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THE RISE OF THE SYSTEMIC ENTERPRISE

How Boards and C-Leaders Control Business Complexity and Achieve Better Results with a Unified Systems-Based Approach

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OVERVIEW

Globalization trends and technology have introduced unprecedented change and uncertainty. For unprepared businesses, the drivers of the Fourth Industrial Revolution will become a constant source of surprise and crises will unfold at an ever-increasing rate.

Today, business models, strategies, organizational structure and information systems can quickly become obsolete. To survive, organizations must constantly retune their approach across all levels. It's no longer feasible to reactively manage all these shifts. The ability to anticipate and adjust to changing dynamics needs to be woven into the fabric of the business.

This paper explains how boards are using the metrics and insights derived from predictive mathematical emulation to deal with modern business dynamics, which have become too complex to manage using experience or statistical methods of business process management (BPM).

When armed with a quantifiable way to view the impacts of system dynamics, executive leaders are better prepared to deal with a multitude of different, competing issues that if not well managed can lead to the collapse of the interconnected systems that are critical to business success.

When board members and executive leaders use a rational and unbiased mechanism to advance multi-stakeholder, systems thinking and in ways that harnesses the technological opportunities of the Fourth Industrial Revolution, they can achieve better business results and outperform competitors.

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INTRODUCTION

Arguably one of the most profound challenges today's executive leaders face is avoiding the overall breakdown of business systems, which can be caused by the failure of any one of the interconnected internal or external systems upon which the business depends.

Modern businesses are primarily defined by their translation into systems—whether it be an automotive production line, healthcare system, nuclear plant, financial system, or any other set of interacting or interdependent components. These systems include millions upon millions of components, dynamic interactions and interdependencies that combine to achieve the overall objectives set forth by business stakeholders.

Today's business systems produce dynamics, which are influenced by external and context dynamics that have grown too complex to be managed based on experience or even with the help of popular business process management (BPM) tools. Business leaders need a quantifiable way to measure the operational risks caused by dynamic complexity, as well as rational and unbiased mechanisms to advance multi-stakeholder, systems thinking in ways that harnesses the technological opportunities of the Fourth Industrial Revolution.

The insights gained through predictive mathematical emulation help board members control the modern dynamics of business that have now become too complex to traditionally manage

SYSTEM INTEGRITY IS MISSION CRITICAL

Boards and C-leaders must deal with a multitude of different, competing issues—which each require individual solutions—as well as manage the interconnected challenges they engender. The cost saving and business efficiencies gained through automation advances in the last 20 years have saved many businesses from failure, but have created a Gordian knot. Layering of short-term fixes, without understanding the long-term risks, has created rigid organizations that are unable to respond to rapid change cycles driven by technological innovations and shifting market expectations.

To create more resilient businesses and ultimately more value, it is necessary to build and maintain operational environments that deliver the highest performance with the best economy, but also allow the business to agilely adapt to constantly changing requirements.

New mathematical emulation techniques enable an integrated “systems-based” approach. This allows leaders to use advanced predictive capabilities to quantify the impacts of system dynamics and understand with a high level of confidence which actions are needed to meet the business’ short-term and long-term objectives. In this way, decisions can be taken to help individual business units meet their goals, while ensuring that the organization also maintains the integrity of interconnected systems or invests when needed in business-wide systems strengthening.

[1] SYSTEMIC ENTERPRISE

A BOARD IMPERATIVE

Prior to globalization, most business systems were relatively stable and easy to control using the linear, closed loop models and thinking supported by BPM tools. Today, the existence of any business can be threatened by accelerating, interconnected pressures from both known *and* unknown influences that must be managed.

Our world is becoming more dynamically complex every day. Global operations and technological advances accelerate the pace of change. In turn, the frequency and severity of operational risks are increasing, while the window of opportunity to fix unanticipated problems is actually shrinking. These circumstances create a reactive management culture and undermine the ability of the business to meet its stated objectives.

Today most business stakeholders lack the foresight necessary to predict an unexpected system disruption—or even understand the full impact of a crisis—until they have the benefit of experience and historical data to analyze. The hype of *big data* promised to mitigate the risk of unknowns by correlating the experience and expertise derived from the known. But as hope gives way to reality, it is clear that decisions based on historical data will always be partial. It is the unknowns that will threaten the resiliency of a business when an unexpected system failure occurs.

When compared with previous industrial revolutions, the Fourth Industrial Revolution is evolving at an exponential rather than a linear pace and it is disrupting industries worldwide. The drivers of the Fourth Industrial Revolution will become a source of constant surprise, even for the best connected and informed business leaders.

CHALLENGES IMPOSED BY MODERN SYSTEM DYNAMICS

Unexpected System Behaviors

Systemic implementations produce non-linear behaviors—meaning that evolving dynamics may produce undesirable outcomes that cannot be explained using linear or closed-loop models.

Constant Market Pressures

Market dynamics of the Fourth Industrial Revolution challenge businesses to continuously produce more for less and support more rapid change cycles.

Shortened Platform Lifecycles

Frequent, ad hoc changes rapidly accelerate the aging of platforms, which in turn negatively impacts the margin, income or quantities produced by the system.

Escalating Operational Costs

Insufficient or incomplete system testing prior to deployment, increases the number of operational incidents and escalates the cost of maintenance.

(2) WHY CURRENT

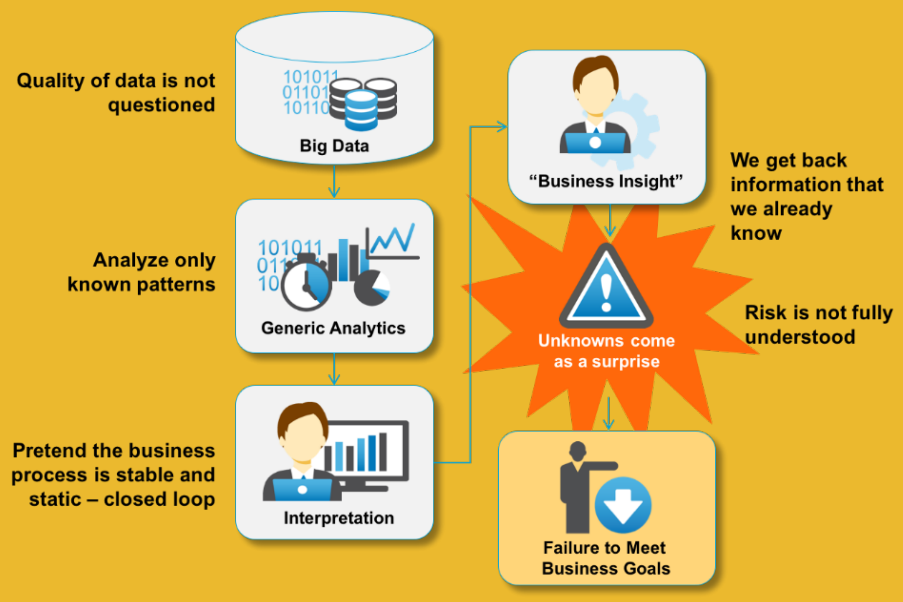
BPM TOOLS FALL SHORT

In many cases the information gained through current BMP practices is not extremely helpful to decision makers.

Vague predictions, disjointed or missing information, unknown timelines and unquantifiable repercussions make it difficult for business leaders to propose and defend any change that will cost the business money or alter the current status quo.

This means that most businesses are forced to reactively deal with problems as they arise.

UNKNOWNS COME AS A SURPRISE



Current BPM statistical approaches
Approximate prediction of behavior
Valid under certain circumstances for short periods of time
Dependent on accuracy and volume of big data
Many risks come as a surprise because dynamic complexity cannot be accurately reproduced
Useful for closed loop systems operating in non-dynamic environments

(3) PROBLEMS CAUSED BY

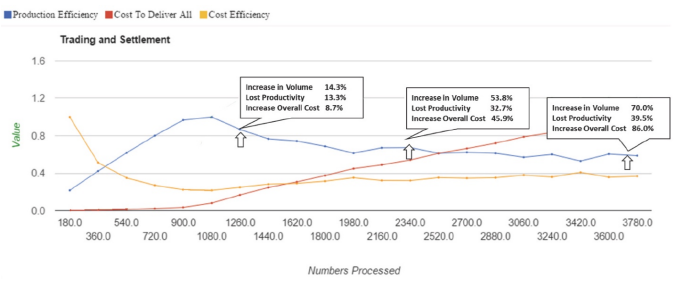
DYNAMIC COMPLEXITY

> When thousands or even millions of components, dynamic interactions and interdependencies are combined to create a business system, dynamic complexity is a term used to quantify the number of dependencies, feedback, operating organization, optimizers and enforcement mechanisms in a system. The term also describes the cost inflation, quality degradation and/or a loss in capacity that occurs when system resources are absorbed for unintended purposes due to system contentions, conflicts, locks and delays.

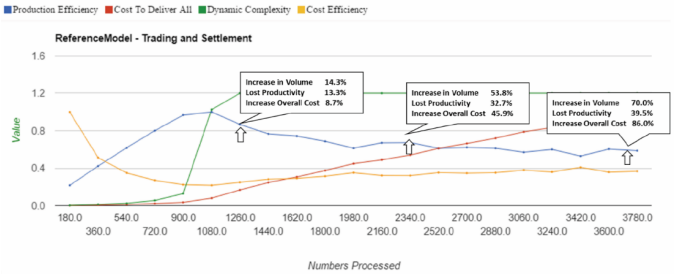
Dynamic complexity threatens the sustainability of business models, profitability and competitiveness. The reactive treatment of dynamic complexity symptoms leads to a **growing number of negative impacts including cost inflation, quality degradation and/or a loss in capacity**. This outcome can only be prevented if the role of dynamic complexity is well understood and the appropriate cure is proactively applied before problems appear.

EXAMPLE

The first graph shows a trading and settlement system scenario, where the **cost per transaction began to rise** as volumes increased. This was a counter-intuitive finding since cost typically decreases as volume increases. The phenomenon could not be explained using conventional BPM because there was no historical precedence for this behavior. Obviously, forecasting becomes problematic when predicted **outcomes no longer match reality**.



When using a modern mathematical approach that supports non-linear representations and open loop solutions, it can be seen in the second graph that **the rise in cost was a direct impact of dynamic complexity**. As volumes increased, more system resources were absorbed due to external influencers, internal structures and environmental constraints that were not captured using statistical models. The relationship between revenue and cost could only be analyzed once all internal and external variables that influenced the behavior of the system were included. **Using these methods, unknowns become knowns.** In this case, business leaders have a more complete view of reality because they can see how system complexity and evolution impacts cost and revenues under changing scenarios.



(4) REVEALING DYNAMIC COMPLEXITY RISK

X-ACT OBC PLATFORM

In the future, no business will survive unless system management practices evolve to the point that they empower executives to confidently make the decisions necessary to maintain the integrity of interconnected systems or invest when needed in business-wide systems strengthening.

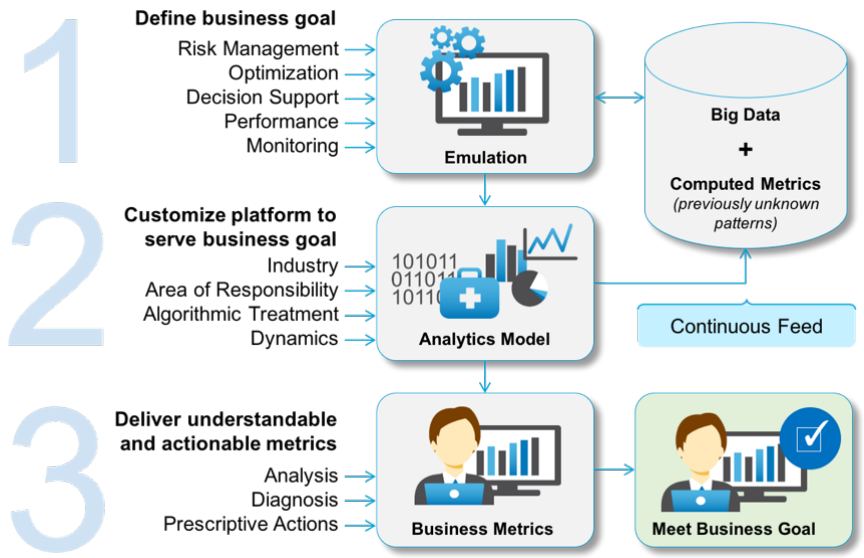
Advances in mathematics, analytics and emulation, backed by machine learning sciences and increasing computational power, are changing how we understand the dynamic complexity of a system and manage the resulting operational risk. Using **X-Act OBC Platform's** advanced analytics and mathematical emulation capabilities, we can now **identify how dynamic complexity leads to system limits, diagnose the root cause and determine the best remedial actions** by weighing the benefits, complexity and cost of proposed solutions.

+ IDENTIFY
Predict the conditions that will interfere with the achievement of business goals

+ ACT
Determine which changes or remedial actions are needed to support business goals

+ MONITOR
Identify problems and apply preventive actions in time to avoid undesirable outcomes

A GOAL-ORIENTED APPROACH



X-Act Predictive Emulation
Precise prediction of behavior
Valid under any circumstances for long periods of time
Requires only a limited set of accurate data
Surprises are limited because dynamic complexity can be accurately reproduced
Useful for open loop systems operating in dynamic environments

> Businesses that adopt a systemic enterprise approach can **predictively reveal the dynamically complex factors that cause poor performance and act strategically** to maintain the highest level of performance.

COVER NECESSARY DEPTH AND WIDTH

GUARANTEE PROVABILITY

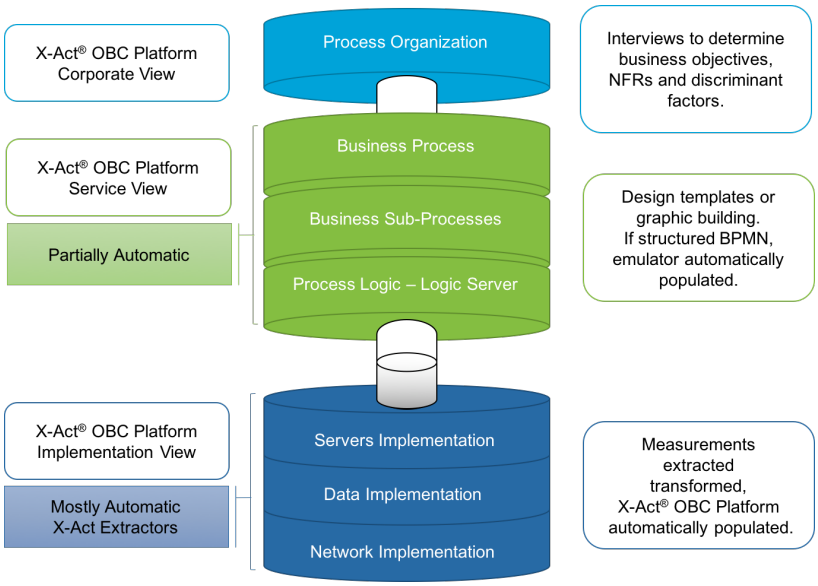
SUPPORT ROBUST PREDICTIVE & PRESCRIPTIVE MODELS

> Due to the current rate of disruption, business models, strategies, organizational structure and information systems can quickly become obsolete and risks can quickly evolve. **Organizations must maintain visibility across all levels to proactively anticipate and adjust to changing dynamics at the right time.**

END-TO-END VISIBILITY

To expose and remediate the impacts of dynamic complexity, **X-Act® OBC Platform allows users to model business processes as wide and deeply as needed** from the corporate level through to the physical mapping or all the way to the request for resources.

X-Act® OBC Platform uses accurate, representative and reproducible mathematically converging algorithms to represent the dynamics of every object in an operational structure—including processes, systems and physical objects.

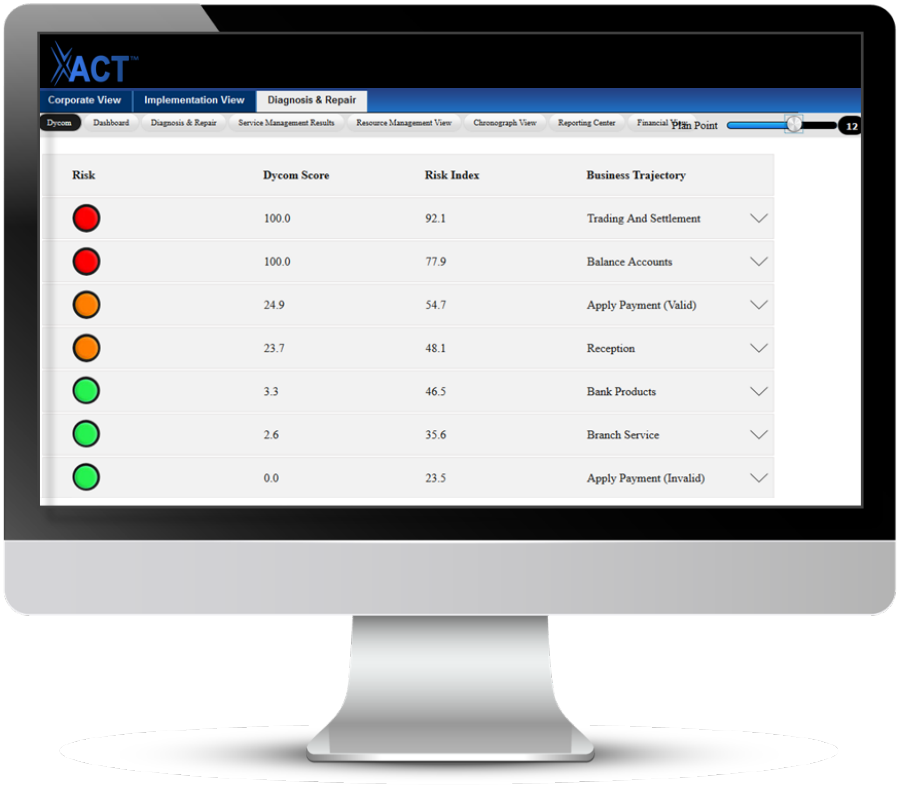


The platform computes the impact of dynamic complexity and the associated risk that corresponds to changes in volume, innovation or implementation. A lower level computation provides the corresponding cost, service quality and productivity at different points in time. This allows users to **reveal the root cause of a risk at any level and identify which remediation options will be most effective.**

[5] MAKE DECISIONS

USING ROBUST METRICS

Dycom and **Risk Index** are two of the most important metrics delivered through X-Act OBC Platform as they provide a high-level view of system health and risk with both quantitative as well as qualitative significance. **Dycom** and **Risk Index** scores appear in the X-Act OBC Platform reporting dashboards and show executives if a current problem exists—or when a problem will arise. Additionally, the metrics help executives understand the impact of any potential risk as well as the effectiveness of any proposed remedial options.



X-ACT OBC PLATFORM

Dycom and Risk Index Dashboard

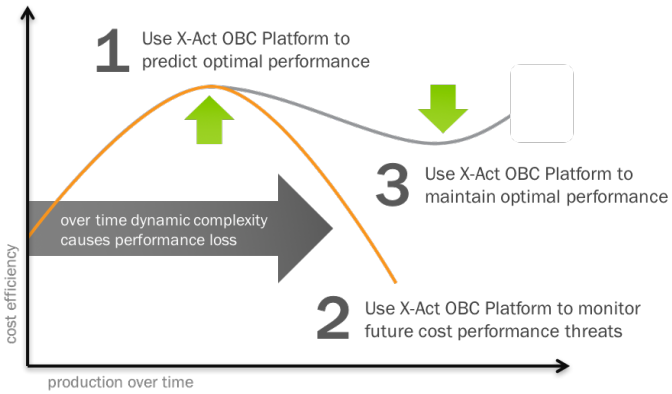
A high **Dycom** score shows that dynamic complexity is exerting a significant strain on the system. A high **Risk Index** score indicates there are not enough resources to meet system demands. When both **Dycom** and **Risk Index** are high, a risk may be imminent.

By changing the emulated system parameters within X-Act OBC Platform, users can predictively find which scenarios will cause a system disruption and evaluate the applicability of prescriptive solutions. This prepares the organization to **proactively take any actions necessary to avoid future risk events.**

(6) APPLY SYSTEMIC KNOWLEDGE TO

OPTIMIZE OUTCOMES

MAINTAIN THE HIGHEST LEVEL OF PRODUCTIVITY



Optimal productivity equates to the delivery of business goods or services at a minimum cost, while maintaining acceptable service quality. Through our research and use of **X-Act® OBC Platform**, we know that once we move beyond the point of optimal productivity, any additional increase in volume will cause a deterioration in productivity and an escalation in cost. Additionally, the enterprise is running sub-optimally before the optimal productivity point is reached.

AVOID FUTURE PERFORMANCE PROBLEMS

The dashboards produced by **X-Act OBC Platform** allow business leaders to compare the current system versus an optimization scenario so that they can make decisions with full knowledge of the benefits, costs and constraints of any proposed solution.

Monitor the systemic enterprise characteristics and behavior in near real time

Identify the cause of any limitation and use predefined risk patterns to intervene with the right cure at the right time

Continue to mature business process management programs by generating new patterns

(7) INNOVATE & STRENGTHEN

CRITICAL SYSTEMS

Business systems must evolve to better meet demands for innovation and continuous value creation. The X-Act OBC Platform supports decisions to ensure that the organization maintains the integrity of interconnected systems or invests when needed in business-wide systems strengthening.

Advanced modeling and what-if capabilities can be used to proactively expose evolving risks across business lines, propose new operating and customer models and **innovate to better meet dynamic business requirements, cut costs, improve efficiency and take advantage of emerging trends and technologies.** Using X-Act® OBC Platform, executives can gain a forward-looking view of the health of interconnected systems, and know when a system transformation or disruption is needed. Any decisions can be justified with accurate knowledge of the benefits, costs and constraints of any proposed change.

SYSTEMIC KNOWLEDGE SUPPORTS DECISIONS TO MAINTAIN, TRANSFORM OR DISRUPT SYSTEMS

The graph shows the X-Act prescriptive emulative of a trading and settlement system in which costs are rising and efficiency is deteriorating. X-Act allows system stakeholders to **quickly evaluate thousands of scenarios to identify possible solutions** by emulating changes to infrastructure, architecture and business models.

In this case, the proposed *'Transformed System'* emulation showed that changes to the current system's architecture and business model would increase the system limit to meet the business' projected increase in transaction volumes. But, would also create unacceptable service quality conditions due to the decrease in production efficiency. The *'Disrupted System'* emulations showed that further changes would better meet the business goals by delivering at least 1.83 times the volumes of the transformed system.

[8] SYSTEMIC ENTERPRISE

CASE STUDIES

	Credit Card Processor	Car Manufacturer	Global Fast Food Chain	Airline	Postal Services
Business Goal	Defend market position	Prepare for market expansion	Optimize supply chain	Reduce maintenance disruptions	Prepare for privatization and deregulation and cut cost
Challenges	Increasing complexity and declining profits due to continuous enhancements that didn't favor the necessary disruptive solution	New market brings new requirements and constraints that create unknown risks.	Implement supply chain management solution to efficiently deliver supplies under time constraints to 36,000 global restaurants	Reduce time planes remain off-duty and return to service faster—managing different technologies and maintenance procedures	High cost of operations and infrastructure while facing decline in mail volume, price sensitivity and increasing competitive criticality
Conventional BPM Wisdom	Execute optimization project to increase transaction processing volumes, cut costs and extend system lifetime, but long term risks of this strategy were not quantifiable.	Implementation showed a reasonable ROI, but it wasn't possible to explicitly analyze risks. Decisions made using past experience ignore new market dynamics and unknowns.	Execute massive $250 million project to create a global customer relationship management (CRM) and supply chain management (SCM) system	Conventional practices were not able to compress the maintenance time windows without creating a risk that the business was unwilling to accept.	Cost management produce potential social unrest. Also conventional management practices generally use static patterns that are based on limited analysis to proper situations
X-Act BPM Foresights	Business will not be able to face competitive pressures without pursuing a new architecture and infrastructure project in the near term	X-Act sensitivity analysis enhanced the predictability by analytically testing each market parameter and determining the influencers	X-Act emulation showed the project wouldn't meet business requirements within the approved budget.	X-Act identified a hierarchy of maintenance to support a gradual maintenance plan—including at the gate actions without increasing risk	X-Act recommended a 30% reduction of sorting centers without quality loss. Also reduction of energy footprint.
Results	Business opted to pursue optimization project and today faces significant challenges due to the obsolesce of infrastructure and increasing competitive pressures.	$30M gain in cost avoidance and controlled ROI for full expenditure recovery in 36 months	Through the cancellation of the project, the corporation realized an economic benefit of over $170M in risk avoidance.	The off-duty maintenance window is compressed by more than 25% which allowed extended active service	Cost reduction of $120M and an ability to define and market competitive pricing in maintaining better service quality

Using Predictive Emulation to **IMPROVE EXISTING SYSTEMS**

When optimization and transformation of an existing organization and its systems is the goal of the predictive analysis exercise, X-Act users can build an emulator using certified and pre-tested mathematical objects and data that represent an ideal implementation and then build a second emulator that accurately represents the system being analyzed.

Once both emulations have been built, X-Act users can identify the cause of an eventual deviation between ideal and actual construct. In this way, the emulator then becomes a field experimentation facility. Based on our experience, we have found that companies can typically expect to identify opportunities to increase performance and reduce costs by a few orders of magnitude when following this process.

Case: Solving the Mystery Behind **ATM SERVICE OUTAGES**

In this case, an ATM system that supported a network of over 7,000 ATMs in Europe was demonstrating odd behavior—periodically causing full suspensions of ATM activities throughout Europe and inconveniencing banking customers who visited the ATMs during a downtime.

The dysfunctional behaviors could not be explained using traditional methods of system analysis.

X-Act OBC Platform Predictive emulation showed that:

- The weight of the database consumption represented nearly 100% of the CPU time on the database server
- The chosen system architecture was heavily synchronous and became costly and time sensitive in high volumes—memory refreshes increased the possibility of a timeout
- Analysis showed that 60% of failures occurred on the database server—the remaining occurred on the DAP server or were due to a load balancer, hardware failure
- The predictive stress test showed that the most critical component in the business trajectory chain was the JDBC component on the DAP server, which was only capable of servicing 24 ATM functions per second after which the quality of service degraded due to an increasing number of conflicts within the DAP server
- Reengineering options could deliver a potential 25% in savings

The mathematical modeling allowed us to define the operational limit, identify the causes, propose the remediation and evaluate the longer-term reengineering options. Based on clear quantitative and qualitative predictive metrics, it was easy to facilitate the dialog among management, development teams and suppliers to improve the implementation and control the service levels.

Using Predictive Emulation to Plan for **NEW SYSTEMS**

When building a new business system, X-Act OBC Platform can be used to select the optimal infrastructure that will satisfy a business objective and service level guarantee as well as deliver the right support and predictable scalability to meet growing volume requirements. In this case, the emulator is built using certified and pre-tested mathematical objects and data.

The emulator can then be used to support *what-if* analysis—covering all possible models and patterns to support decisions. This approach supports a new era of systemic enterprise in which concepts are fully tested through emulation before any monetary or resource investments are made in the actual implementation.

Case: Preparing to Survive **MARKET DISRUPTION**

Market disruption quickly moved postal organizations from attractive economic and industrial models to an unbalanced financial corporate position with a major risk of obsolescence. To survive a market disruption of this magnitude, executive leaders of La Poste used X-Act OBC Platform to identify and implement the right strategies to compensate for major shifts in customer demands—while managing costs without negatively impacting the quality of services.

The mathematical emulation of the end-to-end postal services allowed us to proactively identify potential risks that could affect delivery time, temporal changes in volume and the cost of service for processes, technology, humans, logistics and organizations. Using the *what-if* capabilities of X-Act® OBC Platform, we identified the optimal balance between projected mail traffic volumes versus the cost of operations and quality of service.

X-Act OBC Platform let us easily test and prove all feasible transformation scenarios as well as disruption scenarios—such as new business models and innovative approaches that would allow the business to become more agile and be better prepared to meet the evolving needs of the citizens it served.

+ OPTIMIZE
Reduce number of sorting centers, build more exchange hubs and optimize treatment of daily unprocessed mail volumes

+ TRANSFORM
Train workforce and add new offers, such as hybrid mail and ecommerce, coupled to existing distribution channels

+ DISRUPT
Move to a postal cloud and offer new goods and services to rural areas

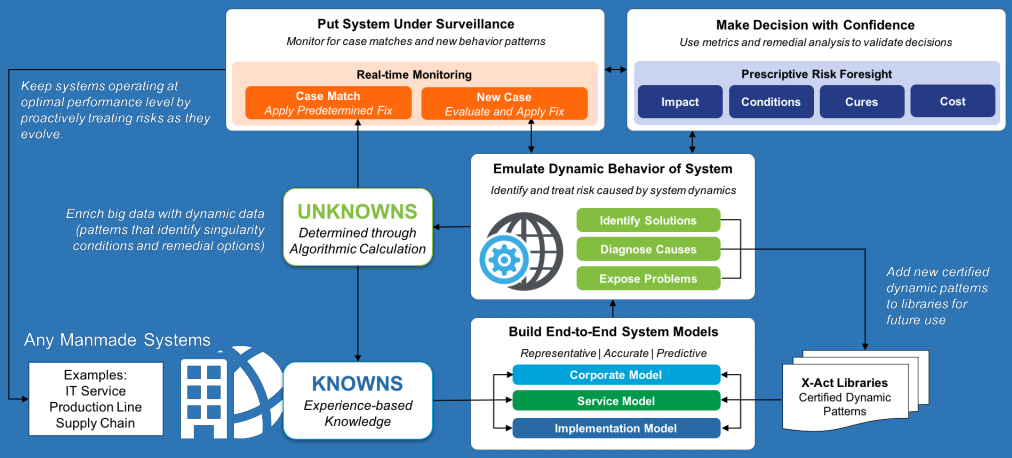
Based on our analysis, management decided to reduce the number of sorting centers and use a single transportation option. Additionally, they launched advanced training programs and chose to support business diversification options. To monitor the evolution of risk, they implemented the predictive risk monitoring capabilities supported by X-Act OBC Platform. Through these actions La Poste achieved $120M in cost reduction and is better prepared to respond to continuously changing consumer demands.

[9] HARNESSING THE POWER OF SYSTEMIC KNOWLEDGE

SELF-HEALING SYSTEMS

Integrating the predictive emulation capabilities of X-Act with the cognitive capabilities of IBM Watson will make the futuristic vision of self-healing enterprise systems—that automatically adapt to deliver optimal service—become a reality.

ALGORITHMS ARE THE SYSTEM MANAGERS OF THE FUTURE



Because dynamic complexity rapidly evolves, human insights will become less useful. Ultimately, algorithms will help businesses create a defendable advantage—by revealing the factors that cause poor performance and automatically retuning systems to maintain the highest level of production performance.

The pairing of systemic knowledge and automation will enable businesses to maintain systems that deliver the best performance and agilely respond to constantly changing business requirements.

CONCLUSION

Change is not always an easy path. Senior stakeholders must have the courage to abandon current management practices in favor of a more scientific approach that may reveal a sober reality filled with difficult choices. But, the potential rewards are great. Companies that mature their management practices to preemptively understand and control dynamic complexity will be better positioned to continuously create value and competitive advantage.

New system dynamics will continuously threaten the existence of businesses by accelerating, interconnected pressures from both internal *and* external influences. We can resist the reality or embrace the opportunity. Users of X-Act OBC Platform can harness the power of algorithms to proactively discover under which conditions dynamic complexity will absorb resources and takeover the planned yield, thereby deteriorating the expected quality and quantity while inflating costs.

If a prediction confirms that the maximum productivity is about to be reached, the business can prepare to either take immediate action before the degradation occurs or accept the limit and adjust business goals until re-engineering is possible. In all cases, X-Act OBC Platform helps business leaders evaluate their remediation options and choose the optimal solution.

As dynamic complexity continues to evolve and negatively impact critical business systems, the usefulness of human insights and statistical approaches will continue to decline. A systemic and iterative collection of knowledge is the only way to keep pace with the complexity of modern business systems and rate of technological disruption. The algorithmic-based management approach of systemic enterprise empowers leaders with visibility across the boundaries of all business systems so that they can more reliably define and maintain a path to better business results.

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URM GROUP is committed to helping organizations mature their risk management practices to more effectively and agilely respond to risks that are growing in frequency and severity due to the dynamic complexity of our modern world. Through our research and applied use of proven emulation technologies, we teach people how to proactively discover and control risks at the right time to avoid future surprises and unwanted outcomes. Our universal risk management methods arm business and government leaders with the foresights they need to confidently respond to changing dynamics and clearly understand which (and when) preventive and opportunistic actions should be taken to ensure the continuous efficiency and cost effectiveness of operations.