Addressing the Challenges of Data-Driven Analysis in Intuition-Driven Organizations

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ABSTRACT

Over the last 15 years, management's adoption of technology has advanced much slower than technology itself. Primary challenges include holding informed discussions with senior management, shaping realistic understanding of capabilities, working with stove piped information technology departments with a restricted understanding of new technology, and acceptance of data-driven simulation results over intuition-based expectations. These challenges grow in magnitude with organizations driven by intuition-based decision makers.

Biases and knowledge gaps with modeling and simulation (M&S), artificial intelligence (AI), and machine learning (ML) among managers and leaders are evident across a spectrum of clientele. When organizations decide to move from intuition-based to data-driven decision, they encounter hurdles of biases, gaps, poor assumptions, and emotion-driven responses.

In this paper, we describe the value of tying the learning lifecycle directly to the business development process from lessons learned from our own experiences. Many challenges can be addressed through organizational development theory, tools, and techniques. Others can be clarified by examination of the cognitive bias codex and personality preferences. Integrating the learning and business development cycles may be the best way to overcome the technology disillusionment curve.

Our experience dates to Synthetic Environment for Analysis and Simulations (SEAS), an agent-based M&S platform and NTSA 2004/2005 award winner in analysis. We've moved forward to Reference World Synthetic Information Environment (RWISE) an agent-based M&S platform enriched with AI/ML in an elastic environment. SEAS was years ahead of its time with distributed AI operating in a hybrid cloud. It stretched the imagination and challenged intuition-based decision-making in the Department of Defense, Homeland Security, and commercial users in broad range of areas. Its successor, RWISE, is a data agnostic, data driven, agent-based AI/ML platform for data ingestion, model development, and forecasting to compare multiple futures based on injecting and testing strategy actions.

ABOUT THE AUTHORS

Charles F. Day is Founder President and CEO of Charles F. Day & Associates. Dr. Day founded his business after years of service in the US Army. He graduated from Purdue University with Bachelor of Science degree in management. His active duty Army service including Research & Development Management. He completed an MBA at St. Ambrose University and a Doctor of Business Administration from Nova Southeastern University. He holds the Owner/President Manager certificate from the Harvard Business School. He sponsored an Industry Chair at the National Defense University and guest-lectured in business and organizational topics.

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INTRODUCTION

More new Information Technology programs and projects within businesses fail than succeed (Chaos, 2018) and new technological approaches are prematurely rejected because of human factors. (Gartner, 2019). We are at the forefront of dramatic Artificial Intelligence/Machine Learning (AI/ML) driven changes that will displace current business systems and workforces. Technologies are advancing faster than we can figure out the impacts on business and society. Overarching implications are hard to grasp. There are very real and practical challenges organizations face in adopting new AI/ML enriched technologies, processes, and procedures. People need to change both thinking and behaviors to link organizational development to every adopted emerging technology initiative. Our Agent-based societal Modeling & Simulation Platform as a Service is a unique advancement that provides a valuable case to explore the AI/ML based capabilities use and acceptance within organizations. It provides collaborative analysis and dynamic planning capabilities, from operational to strategic levels, up to Whole of Nation and Whole of Government. RWISE does this by modeling socio-political, network and infrastructure data and trends into a synthetic world. We employ "agents" each simulating the state of being and connectivity of one individual within networks within society each with their own "intelligence." Smaller systems are aggregated further to form larger systems, a fractal-type pattern that continues until the relevant use case universe is realistically represented.
We then use its simulation engine to express historic data forward into a baseline forecast. Users can then inject actions into simulations to observe how the changes compare to the baseline forecast. Integrating backward-looking deductive logic and forward-looking inductive logic in a single, integrated framework, results can escape the boundaries of the "sandbox" of historic data. With our use of AI/ML, we allow all variables to remain in play during simulations. It is leading edge, data driven, and deals with complexity beyond the boundaries of people's intuition, making it hard to understand and accept. We've found three common components to the problem set as we've used our Societal M&S platform for different customer use cases. Our focus here is not to detail the technology we applied but to address organizational and the human issues we've dealt with and will continue to see consistent with the nature of the technology we use.

What is the problem

The current technology wave is changing most all aspects of life. The rate of change destabilizes our mental models of the world. Emergence of AI/MLis a major factor in the sea change. We know something about the technologies and social impact we're experiencing now, but we know very little about the technology ecosystem architecture functions that will dominate the future (Gershenfeld and Hill, 2019). The explosion of data, compute power, networks and emerging AI/ML is redefining business and industry in ways we struggle to understand and project. The actual business value of adopting different emerging technologies is difficult to define and nearly impossible to compute as is the business' accumulated technical debt (Watts, 2017). Nevertheless, organizations must somehow adjust their strategies to account for the driving forces of technology in all aspects of life.
Several contributing factors fall into the arena of the "as-is" state of an organizations design. Knowledge, skills and abilities tend to be stove piped into functional areas. Matrixed, or cross-functional teams, tend to have employees migrate through the team. The changing landscape calls for organizational change to meet the emerging landscape instead of simple adoption of new technologies within current functional areas. We can't quantify these risks and without solid business case analysis, we struggle to manage them. Very often we rely on leadership's intuition. Human biases create barriers to change, including giving up tradition and acceptance of new solutions.

Why is it interesting and important?

The importance of this topic can be examined through the lenses of human/technology interaction aspects, business aspects, and human psychology. First, in general human-technology ways, as human decision making is prompted, supplemented and even replaced by AI, Human in the Loop (HITL) activities with the deep analytics and AI are reduced (Scharre, 2018). The AI/ML capability in use is a "black box" to the users. The IT system User Experience (UX) becomes the standard for appraising the value of the system – not the "black box" back end of the platform where the work is done. Routinely, people tie their attitudes to the attractiveness and intuitive use aspect of the UI, not to what is delivered through AI/ML. Instantaneous results with attractive visuals do not relay the validity or innate biases of the algorithms hidden away in the engine producing the results.

Second, in business aspects, keeping up with state of practice and best practice is important to remain competitive. Retention and expansion of market share is dependent on technology adoption and maturation factors. "Technical Debt is increasing as the pace of software and hardware end of life exceeds the velocity in which organizations can change."(Gartner, 2019). Further, there are new liabilities associated with not grasping requirements for data storage, control, and transmission. Average human understanding falls behind the internal inputs and outputs of the organization. We don't know why AI is telling us something, only that it is.

Third, but not least, the aspects of human psychology should be fundamentally recognized and served for organizational health. Successful adoption of change leads to employee satisfaction, supports competitiveness in the market area, reduces the organizations technical debt, and positions for a Return on Investment that can enhance the wellbeing of employees and investors alike. Most projects fail because of management rather than technology. Personal intuition and human biases play a role in acceptance of IT related changes but are not well studied in academic literature.

Why is it hard?

The focus of this paper going forward is a discussion of foreseeable future effects of Information Technologies on market environments, dynamics within organizations, and personal impacts. Specific AI/ML technology development and application fall outside the scope of this paper.

Significant organizational change is hard, and most attempts fail because of lack of organizational and individual readiness to adopt the changes. The focus tends to be put on an organization's systems and governance. These often seem to overshadow discussion and acceptance that organizational change is required simultaneously across functional areas in response to new IT. The human capital questions are seldom answerable at the beginning of the change effort.

THE FUTURE OF TECHNOLOGY

Dr. John Kelly, Senior Vice President of Cognitive Solutions for IBM, is sometimes referred to as the "Father of Watson." During his 24 May 2018 keynote address to the 2018 ThinkGov conference in Washington, DC, he talked about the uniqueness of this time in history. He referenced three things as moving exponentially. Moore's Law of computing power has moved from 1000 resistors per chip in the 1980s to 10 billion per chip now. Metcalfe's Law of network nodes and network volume growing at an exponential rate. We are also experiencing exponential growth of data. He went on to say in the first time in human history we can learn faster than the natural process. Even with the tremendous growth already realized, he thinks we're still at the beginning of these curves. He's concluded the only way to keep up these growth curves is though Artificial Intelligence.

The Growth of Data

(T)he world will create 180 zettabytes of data (or 180 trillion gigabytes) in 2025, up from less than 10 zettabytes in 2015, according to IDC (IDC, 2019). Moore's law projects the cost of IT will decline continually while simultaneously grows exponentially. We can gain a different perspective on IT growth by looking at growth and market size.

The big data analytics market is experiencing a "boom" and will soon surpass $200 billion. We are in a period of unparalleled opportunity compared to anything in the past. IDC says that worldwide revenues for big data and business analytics will grow from $130.1 billion in 2016 to more than $203 billion in 2020, at a compound annual growth rate (CAGR) of 11.7%. Services related spending is expected to grow at a five-year CAGR of 14.4%. Cognitive Software Platform, Content Analytics, Search Systems categories total worldwide spending equating to $116B, which may grow to $200B by 2020 This equates to a CAGR of 19.9%. Furthermore, "data monetization" will become a major

source of revenues, as the world will create 180 zettabytes of data (or 180 trillion gigabytes) in 2025, up from less than 10 zettabytes in 2015. From 2020 to 2025, the volume of traditional data will grow by 2.3x; the volume of data that can be analyzed will grow by 4.8x; and the actionable data will grow by 9.6x. (IDC, 2019).

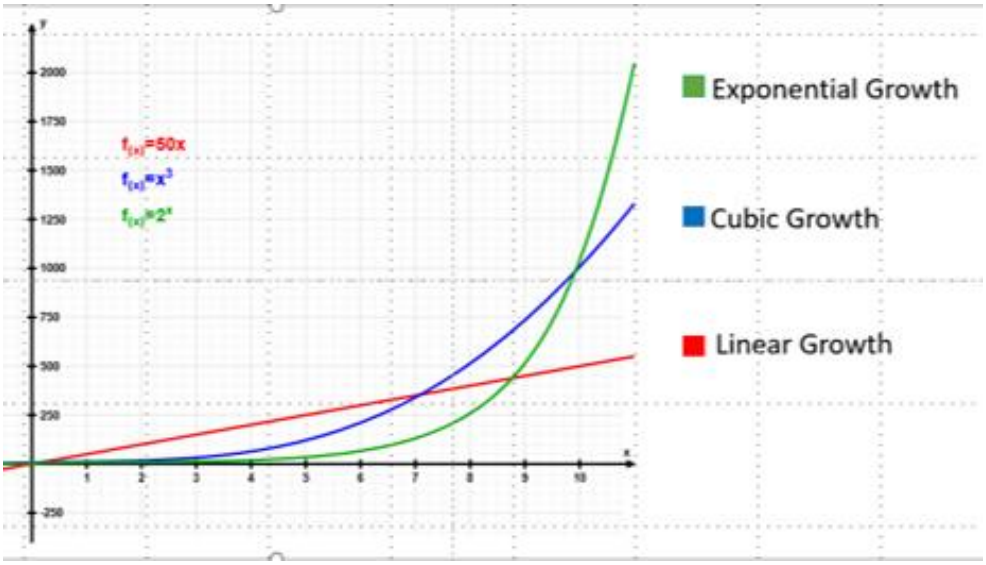

Figure 1. Growth Curve comparisons

Disruptive business solutions and AI platform services will cannibalize revenues of 30% of market leading companies, according to the 20 June 2017 Gartner report of "100 data and analytics predictions through 2021." The report continues to predict that by 2019, startups will overtake Amazon, Google, IBM and Microsoft in driving the AI economy, and, 50% of IT vendor management organizations will use advanced analytics to manage critical vendor risks. These services fall into the following technology markets defined by Gartner: advanced and predictive analytics software tools, analytic data integration and integrity, cognitive/AI software platforms, content analytics, continuous analytics, end-user query, nonrelational analytic data store, supply chain analytic applications, and workforce analytic applications.

Advances in AI and ML and Market Expectations

During a 2019 Government/Industry Artificial Intelligence Conference the new Department of Defense Joint Artificial Intelligence Center was discussed. Government speakers acknowledged they have learned there are unlimited ways that AI can be applied, and they must restructure how they work with industry to be able to capitalize on American innovation. They prioritized areas of interest and a primary interest was "AI at the Edge." In this concept is as broad as the Internet of Things (IoT) and related to AI that can operate without connectivity to the internet. The possibilities are endless through AI.

We have data everywhere and assume it is structured data is always well structured, and unstructured data is somehow less important because it's more difficult to use. Data-driven decision making is often thought of as being based on structured data. Besides legal necessities, unstructured data makes critical contributions to decision-making as well. We are scratching the surface now.

The cognitive software market may grow at a Compound annual rate of ~20% but that growth is offset by the decrease in costs based on Moore's Law. Gartner has predicted that startups are overtaking Amazon, Google, IBM and Microsoft in driving the AI economy, and, 50% of IT vendor management organizations are using advanced analytics to manage critical vendor risks (International Data Corporation, 2019). As figure 2 shows, there is significant turmoil in market players and positioning.

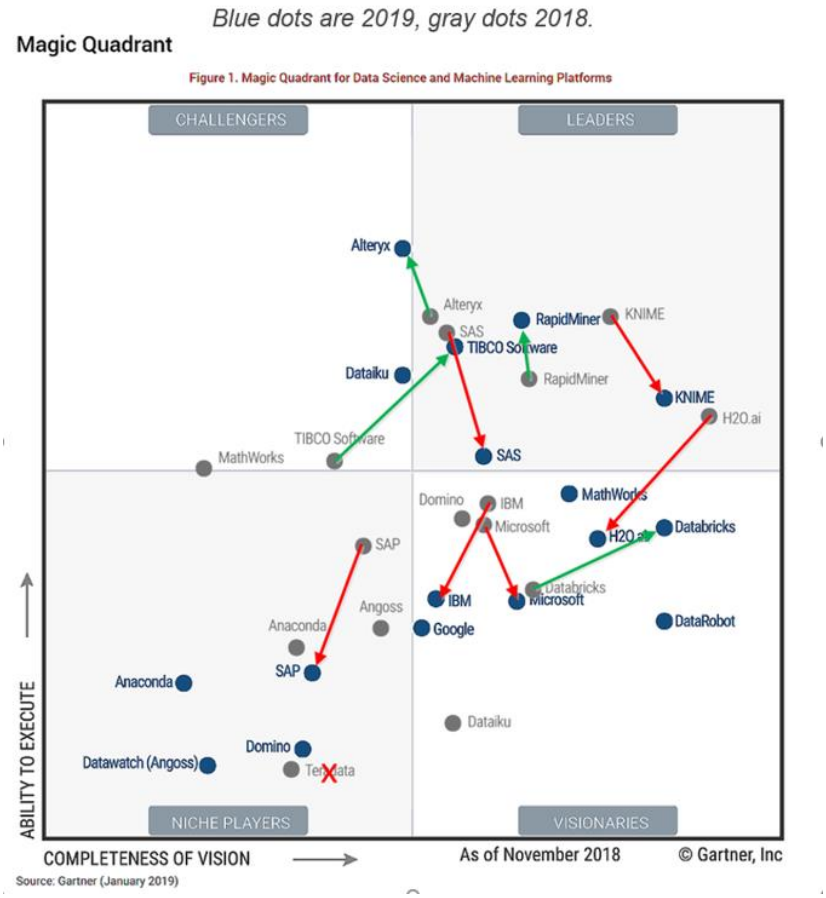

Figure 2. Gartner's Magic Quadrant demonstrates AI market turmoil

THE ORGANIZATIONAL CHALLENGES TODAY

Charles Darwin said survival is going to go not to the strongest or the most intelligent, but the most adaptable. Issues related to change management have been identified for years with different approaches being offered. Organizations want to reduce risk of failure and enhance more effective acceptance organizationally and among individuals of the changes being attempted. Kurt Lewin addressed this in 1947 and published his seminal work in 1951. Peter Senge (1990) published leading edge work describing how learning organizations provide feedback loops and reviews. Kotter (1996) said of people and change, "Sometimes they have no clear vision of the twenty-first century, and so they don't know how they should change. But often fear is a key issue." Chris Argyris (1977) stated more than forty years ago "in a recent review of the literature on management information systems implementation, I found the major thing to be unmet expectations and disappointments, especially when management information systems technology was used to deal with the more complex, ill structured problems faced by organizations. There hasn't been much change in what we find today from those observations decades ago.

Challenges within organizational structures and units,

Grand challenges as Chris Argyris reminds us, is "all descriptive concepts, … used to organize reality and guide behavior, become normative" (1973). Individuals who, by innate temperament alone, protect tradition and distrust change, often create barriers to successful change.

Skill sets are made obsolete and jobs are threatened as shown by BLS forecasts (BLS, 2020). New knowledge, skills and abilities are expected. Concern for family and fellow employees is peaked. Questions of ethics and morality of AI/ML induced changes are still being argued (Scharre, 2018).

Senior leaders have a unique perspective within the organization. They should have a broad perspective with strategic information available. Their view should be longer, but their success is generally measured on a shorter scale than

that of their strategic planning. There may be short term disruptions that affect ROI in market values that override long-term gains from their long-term plan. Everyone may see the changes occurring in the market space and the emergence of the technologies but not have a clear end state, pathway, or "burning ship" to prompt action.
Personal stakes can be very high. Individuals in key positions of seniority may opt out of supporting the change, and even sabotage the effort, because it's too uncomfortable and they're too close to retirement to be willing to endure it. The challenges are exacerbated when changing from an intuition driven organization to a data driven organization because individuals who have been the accepted subject matter experts in intuition are directly challenged by deep data analytics and may be shown to lack the expertise previously credited.
Functional leaders may be challenged from not having shared mental map of the organization or of their functions appropriate place in the organization. A specific barrier to success related to the tremendous challenges of shifting from and intuition driven organization to a data driven organization lies in a lack of shared mental maps and knowledge sets between the IT workforce responsible to integrate the new technologies, develop the internal policies, procedures, tools, and techniques, and perform the evermore complex security activities necessary to protect the organization.
Main line employees are generally challenged by restricted information and focus on detail processes and procedures to the near exclusion of the greater market forces affecting their organization. Information Technology workers are focused on the latest tools and techniques available consistent with their legacy work, with incremental/ functional improvements rather than strategic leaps. The non-technical side of the business and the individuals within those sectors are focused on the non-technical functional performance and a shorter timeframe focus.

General Technical Challenges

There are common Technical challenges with data in all organizations. We've found data wrangling at the program/project inception is likely to be 30% of the total effort timeline. IBM has come to the same conclusion as their Chief Global Data Officer, Inderplay Banduri discussed Nov 14 2019, at the IBM Foundations for Evidence Based Policy Making meeting in Washington, DC. Problems are you must find, catalogue and curate all the data and make sure it is of sufficient quality to use with AI/ML. Second, there must be established enterprise-wide governance and management of IT and data systems. Businesses must be able to answer who the custodians of data are, the provenance of the data, access, distribution, and containment of access. Unofficial desktop repositories, usually in the form of excel files and Access Databases, are widespread. There must be an authoritative data source, and architectural governance for the AI framework. Forrester has predicted 75% of early projects will underwhelm due to operational oversight weaknessess. Finally, user acceptance is easier if AI is "white box" and open for understanding. However, the proprietary nature of the AI contradicts "white box" solutions being readily available (JAIC Government/Industry Conference, 2019) (IBM Foundations Meeting, 2019).

Expectations Challenges

Managing expectations is a tremendous challenge. Books and films have created images and mental maps of the power of AI to the point of broad acceptance and high expectations. Most "C" Suite people have high expectations but low understanding of the technical requirements that must be met and the technical difficulties of using big, sparse, poorly architected dataset, and they usually don't want to know. They pay people to take care of those details. The Standish 2018 Chaos report lists incomplete requirements, lack of user involvement, lack of resources, unrealistic expectations, and lack of executive support as accounting for 55% of all IT project failures. Today more than ever before, the hype of AI is rampant. Figure 3 shows Gartner's assessment of current AI applications on the "Hype Cycle." Understanding and adjusting client expectations including their involvement and their resource requirements is critical to project success.

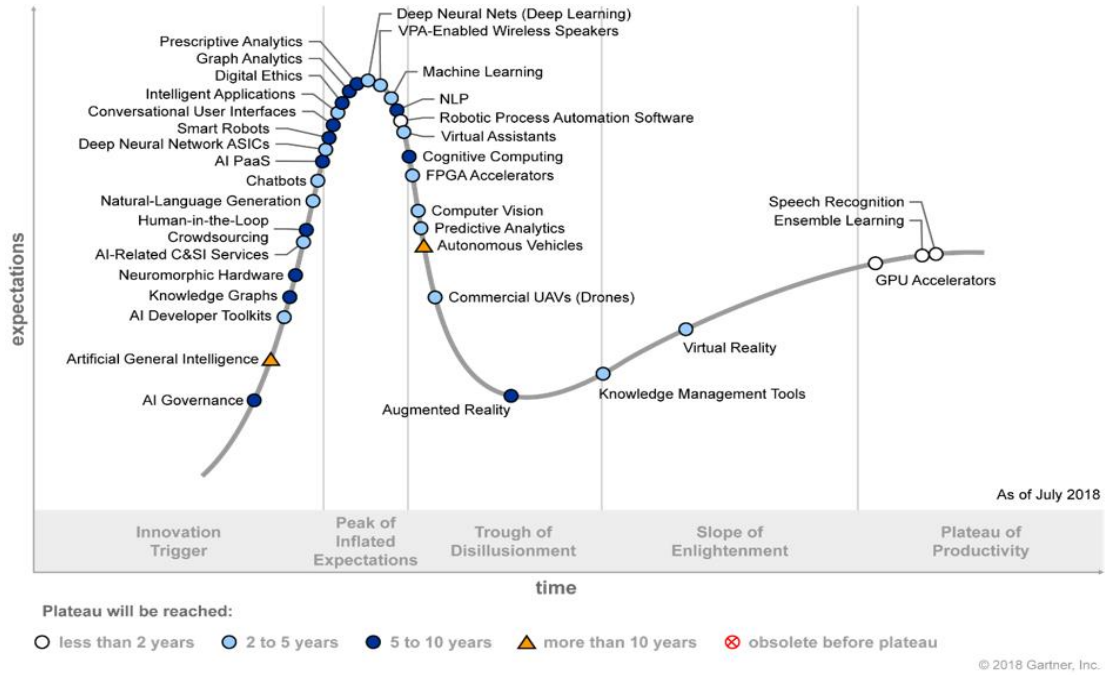

Figure 3. Hype Cycle for AI, 2019 Gartner (Gartner, 2019)

Change Management

Intuition of leaders is often a driving force, if not the driving force within an organization. Decision-making under uncertainty requires assumptions fill in for facts not available. Intuition can be thought of as applying inductive logic and those with the broadest access to different views may make the best decisions with information available. Making the move from Subject Matter Experts guiding the organization to data driving the organization may be the most difficult transition to attempt.

Psychology informs us that we all have biases that are part of our nature (Fischhoff, 1975, Tversky and Kahneman, 1974). Among the nearly 200 cognitive biases are "overconfidence, self-serving, herd mentality, loss aversion, confirmation, judgement, and hindsight bias. Judgement bias describing optimistic or pessimistic decision-making under ambiguity. Hindsight bias describes misremembering our earlier thinking after finding new information. From other personality descriptions, there are those who's natural temperament is to reactively protect and preserve social fabric and traditionalism. (Keirsey and Bates, 1984) (Kroeger and Thuesen, 1988). Human nature makes change difficult to organize and execute across individuals and groups. These psychological issues underlie all theories of organizational change.

Kurt Lewin, often recognized as the founder of social psychology, is credited with the approach of unfreezing the organization, making the necessary change, and refreezing. William Bridges (1991) laid out an approach to managing transitions from "Endings," through the "Neutral Zone" to new "Beginnings." (Bridges, 1991) He recognizes lack of a vision of an end state dooms most transitions to failure. John Kotter (1996) laid out an eight-stage process of creating major change. Social psychologists such as Daniel Kahneman (Tversky, et al., 1974), Kurt Lewin (Schein, E. H., 1996), and Baruch Fischhoff, (1975) discuss cognitive bias in detail. Further personality-based behavioral tendencies are discussed is detail within the Myers-Briggs frame of study (Kroeger & Thuesen, 1988).

OUR PURPOSE

The purpose of this paper isn't to introduce new approaches to the problem but rather, to share observations and lessons learned and reinforce the necessity of including organizational assessment, change management, necessity of levers of control, and a roadmap for the organization and its individuals to new structures, purposes, methods, and rewards that come along with the "new beginnings" (Bridges, 1991) resulting from a change. Assessing organizational readiness for change should be a top priority for the service provider. Having the reach back capability to Subject Matter Experts and consultants in strategic planning, change management, and organizational performance measures

can be important to success. These activities should be considered during business development cycle and through the project planning, organizing, execution, and monitoring activities.
Data-driven decision making should focus fundamental organizational activities to accompany the organizational migration from their current "as-is" state to the "to-be "state as a data-driven organization. To adequately support a client organization, we recommend you have sound Business Development processes, Customer Relationship Management, Project Management, Change Management, basic social psychology understanding, as an Organizational Readiness Assessment toolkit. We recommend they all be integrated into the planning, organizing, execution, monitoring, and close out of the conversion from intuition-driven to data driven organizations.

THREE RELEVANT CASE STUDIES

The following cases each involved entities concerned with national, state, or local communities. The specific clients are not named here and are illustrative examples of the types of issues common to many, if not most, organizations.
Theoretical Perspective; the theoretical underpinnings of our AI/ML enriched Platform as a Service for analysis, modeling and simulation goes beyond the scope of this paper. These cases are a sample size not large enough to perform quantitative analysis but provide enough information for qualitative review. In each case a different level of analysis and modeling, tailored to their policy/strategy question was used. There were differences in internal sponsorship and goal of the project, data custodians, accessibility/releasability of data sets, technical backgrounds and qualifications of technical representatives, and previous experience with Modeling & Simulations.

Table 1. Common Sources of Data Used

Sources of Data Tables and Set Wrangles into Different Models		
Department/Ministry of Labor	G-Econ Project, Yale University	United Nations data
Publicly available National data such as Census Bureau and	International Labor Organization	Trading Economics
International Monetary Fund Reports	World Trade Organization	Gallup Organization
World Bank Reports	The Economist Intelligence Unit	Organization unique, proprietary and custodial data

Case Example 1. Workforce Engagement

As our first example, a government entity was interested in using societal modeling and simulation to validate national policies they intended to an act for the purpose of increasing citizen participation in the workforce. There burning question was "how do we engage work eligible citizens who had left the workforce." We used their data and supplemented it with data available from national and international organizations to create a comprehensive overlay of the population distribution and employment, their industrial composition and distribution, and economic factors. With this particular project we used evolutionary game theory modeling of work age eligible citizens and of businesses with the exception of a single particular industry. We injected different policy initiatives they were planning to use into different simulations to test their impact. Our simulations found none of their policies would result in meaningful change.
The client was very skeptical of the simulation results because they were so contrary to expectations developed by their subject matter experts. They engaged a major consulting firm who conducted a year-long study but reached the same conclusion as our simulations. Having our simulations validated by a leading, independent, internationally recognize firm prompted them to come back to us with the question, "can you find policy actions that would work?"
Drawing on our network of economic and societal subject matter experts, we devised multiple policy actions and tested them through simulation. Our simulations informed us of policy actions that would lead to success, and also constraints to success. For example, we learned if the client's GDP was outside the range of 2.5 to 3.5%, no policy action would be effective. The client initiated dramatic policy initiatives within months of our report of new simulation results. Those policy actions have proved effective.
Particular challenges with this project included access to client held data, data dictionary differences between different client datasets, big data gaps, insufficiency of data that was corrected by bringing in other data sources, lack of communications capabilities to the different major stakeholders, their lack of modeling and simulation expertise to validate our methodologies to other stakeholders, and skepticism that their highly valued subject matter experts could be wrong.

Case Example 2. Criminal Justice Reform

As our second example, a government entity was interested in modeling their criminal justice processes to determine how adoption of emerging "best practice" could reduce incarceration without a rise in crime rate. The burning near-term question was “how much bed space do we need in our jails.” This particular use case did not call on societal modeling inasmuch as it called for injection of different "best practice" initiatives singularly and in combination. Our modeling and simulation forecast effects were based on decision tree analysis and multivariate regression analysis. The client internal experience with data analytics to date had been predominately with MS Excel. They had legacy databases as much as decades old of various types that had never been extracted, transformed, and loaded into a consolidated set. They had not harvested data across siloes from their various data bases previously. There was little visibility of data sets outside functional areas and no shared ontology.
The client data was siloed with little to no commonality and data dictionaries, or shared ontology as is the case with most organizations. Safety & Security data did not share commonality with Health & Human Services in key metrics. The data wrangling consumed 2 to 3 times more effort than was anticipated in the project. In lieu of there being valid data of the impacts of different emergent “best practices,” we built models from sparse and partial datasets they had and academic theory for the impact of different policy actions. Our simulations were conducted using the different practices in different combinations to forecast the range of changes reasonable to expect.
The results showed there were significant reductions in incarceration possible overall. Some decreases would be offset by necessary increases in health care facilities. Other decreases were as simple as restructuring steps in the workflow of processing offenders, or, reducing bail. New training and education initiatives within the criminal justice workforce and larger community would be required. Those costs would be offset by cost reductions for operating jails. The client adopted some but not all the initiatives tested. Simulation they defined at inception did not provide for the fuller range of societal impact on the community and they proceeded with caution to initiate reforms tested one at a time.

Case Example 3. Post-Secondary Educational Attainment Policy

As our third example, an organization was interested in testing national policy actions to improve post-high school education outcomes for the country. Their burning question was “how can the nation promote higher educational levels and close racial achievement gaps in doing so.” They had relied on government furnished data historically and had used multivariate regression analysis almost exclusively in the past. They were focused on national data and national impacts of different policy actions and wanted a fuller societal model with demographic breakdowns used within the US Census Bureau data sets.
Our model was developed using 14 different data sets. Most were provided by the US Census Bureau and Bureau of Labor Statistics (BLS) and others were publicly available data. After an initial 3 sets they had previously relied on were integrated into a single data dictionary and consolidated into a model, we brought in more data as client objectives expanded and their understanding of data limitations matured. The added data sets required redescritizing the entire model as they were added. We tested our AI generated forecasts by back testing against previous years of census and BLS data. Simulations were run to test the policy actions they had devised. None of their strategy actions returned results sufficient to support their goals. Their Technically Representative’s first reaction was to reject the simulation outcomes and conclude the platform didn’t work. Senior Leadership didn’t react quite the same way. Their response was “Thank goodness we are finding that out now before we try those other ideas.”

CONCLUSION

There are many lessons to be learned from our cases. The single, overarching, and undeniable lesson is to know your customer. Know what they want to accomplish as the end state and document it jointly. Do they want an immediate business benefit, a long-term transformational program, or a combination of immediate benefit and a steppingstone to transformation? Understand their limitations to support their efforts to achieve the milestones. Publishing quick wins to the stakeholders is a key activity to keep the organization’s focus on what you’ve been charged to achieve. Expect interest to wane before project execution begins. Keep in mind you have the odds against you in project success.

Steps to knowing your customer and keeping your relationship at the appropriate level of shared understanding can be achieved with the following:
Marketing and business development process points:

- Execute a business development process that constantly gain new insights into the client.

- If applying the Business Development Capability Maturity Model (Newman, 2008), operating at the "managed" level may be necessary to perform all the activities needed by the client. This is especially true for organizational migration to data-driven decision making.
- The "Capture" phase of business development should include the gaining understanding of enterprise's internal environmental factors. These include organizational culture, structure, and governance. As discussed by the Project Management Institute (2013). The client's internal environmental factors may carry more weight toward success than your own.
- This may extend into an abbreviated assessment of Customer organizations capability maturity model level (ad hoc versus documented processes with measures and integrated feedback) to assess their readiness for the project.

Assessing and Supporting Organizational Readiness:

- Organizational consulting may be a necessity. Change management practices should also be considered. If the client organization is not ready for change, they won't.
- Many organizations don't have a strategic planning and response cell. Nor do they formally incorporate changes in Political, Economic, Industry, Social, Technical, Environmental, and Legal (PEISTEL) facets.
- The consulting role may include PEISTEL research, strategic planning, quality and organizational performance measures.
- Program Management and technical requirements assessment and generation are critical. Capture and formalize discussions and agreements into their thinking.
- Be prepared to consider important PEISTEL factors in your discussions and formalize .
- IT staffs are usually structured and staffed to their current requirements with little excess resources.
- It should be an important part of their strategic plan with sub goals cascading down through the organization.
- The client must have the skills knowledge and abilities in the technical fields, strategic management fields, organizational change management areas, and an ability and willingness to help shape and champion the end state.
- You must be prepared to help develop, or to provide, the roadmap for them with a vision of the future state. This means you must have access to subject matter expertise in the customer's industry domain space, either provided by them or provided by you.

Program Planning:

- Your SMEs in the domain space must be prepared to research the domain space in depth to determine realistic interventions that can and should be accounted for in tailoring the simulation engine. Factor this into your Program Work Breakdown Structure.
- Expect a significant academic research effort to accomplish the data-driven initiatives. Understand there will be times when theoretical models or industry "best practice" will be used due to lack of data.
- Provide the data management support (data engineers, architects, analysts, and scientists) to them and have capabilities to fill their gaps current gaps.

Proposal Development and Agreement:

- Be sure to discuss the technical requirements in depth and make sure they understand their responsibilities and impacts to the program/project.
- Make sure the senior staff, even up to the "C" staff, understands the program/project, has realistic expectations, are active and remain active in supporting the Program success.
- Unsure you do not write any bottlenecks into your agreement such as having a single technical point of contact for anything.
- Include the Work Breakdown Schedule and mandatory In-Process Reviews to be attended by the stakeholders.

Program Execution:

- Maintain good Program Management practices. The Responsible, Accountable, Consult, and Inform (RACI) is critical, and it remains critical through the life of the project as is he communications plan.
- Ensure all stakeholders are individually provided updates without going through a "gatekeeper."
- The technical contact for the customer must be qualified by education, certification, and directly related experience.
- Customer Relations Management extends beyond technical and programmatic issues to the heart of the organization. Interest, excitement, Fear, distrust, complacent, and idle curiosity will be at work within the workforce.

- Plan your risk mitigation strategy with the expectation they will not have the resources to support the program while performing, maintaining, upgrading, replacing their legacy systems.
- Agile development is useful for the developers but much less interesting and usable by the client's leadership.
- Use both agile and waterfall with emphasis on communications plan that is responsive to the RACI.
- Minimum Viable Product for technologies are generally launched with high technical debt. But MVP probably contributes to the disillusionment phase of technology acceptance.
- You must be able to help create the business case early by capture of current-state compared to end-state.
- Technical Debt is real but not well discussed and not well captured as part of the business case.

People Factor:

- Clients are sensitive to any discussion about technology displacement of employees and may react very badly to anyone making it a part of BCA.
- If stakeholders don't participate appropriately, be prepared to protect those who do from scapegoating by those who don't
- Some individuals will naturally remain enduring skeptics and protagonists to any significant change. Keep communications open to stakeholders to minimize their effects.
- Key leaders must have defined goals and expectations for the program and a commitment to the entire transition to their future state.
- You should take steps to protect the credibility and reputation of the individuals inside your client's organization with who you work directly.

FUTURE RESEARCH

Academic Research into this area is difficult for several reasons. Businesses do not want to invite researchers in when there is potential their weaknesses may be exposed to the market. There is also a high cost to the conduct of longitudinal studies of enough companies to constitute a sufficient sample size. Qualitative assessment is more available than quantitative data for analysis. Jim Collins (1994) and his publications Built to Last, Good to Great (2001) and How the Mighty Fall (2009) is a good example of the challenge.

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