The Expertool Paradigm -

Management Science for the Challenges of the New Economy

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Joseph Glick
Founder
The Expertool Paradigm, LLC

Contents

1 Abstract

The effects of globalization across interconnected markets have forced managers to face change and complexity as never before. The new technology-driven, knowledge-based economy is rapidly changing the way value is created and competitive advantage achieved. Simultaneously, advances in biomimetic engineering, cognitive science and complexity theory have yielded powerful insights that can help us understand and address the emerging challenges. The abundance of biological metaphors in management literature underscores the logic of this direction, but the application of recent discoveries and innovations to management science is a new and largely untouched frontier.

The Expertool platform is the result of over a decade of pioneer efforts in this new territory, yielding a unique cognitive solution enabling the modeling of multidisciplinary expertise and complex interactions in business processes. The diverse range of solutions delivered and of business domains served testifies to the effectiveness of the paradigm to address certain key and persistent business challenges:

- Combinational interaction complexity
- Managing expertise as an enterprise asset
- Enabling dynamic economy of scale

The core elements of the platform were evolved during real-world projects (academic, government and diverse global enterprise clients), yielding significant and measurable results. The underlying framework is the Expertool Paradigm, which includes:

- Neural mapping engine
- Biomimetic information and knowledge architecture
- Qualitative and quantitative modeling in an integrated environment
- Segregation and design differentiation of expert and novice interfaces
- Scenario modeling and case-based reasoning
- Organizational optimization around behavior and knowledge requirements
- Dynamic organizational scalability through fractal, similarity-based cellular architecture

Implementation of this paradigm in methodologies and software has enabled the delivery of unique capabilities and short-term ROI to early adopters.

2 The Challenges

The convergence of the impacts of technology and economic globalization are changing the business landscape in ways that are just beginning to become manifest. Significant among the understood consequences are:

- The economy is knowledge-based
- The scope and speed of change is unprecedented
- Standard solutions are not keeping up with the challenges
- The very survival of previously dominant organizations is uncertain

As a result, some of the traditional, fundamental business assumptions and strategies driving organizational design and value engineering efforts have to be reassessed from the ground up. As an example, a Rand Corporation report to Congress in 2007 concluded that in the emerging economy lifelong learning skills will have a more significant role in competing for jobs than the initial level of education.[1] As daunting as this may be for the labor force and educational institutions, it is much more challenging for managers who must create learning organizations in order to survive in an economy in which expertise and agile adaptability are the primary basis for competitive advantage.

While the value or learning and adaptability as key elements of organizational design are well understood among management thought leaders[2] and leading practitioners, the principles and design concepts that have been around since the 80's and 90's have not propagated into standard practices. Instead of driving the innovation of effective transformation tools, the incorporation of organizational learning terms into technology marketing jargon has served to obscure the real obstacles to achieving meaningful results. From a solution architecture perspective, the primary challenges to creating and sustaining organizational entities that learn and adapt are:

- Combinational interaction complexity
- Managing expertise as an organizational asset
- Enabling dynamic economy of scale

Each of these challenges is discussed separately in sections 2.1 – 2.3 below, and sections 3.1 – 3.3 describe how the corresponding elements of the Expertool Paradigm address the relevant issues.

2.1 The Combinational Interaction Complexity Challenge

At the time of this writing, the most evident examples of the magnitude of the combinational interaction complexity challenge relate to the global financial crisis. Reporting on the fundamental errors that plagued the predictive models that were relied upon as safeguards, an early NY Times article cited several examples of inadequacy in modeling complexity.[3]

Interrelationships and their potential interactions are at the core of the difficulty. Financial models require an array of assumptions about the probability of various alternative values in the decision trees. For example (simplified and arbitrary):

Mortgage default rate –
    High value = 12%
    Medium value = 8%
    Low value = 4%
Probability –
    High value = 10%
    Medium value = 60%
    Low value = 30%

The numeric values assigned to these probabilities are based on qualitative assumptions that are rarely defined. One could ask:

- Are they based on historical trends?
- Are they based on an analyst's judgment?
- Are they based on what makes the derivative saleable?

The complexity challenge scales because the tree hierarchies are simply *not designed* to highlight the interrelationships between probabilities across trees, especially when models are wrapped within models. Moreover, the opaque and usually undefined potential interactions *between the underlying assumptions* cannot be modeled quantitatively (e.g. what are the impacts of a financial institution's compensation structure on a given analyst's portfolio risk analysis?).

For organization modeling professionals, the core challenge is to understand the interactions between goals, strategies and risks across markets, business processes, technical architectures and supporting organizational units. According to Deloitte, it is rare to find an enterprise that has begun to address the interrelationships and interactions of risks across the company.[4] In view of the impossibility of modeling all potential interactions[5], Deloitte, like everyone else, recommends scenario analysis.[6] McKinsey recently highlighted the need to expand the range of possible scenarios included in planning and budget activities beyond the self-serving constraints of "baseline projections whose major assumptions often are not presented explicitly."[7]

The key learnings from the failures of the predictive models should be:

- Since all possible outcomes cannot be computed, effort and resources should be channeled to identifying and testing what is most relevant.
- Understanding potential interactions between relevant alternatives is more valuable that defining a granular array of outcomes.
- Understanding the indicators and precursors of grave and catastrophic scenarios is a more important objective of risk modeling than fine tuning the probability assumptions.
- Metrics whose core assumptions are not transparent are at best useless, and at worst misleading and dangerous, and therefore integrating the assumptions and making them visible is indispensible.

Applying the above learnings is critical to enabling decision makers who are accountable for the organization's future to truly understand their options and tradeoffs, and to be able to make informed choices. Failure to assimilate the above learnings incurs the risk of decision frame blindness[8], and the abdication of executive judgment to subjective reports, predigested by less qualified staff and software vendors' embedded assumptions.

Applying the above learnings, however, is not just a matter of management intent. The generally recommended solution, scenario analysis, is intuitively logical and correct, but traditional toolsets limit the exercises to:

1. High-level strategic scenarios – usually brainstorming sessions that are not interconnected nor linked to data
2. Narrow quantitative scenarios – usually many random iterations across a limited set of parameters

Effectively applying integrated and knowledge-based scenario analysis in large organizations and complex environments requires a new paradigm to address the combinational complexity of the potential interactions between many factors. For example, one might not think that optimizing a route to deliver 25 packages is highly complex, but the number of factors that UPS considers results in what they call a "combinational explosion…for 25 stops there are more than thirteen trillion, trillion delivery paths…it would take 122 million years to compute every different path."[9]

Such combinational explosions cannot be effectively modeled in tree hierarchies or even in relational databases. However, since the human brain handles such complexity extremely well, the "state of the science" is to explore ways to imitate the brain's methods used to achieve such success. For more on the state of the science, please see sections 3 and 3.1.

2.2 The Expertise Management Challenge

Capturing human expertise as an organizational asset requires a significant departure from current applications and technical approaches that are labeled "knowledge management" (KM), due primarily to the significant differences between the problem-solving approaches of experts and those of educated novices.

Studies of syntactic, semantic, schematic and strategic differences in problem analysis and solution approaches between recent graduates with advanced degrees and recognized experts in physics, computer science and medicine revealed the following common, distinguishing characteristics of experts[10]:

1. Rapidly and effortlessly recognize issues and anomalies
2. Work with mental models that connect observations and input
3. Manipulate large clusters of information based on context
4. Analyze and plan abstractly and consider many alternatives

As an example, human experts capable of playing blind chess (without looking at physical pieces on a board) do not necessarily have a superior memory (like a computer), but a much more extensive repository of scenarios and associated rules that fill in what "must be"[11] based on relevant context anchors[12].

The cognitive behavior of professional novices in each of the four above areas was the inverse - focusing on familiar details that indicate familiar answers. Therefore, capturing the experts' cognitive behavior in a reusable form requires an abstract modeling environment to define the problem solving context, as well as the ability to specify arrays of discrete, coexisting scenarios associated with the context. Thus the captured expertise becomes an organizational asset that can then be leveraged in expert applications, which can help novices to solve problems or to perform complex tasks correctly.

Modeling the cognitive behavior of experts is uniquely challenging because it requires software that does not limit expert users' ability to describe their mental models to the application designers' view of the world. They need the power to define qualitative, flexible contexts, as well as frameworks and rules for how information is interpreted as the contexts are evolved. Traditional KM software and data architecture cannot meet this challenge, since such applications are primarily designed for sharing content, the usability of which is dependent on the novices' ability to find it.

The challenges of architecting an **organizational expertise infrastructure,** a scalable knowledge-worker platform for expertise capture and application, are methodological and cultural as well as operational. However, the good news is that the development and implementation of the infrastructure does not require launching an enterprise-wide mega project. Like lifelong learning itself, it is an incremental process. The critical success factors are:

- Identify core application domains of expertise
    - Centralized decisions and reviews
    - Analytical activities with few experts and many novices
    - High resource-level roles with a broad range of outputs quality
    - Rapidly changing professional domains
- Create pilot projects that include capture *and* application of expertise that can be tested in production, in parallel with existing processes

For most executives, creating a true learning capability in the organization means navigating uncharted waters, and for this reason it is critical to align the scope of initial projects with discrete, measurable elements of the value chain, so that the results can be easily compared. The measures are described in section 3, and using the above approach to select pilot candidates has yielded near-term (3-4 months) ROI. The results can be a catalyst for self-funding transformation.

Addressing **multidisciplinary perspectives**, however, is an issue that requires special attention. Recent cognitive science research has confirmed that, even in the same organization, experts from diverse disciplinary backgrounds analyze and solve the same problems very differently, using different parts of the brain.[13]

Today, the most commonly used approach in business organizations to reconcile multidisciplinary viewpoints is consensus arbitration. In addition to being costly and time-consuming, the outcomes of these exercises are more likely to fall prey to politics and "groupthink" dynamics than produce quality decisions. Even when the efforts are successful, the documentation represents a snapshot view of the problem space and any significant change in the environment requires repeating the painful exercise.

To build a successful organizational expertise infrastructure, the implemented tools and processes must allow each discipline to model problem domains and solution approaches independently, but in such a way that the inputs can be integrated to provide holistic insight to decision makers and guidance to tactical activities.

A proven and practical path to creating an organizational expertise infrastructure is discussed in section 3.2.

2.3 The Dynamic Economy of Scale Challenge

Since the industrial revolution, the concept of economy of scale primarily referred to achieving operational efficiency though mass production, automation and volume purchasing. In the information age, automation of more complex activities was added to the mix. However, in spite of two decades of "lean" initiatives, which included mergers and acquisitions, traumatic losses and cost cutting rule the day. The painful reality is that both demand-driven growth and crisis-driven sizing down are as likely to cripple a company as to improve it. No one denies that rational right-sizing is important, but it is clearly not the whole solution, and perhaps not the most important element.

Insight into the issues underlying the organizational scale trauma can be found in recent advances in complexity theory, including a better understanding of biological scalability, which is similarity-based and therefore holistic. As Stuart Kauffman put it:

> It follows then that the best way to meet some corporate goal would be to divide the problem into "patches," and put each patch to work solving its particular piece of the puzzle. [14]

Applying the "patches" approach requires holistic design and integrated scaling of people, process and technology. Unfortunately, most efforts to achieve economy of scale through technology have been very myopic. Consider a very typical scenario:

1. Business units expect that enterprise applications will help them fulfill their role more effectively and efficiently
2. When comparing software applications, IT departments routinely reject products that don't readily fit into their maintenance and support strategy
3. Business stakeholders are invited to weigh in on the remaining options
4. Software vendors know this, and optimize their offerings to please IT
5. Business units unilaterally turn to various outside vendors to fill the gap

In this scenario, IT managers are seeking to achieve economy of scale by what is labeled "simplification"(minimizing the range of supported technologies) , but it is in reality a simplistic approach that pushes complexity required by the value chain up to the business units where it propagates increased costs and delays. A holistic view would allow IT to centrally manage necessary complexity and thus deliver high value to the business units.

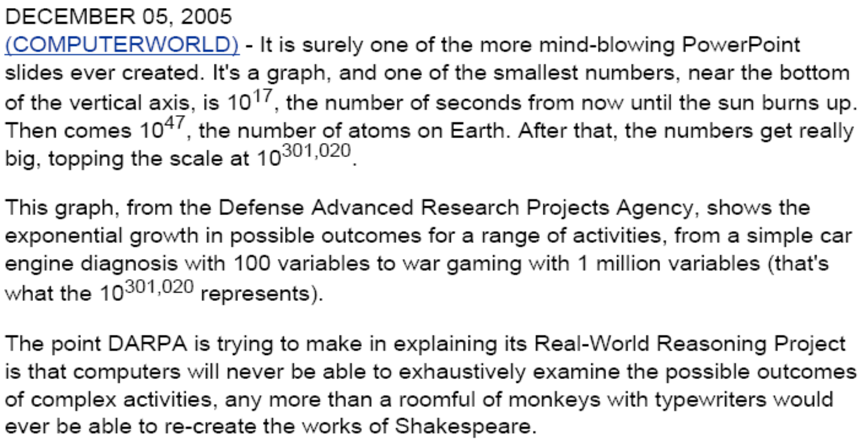
Everyone understands the problems of silos, but the issue is not one of vertical or horizontal integration, but of creating a truly cellular structure that enables holistic scalability, along with flexibility, agility and adaptability. Dynamic economy of scale may seem like an unrealistic goal to some, but the fact is that is exists all around us. Fractal geometry, an application of complexity theory, has been used to model scalability of energy efficiency in animals.[15] Sometimes summarized as $E=M^{3/4}$, the formulas show a geometric gain in energy efficiency in larger animals compared to smaller ones. Harvesting a small fraction of that capability would have enormous impact on business operations, and since the most impressive recent robotics achievements have been realized by biomimetic engineering, management science should apply the advances where appropriate.

A biomimetic approach to holistic, cellular organizational modeling, including the capability to learn and adapt is discussed in section 3.3.

3 The Expertool Paradigm

Addressing the challenges of combinational complexity, expertise management and holistic scalability requires a new paradigm, because as Einstein well put it, “You cannot solve problems using the thinking that caused them.” One of the fundamental elements of the problematic thinking has been that increased computing power and exhaustive mathematical modeling of potential outcomes would enable effective complexity management.

To assist vendors in grasping this error, and the significance of the complexity management issue, DARPA launched its “Real-World Reasoning” project in 2005 (internally called “Get Real”). The report in COMPUTERWORLD begins[16]:



DECEMBER 05, 2005
(COMPUTERWORLD) - It is surely one of the more mind-blowing PowerPoint slides ever created. It's a graph, and one of the smallest numbers, near the bottom of the vertical axis, is 10^{17}, the number of seconds from now until the sun burns up. Then comes 10^{47}, the number of atoms on Earth. After that, the numbers get really big, topping the scale at $10^{301,020}$.

This graph, from the Defense Advanced Research Projects Agency, shows the exponential growth in possible outcomes for a range of activities, from a simple car engine diagnosis with 100 variables to war gaming with 1 million variables (that's what the $10^{301,020}$ represents).

The point DARPA is trying to make in explaining its Real-World Reasoning Project is that computers will never be able to exhaustively examine the possible outcomes of complex activities, any more than a roomful of monkeys with typewriters would ever be able to re-create the works of Shakespeare.

In the real world, human judgment and expertise rule, and the highest authority and compensation are given to those perceived as effective decision makers. The paradigm shift needs to promote innovation that focuses on those elements of human reasoning that can be implemented in technology.

After receiving a DARPA “Real World Reasoning” grant in 2008 to begin research in this area, IBM acknowledged, “Today's computers are powerful number crunchers but don't do a good job of dealing with ambiguities or integrating information from multiple sources into a holistic picture of an event."[17] This lack of capability to build holistic models strikes at the heart of business survival. As stated in a McKinsey[18] analysis of the global crisis:

> **The most important element of a strategy is a coherent viewpoint about the forces at work, not a plan.**

Without a coherent view, scrupulous attention to planning and cost reduction can have unexpected and potentially grievous consequences. The thought leaders agree, and IBM together with its academic partners have accepted the challenge to explore computing solutions that imitate the human brain.

While practical application of biomimetic computing theory is a new research direction for the mainstream software vendor community, it does not represent the first efforts in applying real world reasoning to solving business problems. In the mid 1990's, the Expertool team began developing methodologies and software that emulated human cognition, testing discrete solutions in large, real world projects. R&D efforts resulted in a new business management discipline, Expertise Management, rooted in cognitive science, complexity theory and biomimetic robotics. The underlying framework, the Expertool Paradigm, includes the following elements:

- Neural mapping engine
- Biomimetic information and knowledge architecture
- Qualitative and quantitative modeling in an integrated environment
- Segregation and design differentiation of expert and novice interfaces
- Scenario modeling and case-based reasoning
- Organizational optimization around behavior and knowledge requirements
- Dynamic organizational scalability through fractal, similarity-based cellular architecture

Implementation of the Expertool Paradigm in methodologies and software has delivered unique decision analysis and process optimization capabilities with results that are measurable as follows:

- The value of insights that could not be realized without the paradigm
- The comparative costs and speed of learnings vs. via traditional methods
- The increase in complex interactions enabled per employee/unit
- The decrease in total employees required per complex activity type
- All quality and performance measures applicable to the activity type

Although biological metaphors are not new to management science practitioners, the innovations of the Expertool Paradigm are driven by biomimetic engineering, leveraging current robotics research. The paradigm is further discussed in the next three sections in the context of the challenges that are addressed.

3.1 Combinational Complexity Management

The human brain manages **exponentially scaling complexity** by integrating three fundamental strategies:

1. Neural knowledge architecture – Unlike computers, the brain does not have a predefined structure to store information. Information is added and overlaid through concrete interactions with the environment, and each element of the evolving structure contributes to knowledge, together with growing content and interactions. The reuse and multiuse enables exponential scalability and a measure of securely redundant memory.
2. Stimulation or Suppression signals – Unlike traditional databases with links that merely act as signposts, the signals in the brain stimulate required neurons to participate in the interaction, or suppress the involvement of others.
3. Context-dependent input classification and output aggregation – As human language well illustrates, there is no knowledge or intelligence outside of context. The brain classifies all input contextually, leverages the new input to refine or expand the context architecture, and then uses the new context to create outputs.

Some elements of all three of the above strategies are implemented in the Expertool paradigm:

1. Guided neural algorithm – The modeling software is a totally abstract platform that enables the definition of unique neural maps, defining coexisting and overlapping scenarios including concrete and abstract elements, thereby capturing human judgment. Scenarios (maps) can be defined across unique or redundant elements of information, as well as across multiple levels of abstraction and knowledge domains.
2. Indication/Elimination link types – Granular elements of content or complex scenarios can indicate or eliminate at any scope or scale.
3. Context-focused model design – A model is designed to create a context framework which will drive the interpretation of the content and information within the model. Multiple context frameworks can be combined to interact with an information base, either independently or in concert.

The above approach has enabled construction of models comprised of thousands of nodes and links that capture knowledge that would require from hundreds of millions to billions of cells in a matrix mapping environment (see case study 4.0).

Creating a **holistic view** of forces and impacts within our business environment and developing a coherent strategy requires building a comprehensive landscape that integrates qualitative and quantitative knowledge. The key problem is defining a viable integration approach that will enable meaningful aggregation and interpretation of inputs from many diverse sources of information.

The brain defines and manages scenarios that are simultaneously qualitative and quantitative, and transcend all levels of abstraction and content domains. Unlike reporting tools and dashboards which present aggregated data without insight as to how it was transformed, the brain not only centralizes interpretation of input, but dynamically reinterprets previous input based on new information. The Expertool platform enables application of the cognitive process methods by allowing modelers to:

- Define quantitative and/or qualitative attributes of model elements
- Define relationships between qualitative and quantitative elements across all levels of abstraction
- Integrate outputs of diverse data sources into the model contextually
- Replicate the data aggregation rules from the source platforms within the model and integrate the rules with the business landscape
- Redefine data aggregation rules for updates to the source platforms to more accurately reflect management's intent

Implementing the above approach is not a trivial activity, but the Expertool platform is optimized for incremental and asynchronous adoption, as well as for cost-effective update and integration of focused-scope models.

3.2 Expertise Management

There is no expertise outside of context. While novices often try to solve problems in a vacuum (looking for familiar evidence and selecting the apparently most applicable from a set of familiar solutions), experts scope out a context that accounts for all the evidence and explore an array of problem definitions that are relevant within the context. Modeling multi-disciplinary context is a critical first step before content can be meaningfully added.

Consider the example of an organization that has decided to launch a "green" initiative. What would the context include?

- Drivers – what are the current and potential future business drivers behind the new effort? They could be:
  1. Regulatory requirements
  2. Public image

    3. Organizational values
    4. Certification required by key clients or prospects
    5. Government incentives
- Strategy – what are the strategic options that could support key drivers?
- Scope – global, regional, divisional, etc.

Even with this simple example we can see the criticality of the context. The key drivers will impact the choice of experts and the prioritization of issues. As scope and strategy are flushed out, so are further expertise requirements, and each additional layer of expertise can contribute content that is relevant to the context and understandable to the senior managers who defined the top layer.

The context model doesn't need to be comprehensive to deliver value, but it does need to be complete for the targeted problem space. The adequacy of the scope of the context landscape is measured by the links between the context and the knowledge requirements of the Organizational Competency Units (OCU) that exist or are under construction as described in section 3.3. The goal is to link all the knowledge requirements and sources to the context landscape.

Creating the initial context model is the first step toward the architecture of an **enterprise expertise infrastructure**, the core components of which are:

A. Context landscape OCU
B. Organizational learning OCU
C. Expertise capture OCU
D. Analytical application OCU
E. Operational application OCU

The **context landscape** is in fact an organizational ontology, capturing the expertise of senior decision makers to describe the external and internal "realities" of their business frame, as well as organizational problem solving heuristics that must guide and constrain business strategy and tactics. In recent years, literature about the semantic web frequently discusses the need of an ontology to support the contextual interpretation of search criteria and content relevance, but those efforts refer to a linguistic application of set theory[19]. The context landscape ontology is conceptual and organization-specific, defining what the enterprise is and wants to be in the eyes of its leaders.

Since the ontology is unique to the enterprise, it should not be defined using "best practice" terminology. Leaders should identify the concepts that they view as important in terms used internally (coining new terms as needed), and then the internal terminology is linked to discipline-specific taxonomies (including best practices), enabling the interpretation of linked content and data by the decision makers.

Allowing each disciplinary group to provide input using its own terms eliminates the need for taxonomy debates, which usually are about whose context is correct for interpreting the content. Actually, all the disciplinary contexts are needed and valuable and significant elements of expertise are captured as the diverse mental models are mapped to the enterprise ontology.

The multi-disciplinary views are integrated using two key methods:

- Relevance analysis – experts identify knowledge elements and scenarios that are relevant to elements of context.
- Equivalence analysis – based on the relevance mapping, the software suggests potentially equivalent terms and knowledge elements across disciplinary domains. The proposed equivalence relationships are iteratively reviewed, refined and vetted by experts, and the model is updated.

The resulting expertise repository becomes an interpretation engine for analytical activities (including exposing assumptions in aggregated data and metrics), and a rules engine for automating complex knowledge-worker activities.

3.3 Cellular, Knowledge-driven Organization Architecture

While all organizations require structure, achieving scalability that is dynamic, agile and flexible requires intelligence and the ability to learn. In the past, scientific and educational communities promoted the concept of computers as a model of intelligence, and this viewpoint has yielded organizational design methodologies that look very much like system design practices. It has also resulted in what Professors Morabito and Sack call "the current – incorrect and damaging – trend to think of information technology (IT) related models as business models."[20]

By the mid-1980s, researchers in the fields of artificial intelligence, computer science, cognitive science, and psychology reached the same conclusion as system architects at innumerable failed expert application projects: speaking of computers as intelligent was inappropriate and misleading.

The brain does not store bits of information as if they had their own existence, nor does it "run programs"; it does something entirely different. As explained by Professor Pfeifer, head of the AI Lab at the University of Zurich (bold added), "Researchers now agree that intelligence always manifests itself in **behavior**--

thus it is behavior that we must understand, based on a synthetic methodology whose goal is - **understanding by designing and building**."[21] For example, observation didn't lead to an understanding of insect flight behaviors that seemed to defy the laws of aerodynamics, but replicating those behaviors in micro-robots did yield the insights which could be defined and applied.[22]

Applying the biomimetic robotics approach to intelligent organizational entity design and integrating the fractal "patch" concept discussed in section 2.3 above, has led the Expertool R&D team to the Organizational Competency Unit (OCU) construct. Each OCU has a purpose or mission, and is designed to enable a set of behaviors that are required to achieve its assignment within its environment.

The environment of the OCU is specified as a set of linkages (people, process and technology) both inside and outside the organization, which are potential sources of interactions. Unlike system design, however, the OCU does not respond to or ignore inputs based on programming, but assesses the relevance of each input to its current state and may pass the analysis results to several parallel activities that may collaborate or compete in determining the impact of the input on the behavior or the OCU.

An OCU is constructed by defining:

A. Purpose or Mission
B. Linkages (people, processes and technology)
C. Activities as required by the combination of Mission and Linkages
D. Knowledge and expertise required for all activities
E. Resources (human, technology, economic, other) to enable the OCU and make it self-sufficient.

From an operations perspective, the design of the OCU delivers significant benefits that are particularly important during lean and volatile times:

- **Incremental adoption** – the OCU interacts with the environment through its linkages, and can accomplish its mission regardless how the rest of the company is organized.
- **Dynamic scalability and economy** – the OCU design enables holistic management of people, process and technology. Resource levels can be optimized without crippling the value chain, and integrated capacity levels can be sized as required by corporate strategy and priorities.

The practical value of the OCU design has been proven in an industry-leading global organization. The initial OCU, constructed in a small division, has been active for almost five years, surviving four reorganizations (including one upsize and one downsize), and its key learnings have been used to improve global standards and integrated into an enterprise platform.[23]

4 Case Study – Global Pharma

Transforming IT – toward Holistic Compliance Management

For large and regulated organizations, maintaining compliance with the evolving regulation, risks, technology and business drivers are mission-critical activities. At our Client, years of reactive initiatives in corporate silos resulted in over 3,000 policy, control and procedure documents, as well as regular and disconnected engagements of the "big four" consultancies, including various levels of support by hundreds of internal resources, to address environmental change.

Among ongoing and diverse transformation initiatives, the Expertool team was engaged independently by three members of the governing council to support, among others, the following projects:

A. Policy Integration – create a rationalized set of policies and control objectives to address all risk, business and regulatory drivers, together with the required maintenance processes.

B. Common Control Set Development – create a unified set of technical and process controls to address all policies and control objectives, mapped to the company's technical architecture, risk assessment standards and specific regulatory requirements.

C. Divisional Compliance Program Architecture – create the processes and tools to enable project and program managers to effectively and efficiently comply with the business-side requirements of the Common Control Set.

The Challenges

Combinational Interaction Complexity

- Diverse regulations across all global markets
- Diverse technical architectures across regions and divisions
- Diverse business operations, from R&D to banking

Expertise Management

- Multi-disciplinary input surveys from 20+ decision-makers and 300+ subject matter experts yielded 3000+ issues to address
- No clear path to estimate economic impact of new requirements

Dynamic Scalability

- Company was in the midst of a global, aggressive reorganization
- Compliance requirements growing as resources and budgets diminished

The Key Measures

Project A

- Can we get insights beyond what the "big four" spreadsheets provide?
- Can we reuse previous analyses when updates are required?

Project B

- We did this three years ago – can we do it faster and cheaper?
- We don't have the time and resources to calculate the corporate impact of over 100 new control requirements. Is there an alternative?

Project C

- Can we make compliance requirements assessments for projects quicker, cheaper and more consistent?
- Can we arbitrate disagreements between business and technology staff in some rational manner?

The Results

Project A

- Previously unidentified interactions between the organization's technology roadmap and control strategy identified.
- Opaque assumptions in consultants' documentation revealed.
- Through reuse of previous analyses, the impact of cross-border regulatory interactions on organization-specific project requirements was defined in two weeks. A C-level executive stated that the alternative would have been to hire a specialized international law firm for many times the cost.

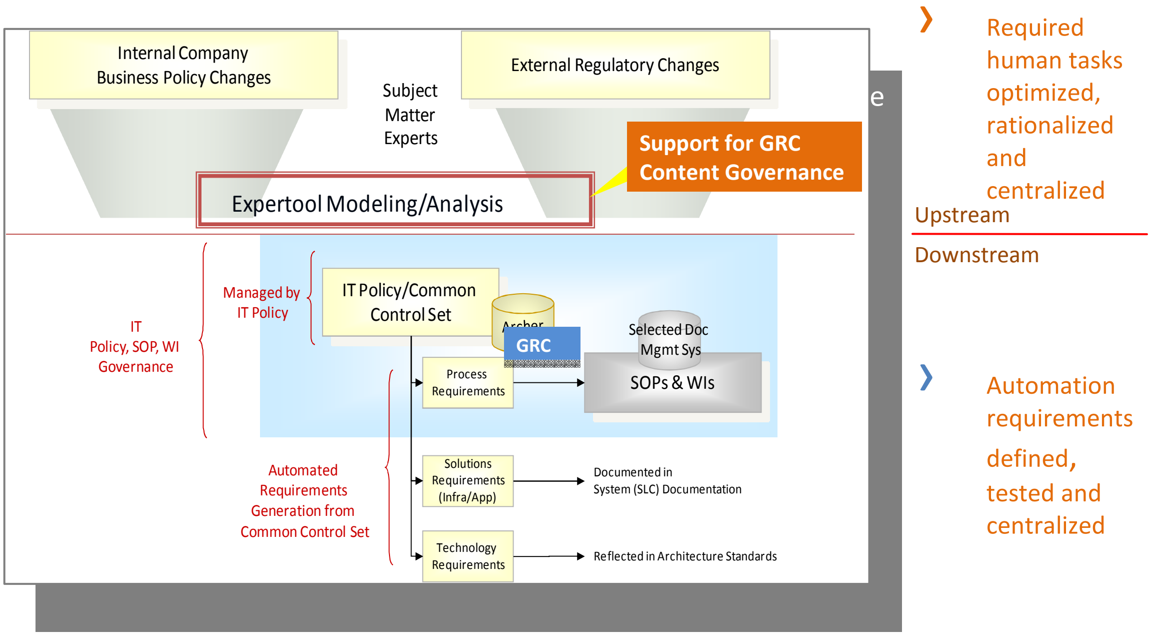
Project B

- The 3000 issues were triaged, prioritized and resolved (or tabled) in 10 weeks, compared to 18 months the previous time.
- Leveraging data that was being simultaneously modeled in Project C as a starting point, an economic impact analysis was completed in 12 weeks, with the governing council's review and approval of the evolving methods.

Project C

- Leveraging model components from projects A and B, a desktop expert application was built for the program office managers that reduced the project compliance assessment from over 20 hours to under an hour per assessment exercise.
- Captured mental models of corporate experts resulted in interactive rules that eliminated over 90% of debatable issues.
- In addition to baseline measures, the model generates a project schedule of requires business-side activities and compliance related language to be added to standard vendor contracts.

Although there have been ongoing improvements, at the completion of the initial stages of the above projects, the sponsors described the resulting transformation using the following diagram:



A genuine transformation was achieved, enabling holistic policy management and control implementation. The sponsor for project A received the company's highest internal management award, and a significantly expanded company role.

For additional information or demo contact:

Neil Jacobson
VP Professional Services
Expertool
(646) 369-2632

neilj@expertool.com

Author contact:

Joseph Glick
joeglick@expertool.com

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