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to the
Committee on Homeland Security
Subcommittee on Transportation Security and Infrastructure Protection
United States House of Representatives
for the hearing entitled
“Partnering with the Private Sector to Secure Critical Infrastructure: Has the Department
of Homeland Security Abandoned the Resilience-based Approach?”

May 14, 2008

Chairwoman Jackson Lee, Ranking Member Lungren, distinguished Members of the Subcommittee, I am pleased to appear before you today. I commend you on your leadership to focus on a resilience-based approach to securing the homeland. Given the unique risks of the 21st century, resilience is a necessary goal.

I am a Senior Fellow with IBM’s Global Leadership Initiative where I work on public sector homeland security challenges from a private sector perspective, much of it on resilience. I am also Managing Consultant for IBM’s Global Business Services practice. And for the past fifteen months I have worked on a framework for strengthening commerce, security, and resiliency.

Today, I thought it would be useful to focus on three things.

- First, really defining resilience, which can be an elusive concept meaning different things to different stakeholders;
- Second, the unique role served by the private sector; and
- Third, a recommendation for how DHS can better engage the private sector in making this a more resilient nation

Chairman Thompson said that “we all have a role to play” because resilience is the responsibility of the federal government, states and localities, academia, and the private sector.

The first step toward accomplishing this is establishing an agreed upon vision for how we as a nation can become more resilient. That vision rests upon a clear understanding of what is meant by resilience.

I. Defining Resilience

Resilience is the ability to reduce the risk and impact of a terrorist attack or disruption while also improving the facilitation of trade and travel. In the context of natural disasters, resilience enables people closest to the crisis to act, provides them with the authorities and information necessary to succeed, and employs an effective governance framework.

Resilience helps to avoid unintended consequences: Resilience — if done right — affords the decision maker the enhanced ability to focus response efforts on the part of the system that is actually stressed and limits the risk of over-reacting, which often times leads to unintended consequences.

Many suggest that resilience is the ability to “bounce back.” And it is, but resilience is different from response and recovery.

Redundancy is not resiliency. Having costly back-up systems or two of everything is the easy yet most expensive way for infrastructure to “bend and not break.” If done correctly, resiliency is more akin to the concept of Intelligent Immunity that we put forth in the most recent IBM report on Global Movement Management, and which I’ll touch upon in a moment.

II. Unique role of the private sector

Finally, the private sector is an asset first, and a vulnerability second: It is an asset because the goods, people, conveyances, and information that comprise private sector activity interact at critical nodes that must be both protected and viewed as a source of resilience. This is a critical step toward being able to make the case for private sector engagement and to establish the form of partnership this Committee rightly calls out as a priority.

At IBM we have been working on the issue of resilience in the global trade system for the past several years. We found that the global trade system can be organized and viewed as a circulatory system of goods, people, conveyances, money, and information.

While many things that move through our system of commerce are monitored to a greater or lesser extent, a lot isn’t monitored at all. Even fewer things are monitored in conjunction with one another.

And yet it is those linkages that often give us the clearest picture of what’s going on... and what might be going wrong.

A robust framework that embraces the fundamental complexity and networked nature of these systems will identify critical interrelationships, inefficiencies, and vulnerabilities *across* the flows. Staying within a stovepiped system puts our competitiveness and possibly our security at risk.

III. A framework to support DHS leadership in building a resilient nation

IBM recently released our paper entitled “*Global Movement Management: Commerce, Security, and Resilience in Today’s Networked World*,” in which my coauthors and I outline an analytical framework we developed to strengthen the global trade system by helping to identify and address vulnerabilities in and across the elements that make up our global movement system. It brings the interrelationships into focus.

This framework requires a partnership between the government and the private sector because it involves an integrated and evolving mix of preemptive, preventive, preparatory and responsive measures across three vital areas: Human Capital, Technology, and Governance.

Strategic Human Capital

Individuals within companies and governments face increasingly complex choices about how to improve performance and address risk. Individual managers and employees face unprecedented volumes of information, new technologies and competitive pressures that complicate their work. At the same time, in a networked economy, decisions made at the individual level can have increasingly global ramifications. Strategic human capital requires leaders to employ emerging techniques for managing in a networked environment. These techniques include improved collaboration, latitude to reach across and outside organizational boundaries, investment in organizational transformation, enhanced technology and, above all, greatly improved training.

Technology

We need to change how we use technology to simplify work processes and seek efficiencies. By sharing greater volumes of information, companies and governments can take advantage of open-source techniques to drive innovation and help make global systems more efficient, resilient, and secure. Upstream companies can be better equipped to provide warnings of supply shortages or other disruptions before they affect downstream partners. Downstream companies can provide early warnings about demand or delivery disruptions to those upstream. Governments can augment counterterrorism efforts with more accessible commercial data while also providing a higher degree of protection for privacy and civil liberties than is currently the case.

Governance

Governance in this context can be characterized by the lack of a coordinated approach that is necessary to address networked risk. Call this a “governance gap.” To bridge this gap, participants in the global movement systems need to embrace a more comprehensive set of factors to understand the actual risks, costs, and benefits that accrue to an organization in a networked environment. Moreover, participants need a means by which to organize their efforts to address these risks, costs, and benefits. Our research shows that organizations have successfully met the challenges of organizing efforts across national boundaries but not yet across sectors.

Conclusion

In summary, to create a system in which security improvements and performance improvements are not mutually exclusive, but mutually reinforcing, requires a partnership between the owners and operators of this global movement system and the federal homeland security enterprise. For this reason, today’s hearing represents a productive step forward.

With a common vision, better information, with the right technology and well trained government and commercial employees who are empowered to take action – a more resilient nation is within reach.

Thank you.

Global Movement Management: Strengthening Commerce, Security and Resiliency in Today's Networked World

W. Scott Gould, Daniel B. Prieto, and Jonah J. Czerwinski

Executive summary

The health and well-being of modern society depend on highly integrated, complex economic systems that serve to move people, cargo, conveyances, money and information around the world every day. These systems include, for example, immigration, aviation and transit systems for the movement of people; maritime, trucking and air cargo for the movement of goods; pipelines and electric grids to transport fuels and energy; and the Internet and other communications networks to move information and to enable financial flows. Collectively, these systems comprise a circulatory system for the global economy: what we refer to in this paper as the “global movement system.”

Global movement systems embody a unique intersection of public and private interests. They are largely owned by the private sector, and users are mostly companies and the general public. At the same time, the functioning, availability, security and stability of these systems are essential economic “public goods,”¹ in which governments have significant economic, national security and public welfare interests. Society expects global movement systems to be like water, electricity and other utilities: People simply expect them to work and to be available on demand. When they fail, consequences are rapid, widespread and significant.

Twenty-four hours a day, seven days a week, the global movement system shuttles goods and services, capital and labor, and bits and bytes around the globe to provide the substance of daily life: jobs, wages, food, electricity, education, news and information, and leisure and entertainment. As a result, nations and economies are becoming increasingly integrated and interdependent. The United States relies on the rest of the world to supply two-thirds of its oil and to finance 44 percent of its public debt.² China relies on exports for 36 percent of its gross domestic product (GDP).³ The primary engine of India's recent economic growth has been information technology outsourcing, even though it accounts for only 5 percent of India's GDP. Tourism accounts for almost 20 percent of GDP⁴ in many Latin American countries.⁵ Emerging markets' share of global exports doubled from 20 percent in 1970 to 43 percent today and emerging markets hold 70 percent of foreign exchange reserves.⁶ Africa has recently emerged as a major petroleum exporter and is developing strategic economic relationships with China and India, providing commodities for their rapid industrialization.

Global movement systems as exploitation targets

At the same time, however, the same systems can threaten societies and economies if they are exploited by malicious actors to inflict harm or if naturally occurring disruptions are managed poorly. The tight

integration of global systems means that disruptions that may seem small or localized at first can rapidly magnify, spill over into other systems and cause serious harm that is difficult to envision or predict.

These challenges are the natural result of the networked nature and sheer complexity of today's modern global economy. The effects are well described by chaos theory, which asserts that even relatively simple systems that obey known rules and behaviors can display unpredictable outcomes depending on the slightest variations in the nature of an event or disruption. As individual movement systems become increasingly networked, interconnected and interdependent, small disruptions and events can create an even higher level of unpredictability.⁷ Making matters worse, the transmission of disruptions around the world is occurring at an ever faster pace.⁸

Countries today are not alone in facing and influencing the challenges and opportunities of complex internetworked global systems. Fifty-one of the top 100 global economies are companies, 300 multinational corporations account for 25 percent of total global assets, and more than 40 percent of total world trade occurs within corporations.⁹

Individuals have also gained new prominence on the global landscape. As a result of globalization and technology, individual actors can intentionally cause disruptions and inflict damage on a massive scale that was previously the sole domain of nation-states. The September 11, 2001 terrorist attacks undertaken on U.S. soil by 19 individuals at a cost of approximately US\$500,000 caused an estimated US\$80 billion in damages.¹⁰ The attacks shut down the entire U.S. aviation system. Cascading effects rippled around the world, affecting many countries and industries.¹¹ As then U.S. Secretary of Defense Donald Rumsfeld lamented, "The cost-benefit ratio is against us! Our cost is billions against the terrorists' cost of millions."¹²

The 9/11 hijackers exploited U.S. immigration systems, benefited from poor information sharing within the U.S. government and used our own airplanes as weapons against our centers of finance and government. The 9/11 terrorist attacks drew the world's attention to the following:

- The efficiency, security and resilience of the global movement system are integrally linked in today's highly networked and interconnected global economy.
- The drive to improve efficiency has made global movement systems more vulnerable.
- Much of the physical infrastructure in global movement systems is in poor condition due to age, everyday wear and tear, deferred maintenance and underinvestment in new capital projects.

The 9/11 attacks heightened awareness of the fact that while global movement systems are the lifeblood of the global economy, they also present important vulnerabilities and serve as a potential pathway for pathogens and disruptions.

Security improvements and performance can work together

Because greater efficiency can make global systems more vulnerable and brittle, many observers assume that the converse is true: that investments in greater security and resilience inevitably must come at the expense of business performance. However, this need not be the case. This paper explains that improvements in security and resilience can help improve overall economic performance. Security and commerce are not in opposition.

Economic performance, security and resilience are mutually reinforcing goals and can be achieved in tandem. In addition, this paper suggests that in a networked economy, business leaders must expand the frame of their investment decisions to give greater weight to considerations beyond their short-term bottom lines and beyond the four walls of their organizations. Company executives need to give greater consideration to their roles in supporting public goods like resilience, stability and the benefits that come with economic interdependence. The same is true for public sector policy makers, who now must consider a broader range of commercial factors in recognition of the private sector's ownership of and influence over global movement infrastructure. In short, we must learn to realign our thinking to address the networked nature of the global economy.

This paper, therefore, offers a new analysis of the challenges facing countries, corporations and individuals in today's highly interconnected world. It also proposes a comprehensive framework to improve the performance, security and resilience of global movement systems.

Key ideas

The key ideas presented in this paper focus on 21st century risk, intelligent immunity, the Global Movement Management analytical framework, strategic human capital, leveraging unique data assets and skills through technology, and addressing a critical governance gap. These topics are summarized below.

21st century risk – Risk in the 21st century is unique because, for the first time, individual actors or individual events pose viable strategic threats to international systems. Threats are asymmetric. Small groups of malicious actors can create global harm many orders of magnitude greater than their cost of operations. Seemingly small local disruptions can potentially cascade and be magnified through tightly interconnected systems to create far-reaching and more extensive damage than often can be predicted. And this trend is forecast to continue.

Intelligent immunity – We developed a new approach to guide the formation of policies, plans and implementation efforts to address terrorism and other threats to global economic systems. We call this approach “intelligent immunity.” This approach is designed to address the economic and security risks in global movement systems. It seeks to make critical economic systems more resistant to disruption by improving their overall health. Commerce, security and resilience constitute the essential elements of a healthy system. Achieving this requires an integrated and evolving mix of preemptive, preventive, preparatory and responsive measures that leverage human capital, technology and governance in new ways.

The intelligent immunity approach focuses not only on making systems more secure against intentional threats like terrorism, but also on making them more resilient in the face of virtually all manner of disruptions as well as seeking to improve their overall performance. Intelligent immunity sets the stage for a holistic approach to improve the overall health and well-being of global movement systems while avoiding actions that impede commerce and impair daily functioning.

Global Movement Management framework – A consistent analytical framework is valuable to better understand and assess the complicated systems and subsystems that comprise the global movement system.

The analytical framework through which we can understand how to achieve intelligent immunity identifies five key flows – people, goods, conveyances, money and information – as the lifeblood of the global economy.

We broaden and deepen our original Global Movement Management framework to include both the physical and logical aspects of each flow. We provide a robust framework for analyzing the complex global movement systems that make these flows possible, including the global aviation system, maritime cargo shipping, immigration systems and the Internet. The simple yet powerful foundation of the framework is that even the most complex global systems can be reduced to their components, and the systems are more alike than they are dissimilar. Focusing on similarities can provide the means to harmonize decisions, investments and activities to improve performance, security and resilience across the board. The analytical framework can be a valuable aid to guide thinking and action by global leaders to manage risk in global movement systems and achieve common goals.

A strategy to overcome the asymmetric risk posed by terrorism and natural disasters in the highly networked global movement system should link the full range of available tools to achieve these goals. Our analysis suggests three main opportunities to achieve intelligent immunity that involve new strategies for people, technology and governance.

Strategic human capital – We believe that individuals within companies and governments face increasingly complex choices about how to improve performance and address risk. Individual managers and employees face unprecedented volumes of information, new technologies and competitive pressures that complicate their work. At the same time, in a networked economy, decisions made at the individual level can have increasingly global ramifications.

Unfortunately, the critical role of people in managing risk and complexity in a networked environment is often overlooked. From the front office to the front line, people make global movement systems work. We call for a new strategic approach to human capital that transforms the relationship between individuals and their organizations by improving trust and access at virtually all levels. This results in a greater shared ownership of mission and objectives and empowers individuals to make “the right decisions at the right time.” This approach, adopted by individual organizations in the global community, will help promote intelligent immunity across the entire system.

Strategic human capital requires leaders to employ emerging techniques for managing in a networked environment. These techniques include improved collaboration, latitude to reach across and outside organizational boundaries, investment in organizational transformation, new and more flexible structures, enhanced technology and, above all, greatly improved training for managerial and supervisory skills across the workforce. To address these challenges, we recommend:

- Taking a strategic approach to front-line employees in global movement systems
- Leading, organizing, training and equipping front-line employees for the new tasks at hand
- Engaging society on a more comprehensive basis in recognition of the new level of personal responsibility that each user has for the system in a more connected and interdependent world.

The goal of this effort is to enhance the individual employee’s understanding of his or her important role in improving enterprise performance and reducing risk. We argue that a significant initiative for investing in human capital and establishing standards for human capital development in the areas of security and preparedness will make companies and governments better able to prevent, withstand and respond to disruption. Increased investments in this approach will allow people to assume higher-order responsibilities and automate tasks that do not require human intervention, further leveraging the time that front-line personnel have to focus on their unique contribution to the safe and reliable operation of the global movement system.

Leveraging unique data assets and skills through technology – Those who have managed and operated portions of the global movement system — on the front lines in government or in the private sector — almost universally agree that we need to change how we use technology to simplify work processes and make human activity more effective. Despite widespread recognition of the importance of sharing information, companies and governments are failing to fully leverage natural advantages that they possess in information and technology to strategically address asymmetric risk in global movement systems. Global Movement Management sets forth a vision for data collaboration on a significant scale to make it easier for individuals to do their jobs, for companies to improve their performance and for societies to maintain the global economy.

This paper sets forth a technology strategy for global movement systems that includes three major components:

- Adoption of a “micro-macro” approach that unlocks currently trapped data to achieve greater information granularity and that promotes greater information federation/aggregation
- Building the “connective tissue” needed to enable greater collaboration both vertically between individuals and organizations, and horizontally among organizations
- Peer production that results from unlocking information and sharing it more widely, helping to drive innovation to dramatically improve the performance, security and resilience of global movement systems.

In sum: Unlock trapped information, share it broadly and create new knowledge and innovation.

We can improve the use of technology to enable individuals to be more effective in their jobs, especially when they have been given the training and authority to make good use of it. More importantly, we can use technology as a strategic advantage by leveraging our ability to manage information to which dangerous elements do not have access – and to do so on a broad scale in order to prevent, detect and interdict malicious activities.

The sharing of currently trapped data will not occur until tools and services become affordable and widely available for data harmonization and interoperability; permissioning, anonymization and encryption; and data aggregation, analysis and visualization. If such tools become widely available and a significant amount of currently trapped data becomes shared, the resulting greater awareness of global systems will help enable companies to improve economic performance by identifying opportunities for improvements in critical economic flows. In addition, this same action will help improve security by making it easier to identify vulnerabilities and to spot anomalies. It also will help improve resilience by enabling companies

and governments to isolate disturbances, avoid overreacting to disruptions, and restart operations more quickly after an event.

Finally, we assert that greater enterprise visibility can help partners and competitors identify mutually beneficial best practices. Upstream companies can be better equipped to provide warnings of supply shortages or other disruptions before they affect downstream partners. Downstream companies can provide early warnings about demand or delivery disruptions to those upstream. Companies can benefit from greater communication with government and law enforcement officials about intentional threats. Governments can augment counterterrorism efforts with more accessible commercial data while also providing a higher degree of protection for privacy and civil liberties than is currently the case. By freeing up trapped data and sharing greater volumes of information, companies and governments can take advantage of open-source techniques or “peer production” to drive innovation and help make global systems more efficient, resilient and secure.

Addressing the governance gap – Governance is the collection of institutions, rules, standards, norms, decision rights, practices and processes that administer, coordinate and/or direct activity within a system or enterprise. Governance for global movement systems is the means by which a diverse and interdependent community of global stakeholders pursues improvements to the performance of global movement systems. Governance of those systems today is characterized by the lack of a coordinated approach that is necessary to address networked risk. We call this the “governance gap.”

To bridge this gap, participants in the global movement systems need to embrace a more comprehensive set of factors to understand the actual risks, costs and benefits that accrue to an organization in a networked environment. Moreover, participants need a means by which to organize their efforts to address these risks, costs and benefits. Our research shows that organizations have successfully met the challenges of organizing efforts across national boundaries in the global movement system before – for example, for international maritime cargo and for the Internet. These success stories provide a model for establishing a new global movement system governance framework.

Therefore, we call for the creation of a Global Movement Management Organization (GMMO) based on key attributes of these models for success. We envision a new international entity to fill the governance gap that presently limits the effectiveness of international efforts. The GMMO can serve to bring together key stakeholders with a shared interest in strengthening global movement systems and provide an effective forum and process to enable cooperation among regional, national and sector-specific stakeholders.

The GMMO can leverage existing international organizations through dedicated and visionary leadership to facilitate three important activities. First, it can align security and resilience with commercial imperatives in global movement systems. Second, it can improve international cooperation and harmonization among public and private stakeholders to strengthen global movement systems. Third, it can integrate security and resilience in a deliberate effort to harmonize risk management activities globally and to enfranchise less developed economic actors through a number of incentivizing mechanisms, including grants, loans, services and training.

Furthermore, as we studied the role of people, technology and governance in the global movement system, several principles that support this GMMO approach emerged: aligning with market incentives, layering horizontal and vertical approaches to improve security, and placing useful information in the hands of front-line employees while helping to ensure that they have the training and authority to act. Improved information sharing will require greater standardization of technologies, tools and protocols. Privacy and other data protections must be addressed at the architecture and design layer. Finally, mechanisms and metrics to measure, assess and optimize policies and programs are required to help make efficiency, security and resilience initiatives work.

In summary, the performance, security and resilience of global movement systems have always been deeply intertwined. September 11 provided a catalyst to invest in security, but, too often, security initiatives have been viewed as being at odds with commerce. This paper supports the idea that commerce, security and resilience are mutually reinforcing objectives. Importantly, we propose a strategy that employs assets that we have, and the terrorists do not. These include large numbers of dedicated people, the better use of technology to unlock trapped commercial data and dramatically improve information sharing and the formation of international organizations to leverage the combined weight of governments, non-governmental organizations and corporations around the world. This strategy will help to counter the asymmetric risk posed by terrorists and manage the unpredictable consequences of unintentional disruptions. The ideas and recommendations in this paper – promoting intelligent immunity as a means to manage 21st-century risk, applying a global movement management framework, strengthening human capital, making better use of technology and creating a new international governance organization – provide a starting point for stakeholders across virtually all sectors to help build more efficient, secure and resilient global movement systems.

To request a complete copy of Global Movement Management, visit: ibm.com/government/gmm.

Endnotes

¹A public good is defined as a society-wide good such as national defense and environmental sustainability that is normally provided by governments by way of taxation since no market forces exist to provide public goods.

Additionally, it costs little or nothing for an extra individual to enjoy a public good while the costs of withholding that good or depriving any individual of it are high.

²“The World Fact Book 2007,” section on United States of America, Central Intelligence Agency (CIA), 2007. <https://www.cia.gov/library/publications/the-world-factbook/print/us.html>. “The Debt to the Penny and Who Holds It,” U.S. Department of the Treasury, September 20, 2007, <http://www.treasurydirect.gov/NP/BPDLogin?application=np>

³Poole, William. “Chinese Growth: A Source of U.S. Export Opportunities.” Federal Reserve Bank of St. Louis, 31 July, 2006. http://stlouisfed.org/news/speeches/2006/07_31_06.htm

⁴Rai, Saritha. “India’s Outsourcing Industry Is Facing a Labor Shortage.” *New York Times*, February 16, 2007. <http://www.nytimes.com/2006/02/16/business/worldbusiness/16cnd-INDIA.html?ex=129746000&en=5f012f3c9f224f72&ei=5088&partner=rssn>

⁵“Latin Business Index 2007.” *Latin Business Chronicle*. October 2007. <http://www.latinbusinesschronicle.com>

⁶“The New Titans.” *The Economist*. September 14, 2006. http://www.economist.com/surveys/displaystory.cfm?story_id=787959

⁷This is known as dynamic instability, a key component of chaos theory, which was discovered by physicist Henri Poincare in the early 20th century.

⁸See, for example, Gleick, James. "Faster: The Acceleration of Just About Everything." Pantheon, 199.

⁹Piasecki, Bruce. "World Inc." SourceBooks Inc, 2007.

¹⁰Robb, John. "Brave New War: The Next Stage of Terrorism and the End of Globalization." Wiley. 2007, p. 99.

¹¹In the United States, for example, the 9/11 attacks disrupted trade flows across the Canadian and Mexican borders, which soon resulted in the shutdown of much of Ford Motor Company's manufacturing, as parts shortages halted the company's near-just-in-time deliveries.

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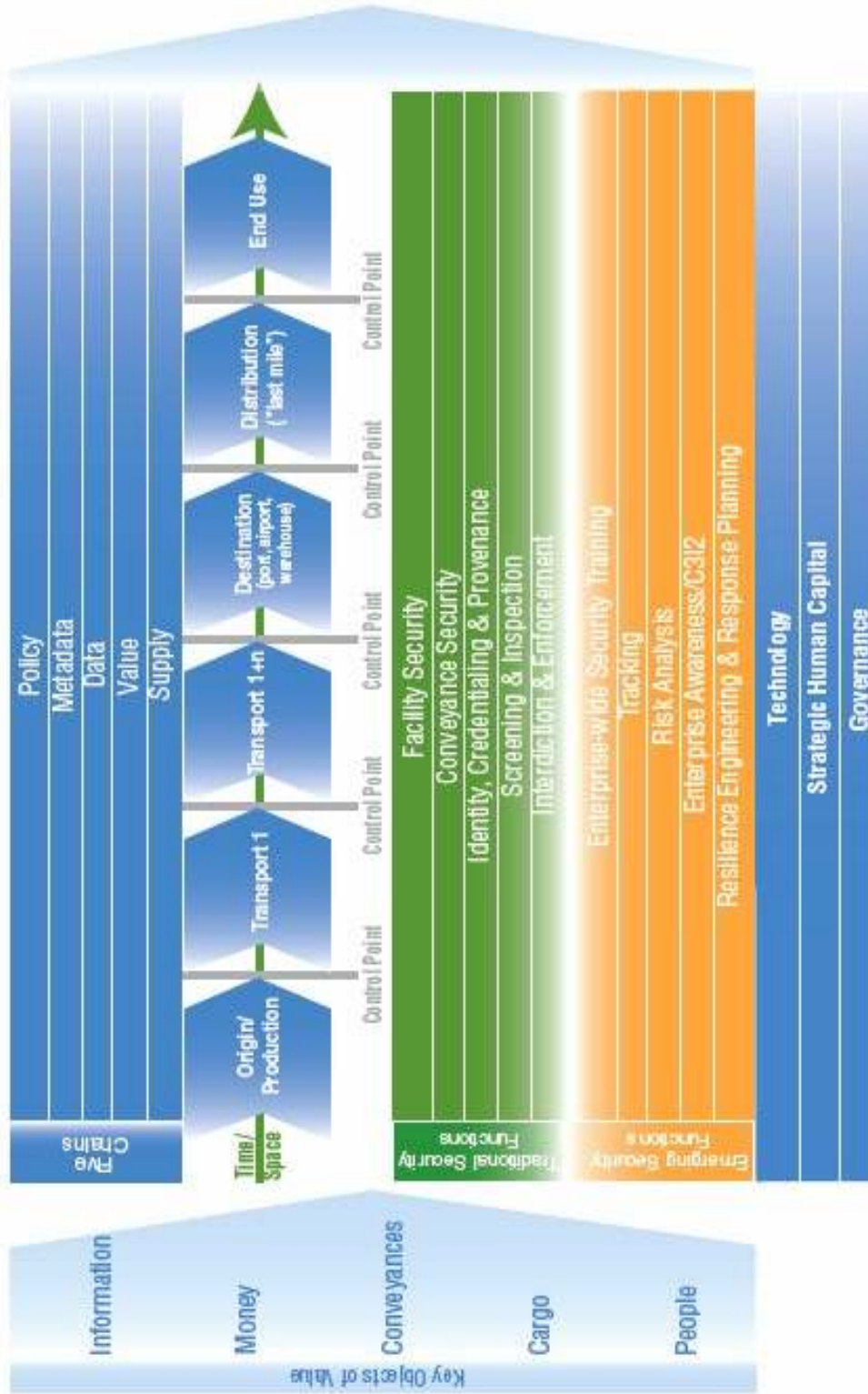
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Source: IBM Global Business Services