become active partners in their enterprise's digital transformations;
- Recognize how complexity influences projects and adaptively decide the best approach to successfully lead and manage work for specific situations;
- Handle uncertainty and unfamiliarity by using willingness to adaptively approach projects with a mindset that is independent of any particular project, program, or portfolio; and
- Recognize how operational and project management landscapes are changing and are open to adapting new management and technical approaches.

Promote Innovation, Transformation, and Changes to:

- Understand the impact of evolving technologies on both major internal change and innovation projects and external customer deliverables;
- Anticipate required changes and the innovation need as a result of VUCA situation/event analyses;
- Innovatively integrate new technologies with required legacy technologies;
- Identify the specific capabilities that must either exist, or need to be acquired, to support the management of changes and innovation;

- Define the related business factors that must be developed, cultivated, ameliorated, or addressed to promote innovation and change;
- Deploy a culture in which employees are provided with incentives and encouragement to work on new ideas and to innovate, despite uncertain outcomes or initial failures;
- Provide time and space to think, and allow some slack in innovation processes to allow creativity to emerge from motivated employees;
- Constantly challenge internal functional organizations to ensure that technology-enabled innovative changes can unlock productivity gains and provide significant competitive advantages; and
- Strive to systematically minimize the downside risk of the enterprise's upside-bets on innovation.

Summary – VUCAA-Leader

The new business realities that enterprises are facing include increased competition, shortened product life cycles, rapidly changing customer needs and interests, the constant need to create value, and having to develop and manage new and revolutionary projects. These realities are impacting and thereby forcing significant changes in day-to-day business operations, project delivery requirements, and the ways in which functional organizations perform both their project and production work and related services. This in turn is requiring operations and project management to employ the soft-skills and the adaptability necessary to agilely and quickly adjust to these unforeseeable, but not unexpected, changes in their business environment.

From a project management leadership perspective, within most enterprises, the business management focus is shifting from the traditional elements of scope, cost, and schedule, to now include a business's strategic engagement that addresses its mission, passion, and dedication, and the inclusion of the broader business benefits of maximizing overall value, having a focus on strategy execution, controlling negative impacts, and managing the down-side of market-risks. To address these shifts, portfolio, program, and project managers need to become VUCAA-Leaders.

Therefore, with both external-environment and internal-business VUCA challenges becoming prevalent in every enterprise's marketplace, business and project management leaders need to build their VUCAA leadership strengths. Leaderships' proactively, defensively, and effectively practicing of the VUCAA-Leader skills, using data driven decisions, can prevent having regrettable business situations and negative product and service outcomes. Leaders need to hone the ability to deploy distinct and daring strategies, and to become focused on driving their enterprise to accomplish its defined business strategies and to create both tangible and intangible value.

CONCLUSION

A symbiotic relationship has always existed between technology and business. Business utilizes technology to provide improved and different products and better services to society as a whole. Society often then uses new or improved products in different ways or to a greater extent than business expected. Business responds to society's changing demands by developing and employing newer or better technology to meet those demands. And, these cycles repeat and repeat. This cyclic progress of enhancements and changes in technology and its application by business

and acceptance by society has been essentially a linear upward advancement starting with the 1st Industrial Revolution through the 3rd Industrial Revolution.

The beginning of the 4th Industrial Revolution in about the year 2000 changed how technology is advancing. The ramping-up of those cycles of change across the world marketplace is now non-linear. It is on the escalating up-sloping knee-bend of a hockey-stick shaped change paradigm. Within business, this new paradigm of change has moved project management from being applied to mostly major projects down to implementation on a small single software project. This has also changed how executive management, operations management, and project management need to interact. The associated operational consequences of this new change paradigm to both business and project management are far reaching.

Therefore, the advent of Industry 4.0 has made surviving as a business more challenging because just functioning within the marketplace has become more Volatile, Uncertain, Complex, and Ambiguous (VUCA). This has created the VUCA challenges to managing within the 21st Century, where to survive, an enterprise must quickly get much better at handling changes in all areas.

These VUCA challenges are becoming more difficult to address, since the technological changes are accelerating and those changes are transforming the way societies communicate, interrelate, gather and share knowledge, travel, shop, etc. Which, is also slowly changing how various countries, societies, and industries perceive family, nationality, and national sovereignty.

The VUCA challenges are disrupting all industries and thereby changing the functional roles and responsibilities of leaders and workers in both operations and project management and changing what they produce. To succeed, an enterprise now has to continuously adapt, modify, and add to the products and services they offer, as well as change how they produce, promote, and sell them. However, not only the products, services and processes need to be continuously changed, but also the enterprise itself has to change in more fundamental and global ways. Enterprises will need different organizational structures, adaptive leadership, different ways of thinking, different resources, more informal ways of communicating, and maybe even a different business model.

If the culture, structure, and agility of an enterprise's internal business model and organizational structures are only adequate to currently make it competitive in their existing business environment, then that makes them inadequate, and the business unable, to compete in response to the Industry 4.0 marketplace disruptions. Companies will either be winners or losers depending on how they handle the accelerating VUCA challenges created by the Industry 4.0 digital landscape revolution.

Executives conceptually understand the changes that the VUCA challenges of Industry 4.0 will bring, but they are less certain how they can act to benefit from those changes or mitigate their impacts. Many enterprises already have a basic strategy of continuous change and improvement in their business operations, but they still need to instill a culture of change, trust, empowerment, collaboration, innovation, sharing control, and an evolution in how to make things work. To that end, leadership should consider three primary changes to the way an enterprise conducts its business in addressing the VUCA challenges: (1) Utilizing a *VUCAA-Accelerated* (VUCAA) Analytical Model; (2) Developing a VUCAA Mindset; and (3) Creating VUCAA-Responsive Organizational Operations, Structures, and Cultures.

(1) VUCA-Accelerated (VUCAA) Analytical Framework and Model: Every enterprise needs to develop a real solution, a framework/model, for dealing with the acceleration of VUCA within its marketplace. This solution needs to respond to the businesses needs as they evolve and also address external forces so the business can seize new opportunities and project management can support the changes.

A VUCAA Analytical Model can assist management in developing their business perceptions of, in identifying the drivers and disruptors for, and creating the project and business management approaches to the four VUCA challenges, with a focus on maximizing value and positively impacting the bottom-line. This model approach to the VUCA challenges can be applied within any functional organization (Operations, PMO, Finance, etc.) within the enterprise as well as at the overall enterprise level. This will assist leadership in establishing and promoting their preparedness, anticipation, evolution, intervention, and decision-making processes

(2) VUCA-Accelerated (VUCAA) Mindset: Leadership within operations management and project management, to managerially address the VUCAA challenges, need to develop a significantly different way of viewing and addressing those challenges. Leadership needs to develop and deploy a VUCAA-mindset composed of a growth mindset, an innovation mindset, and supporting skills. These skills would include emotional intelligence, social intelligence, agile intelligence, cultural intelligence, and business intelligence, coupled with team collaboration across organizations and virtual teams.

This *VUCA-Accelerated* mindset will represent something new within most enterprises and involves experimentation, which means stepping into a vague and uncertain future. This move into a VUCAA mindset must be taken as a management quest towards change, because it is a challenge to the organizational status quo, represents a move toward something different, requires managed risk, and demands the deliberate intention by management to drive invention, promote change, and create value.

The business requirement to be innovatively proactive, utilize innovation ecosystems, and employ digitized processes within the discipline of project management is evident in the marketplace. These actions are needed to address the globally accelerating technological advances and their related disruptive VUCA forces of demographic, societal, and cultural changes, including their associated impacts on various stakeholders.

Existing mindsets can be transcended. Leaders can develop a new mindset to enhance their capacity and capabilities to create different organizational structures, modify the enterprise's culture, foster business transformation, and drive innovation.

The establishment of a VUCAA-mindset addresses the related critical business requirements that exists for operational and project management leadership to develop systems thinking, to be open-minded, to become active-listeners, to leverage diversity, to employ entrepreneurial-ship, and to embrace the accelerating-change in managing business conditions associated with the VUCA challenges.

(3) VUCAA Responsive Cultures, Structures, and Systems: The most experienced executives and managers understand that to succeed, they must accelerate the pace of change, take more risks, and employ agile management practices. This means using appropriate organizational cultures, structures, systems, processes, and tools to manage change and foster needed innovation.

The more forward-looking enterprises are now establishing the new position of Chief Culture Officer.

Adaptive skills need to be a central focus for effective leaders, and they are increasingly in demand. Adaptive leaders throughout the various functional organizations need to work upon developing their adaptive skills to guide their actions, as well as those of their team's, to agilely manage project-based work. As project work evolves, the most effective leaders will be those with adaptive project leadership skills, and that work to complement their traditional project management tools with an advanced skill set centered on adaptive and agile thinking.

All leaders know that changing the enterprise's organizational structures and its culture, for any reason, is very difficult. However, making cultural and structural changes enhances leadership's ability to manage the VUCA challenges. This is also necessary to ensure the enterprise operates creatively, efficiently, effectively, and agilely to serve both internal and external customers' needs and also address varying stakeholders' requirements.

These organizational changes also require an Organizational Project Management (OPM) strategy, structure design, and culture employing a Project Management Organization (PMO) that is harmonious within the enterprise, promotes change management, and can affect business strategy realization through project management's addressing the VUCA challenges [17, 18]. PMI's 2018 Thought Leadership Series found [34] "Today's disruptive technologies are a call to action for recasting the role of the Project Management Organization (PMO). As it is, 92% of executives PMI surveyed view the PMO as a driving force as they transform their organizations using disruptive technology. And nearly 90% of executives believe the PMO will play an increasingly critical part in digitally transforming organizations in the future." An informal survey by the Brightline Initiative at the Nordic Business Forum backed up these results. "It found that nearly 90% of respondents said an organization's project management capability was essential for strategy implementation success."

The enterprise's business units, including the PMO, must be responsible for: (1) managing change, using agreed upon goals, metrics, and budgets, and (2) employing an innovation ecosystem [21] and related governance model. The project management of information technology projects also necessitates the application of specific agile-scrum management principles and methods that will also foster and support a culture of change and innovation within both project management and operations management.

Confronting the VUCA Challenges

Addressing the VUCA challenges is a business necessity in the leadership of project, program, and portfolio management and the leadership of operations, and it is really everyone's business within an enterprise. Organizations whose leaders at any level are ill-equipped to handle the VUCA created environment will find themselves constantly struggling to keep pace with technological change. Growth oriented leadership within many enterprises are working at securing a clearer understanding of how disruptors are threatening the business models of larger, less flexible, less-innovative, and slower-growing competitors.

Mark A. Langley, President and Chief Executive Officer, Project Management Institute said: "As disruptive technology impacts the work we do, project managers become more valuable than ever as advocates and agents of change with the power to significantly impact the bottom line." A

2017 PMI-commissioned talent gap analysis, “Project Management Job Growth and Talent Gap 2017–2027,” performed by Anderson Economic Group (AEG) points to outstanding opportunities in jobs and career growth for project managers. This report shows that project managers are important contributors to productivity. Demand over the next 10 years for project managers is growing faster than demand for workers in other occupations. Through 2027, the project management-oriented labor force in seven project-oriented sectors is expected to grow by 33 percent, or nearly 22 million new jobs. By 2027, employers will need nearly 88 million individuals in project management-oriented roles.

If leadership doesn’t use the proven capabilities of the project management discipline to manage its specific market-driven VUCA challenges and radically transform how the enterprise operates its business, then it will find the business fast losing market-share to its competitors. Or, eliminated completely by unexpected market disruptors. The VUCA challenges are making Project Management one of the key professions of the future, because addressing all the related changes that are needed will employ the management methods of coordination, planning, risk analysis, agile, waterfall, hybrid, scope-change, workforce-capacity-planning, prioritization, and etc., and it will require portfolio/program/project stakeholders, sponsors, facilitators, integrators, and leaders to act as change agents.

In this Industry 4.0 era, with five generations in the workforce, leaders have fully entered a new business era that requires new ways of leading in both operations and project management. Global markets are and will continue to rapidly change, customers will become more demanding, and the VUCA challenges will increase. Organizations that respond to those challenges more effectively organizationally, culturally, structurally, and with agility will achieve the greatest success.

Project and product opportunities are in abundance. In “A Future That Works” (2017) James Manyika and colleagues at McKinsey Global argue that about half of the tasks that people currently do in their jobs could be automated by presently existing and demonstrated technologies. These opportunities can be exploited by those enterprise VUCAA-Leaders that tackle them using a VUCAA Mindset with a focus on change and innovation.

The management of projects is changing as a result of the world-wide technology driven changes happening within all working environments. Leaders must modernize their skills, as well as modify their mindset, to address the Volatility, Uncertainty, Complexity, and Ambiguity that are now associated with how projects, programs, and portfolios need to be managed. Leaders to be successful must prepare themselves and their enterprises for these new and unknown challenges.

The accelerating VUCA challenges are putting immense pressure on business leaders to lead in ways not prevalent today in most enterprises, especially in large corporations, but in ways that are typical of leadership in business start-ups and innovation-oriented companies. Traditional management methods are now insufficient to address the volume of changes and related challenges being encountered. Those enterprises promoting and employing newer operational and project management methods and technology to manage their change challenges on an enterprise-wide basis will outperform all others and will thrive within this 21st Century’s increasingly competitive VUCAA marketplace.

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Darrel Hubbard is President of D.G.Hubbard Enterprises, LLC providing executive consulting and assessment services. He has over 50 years of experience in consulting, line management, and technical positions. He has served as a corporate executive officer; managed information technology, proposal, accounting, and project management organizations; managed the due diligence processes for numerous mergers and acquisitions; was a program manager on engineering projects; was a project manager on commercial projects; and a designated “key person” under government contracts. He has also held executive positions in, and was professionally licensed in, the securities and insurance industries.

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Peter works with CEOs, top teams, other leaders, and managers in the space between strategy development and implementation to assure that organizations have the optimal structure, culture, and project/work delivery systems to achieve their goals and strategies. He assists with organizational restructuring and shifting culture to include a ‘culture of innovation’, and innovative and growth mindsets. He has provided these services to many Fortune 500 companies, including Microsoft, Starbucks, Chevron, Hewlett Packard, Boeing, PACCAR, Weyerhaeuser, Abbott, and others.

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