CHALLENGES AND OPPORTUNITIES IN BUILDING A SUSTAINED ADAPTIVELY-LINKED INTEGRATED INTELLIGENCE ENTERPRISE: HISTORIC PERSPECTIVE

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The advancement and diffusion of knowledge is the only guardian of true liberty.

~James Madison

By 2035, thousands of non-state actors will have access to weapons technologies capable of as much destruction as can be delivered by today's nation-states.[2] In 2016, the Director of National Intelligence (DNI) warned of a shift in threats to modern civilization away from rogue nations to adaptive actors stating: "In the next few years, as many as two-thirds of the nations around the world are at risk to one degree or another for instability, in what I see as a subtle erosion of the nation-state system.[3]" Today's linear (Newtonian) thinking and data processing architectures cannot keep pace with this emerging threat complexity.[4] Is it possible to find order in consciously-created disorder? Which information can be collected today to reveal the dynamic decision frameworks of tomorrow's non-state actors? Does this information already exist within the Intelligence Community (IC), and if so, how can it be coherently fused to provide timely results? How can IC administrators continue to provide leadership and direction while enabling the responsiveness, flexibility, global reach and innovation within and amongst diverse yet dynamically-integrated teams? The answers to each of these questions lie in technology: specifically,

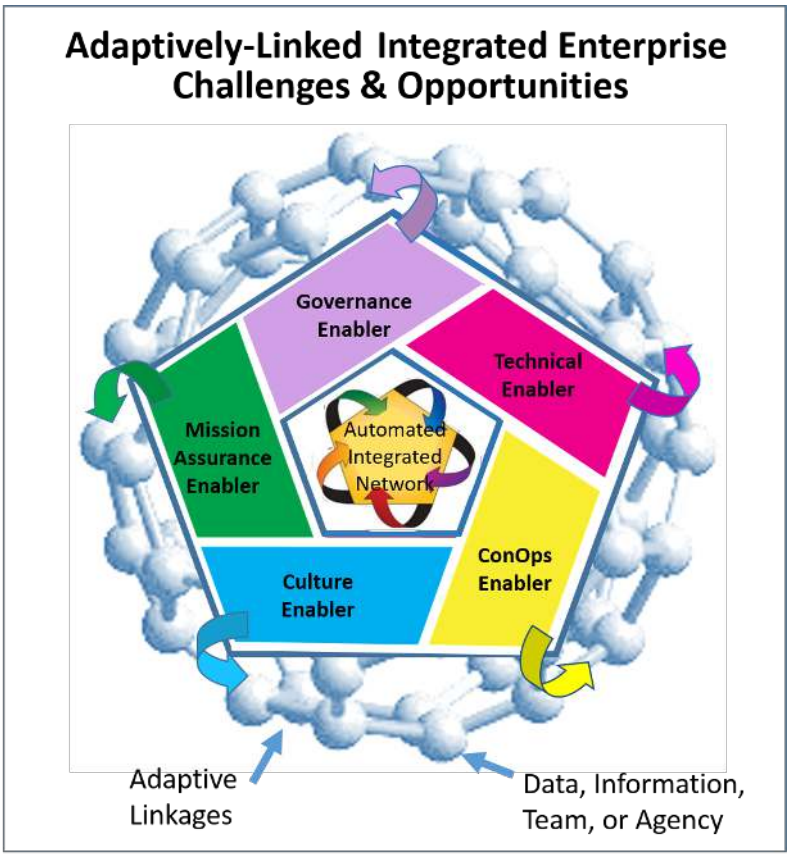

Figure 1. By 2035, the IC must become an Intelligence Enterprise. Inward-facing (data-focused) information technology networks at the core enable outward-facing (outcome-focused) results adaptively linking all data, information, teams and agencies. Five highlighted challenge and opportunity areas must be addressed for full adoption and entry into the Era of Information.

Complex Adaptive System (CAS) architectures that will enable the IC to transition from the linear Era of Automation to the more capable non-linear Era of Information.[5] Shown in Figure 1, quickly embracing this transition over the next decade allows time to gain full adoption competencies (2025-2035) dramatically changing IC technology and architectures, Concepts of Operations (ConOps), culture, governance and mission assurance processes to integrate the Community into an adaptively-responsive Enterprise to address emerging threats.

The Office of the DNI (ODNI) describes today's IC, with its unique access and training, as a coalition of agencies, acting both together and alone, that produce intelligence information and assessments for decision makers.[6] Two revolutions occur within any such technical production industry to reach full maturity: an automation revolution (AR) followed typically decades later by an information revolution (IR). These revolutions change not only an industry's products and processes, but also relationships external to the production.

Much like the textile industry's transformation during the Industrial Revolution, manual production within the IC prompted the creation of automation with transportation networks which allow for global distribution of high-volume production results regardless of factory or agency source. The steam engine of the textile industry is the computer for the intelligence industry. Railroad tracks built to distribute goods are the data and information networks of today's IC.[7] Thus, the Information Revolution for the Intelligence Industry (IRII) was seeded nearly forty years ago with the plantings of the Automation Revolution for the

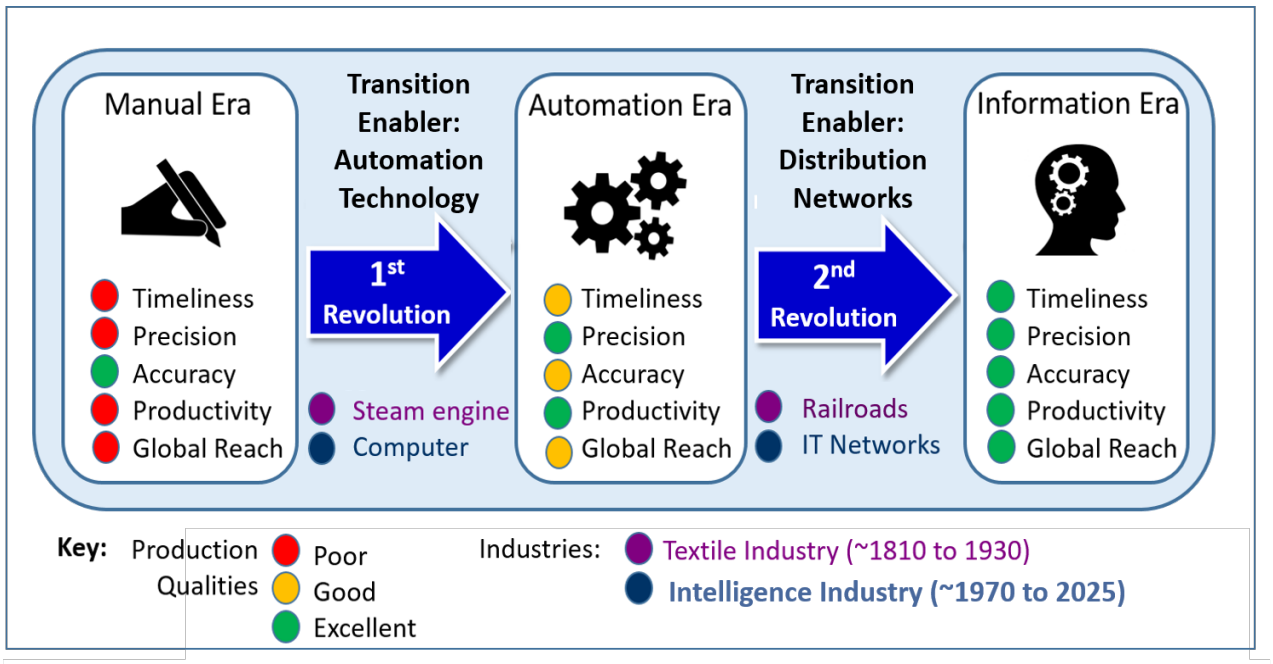

Figure 2. Industry production output characteristics vary by evolutionary era, whether manual, automation or information. Revolutionary changes occur within each industry as they mature from one era to the next. Parallel maturity cycles occur across industries, only two of which are mentioned here: textile and intelligence.

Intelligence Industry (ARII) triggered by the introduction and adoption of basic computer data processing automation. The resultant IRII was both foreseeable and imminent with that planting. The IRII's dramatic transformation will generate effective, responsive, critical and timely competencies to deal with the emerging global threat environment. Simply stated, agency input-focused production of the Automation Era will be transformed into enterprise outcome-focused production of the Information Era.

The former Director of National Intelligence, the Honorable Mr. Clapper stated, "We need to stop fighting technology and put it to work for us." [8] The IRII is rooted in technology and will progress at a rate dictated only by the rate at which Newtonian thought, architectures and policies will be allowed to be replaced by those enabling modernizing CAS architectures.

This paper describes the two revolutions which occur in technical production industries: first the automation revolution followed by the information revolution. The five challenge and opportunity areas of change which will occur as the IC undergoes its IR are then introduced. The conclusion reflects upon the urgency of understanding and adoption of these imminent IC changes over the next decade to prepare for 2035.

FIRST REVOLUTION: AUTOMATION

Initial production within an industry is manually performed. Manual production, shown in Figure 2, is characterized by tasking which is in such close communication with the consumer's need that the tasking agent may actually be or personally know the consumer. With such clear communication and understanding of the end use, the collection of resources and processing will be honed until the final product fits the mission (outcome) with sufficient accuracy. Items made by hand tend to be purpose-built and thus have poor versatility limiting reuse across products or across geographies.

Tedious manual processes inspire the invention of machines. Initially, machines merely replace existing manual and tedious processes, upsetting neither established product usage nor lines of communication with the world outside the factory. Products which used to be made manually remain the same as before, but are now made more quickly, more efficiently and with more precision. The influence of the end-user is diminished and replaced by the priorities of the "factory" automated processes. Figure 2 summarizes the benefits of automation over manual processes.

Within the IC, the National Reconnaissance Office (NRO) acquires automated tools in space and on the ground to provide national decision makers necessary data and information collected worldwide through overhead assets at the speed of automated processing. Figure 3 depicts the existing architecture which automates both SIGINT and GEOINT as well as fused multi-INT processing. This architecture is consistent with Automation Era linear production.

Dramatic increases in productivity due to automated processing trigger the creation of integrated networks to distribute high-volume results. Dr. Pete Rustan described the need for integrated standardized intelligence networks in 2008. [9] Integration, standardization and management of disperse intelligence networks were analyzed by G. Edward Deseve in 2009. [10] As late as January 2016, Kristin Quinn described the timeliness and data sharing benefits of global network integration between the IC and the DoD enabled by Intelligence Community Information Technology Enterprise (IC ITE), the Joint Information Environment (JIE) and the Defense Intelligence Information Enterprise (DI2E). [11]

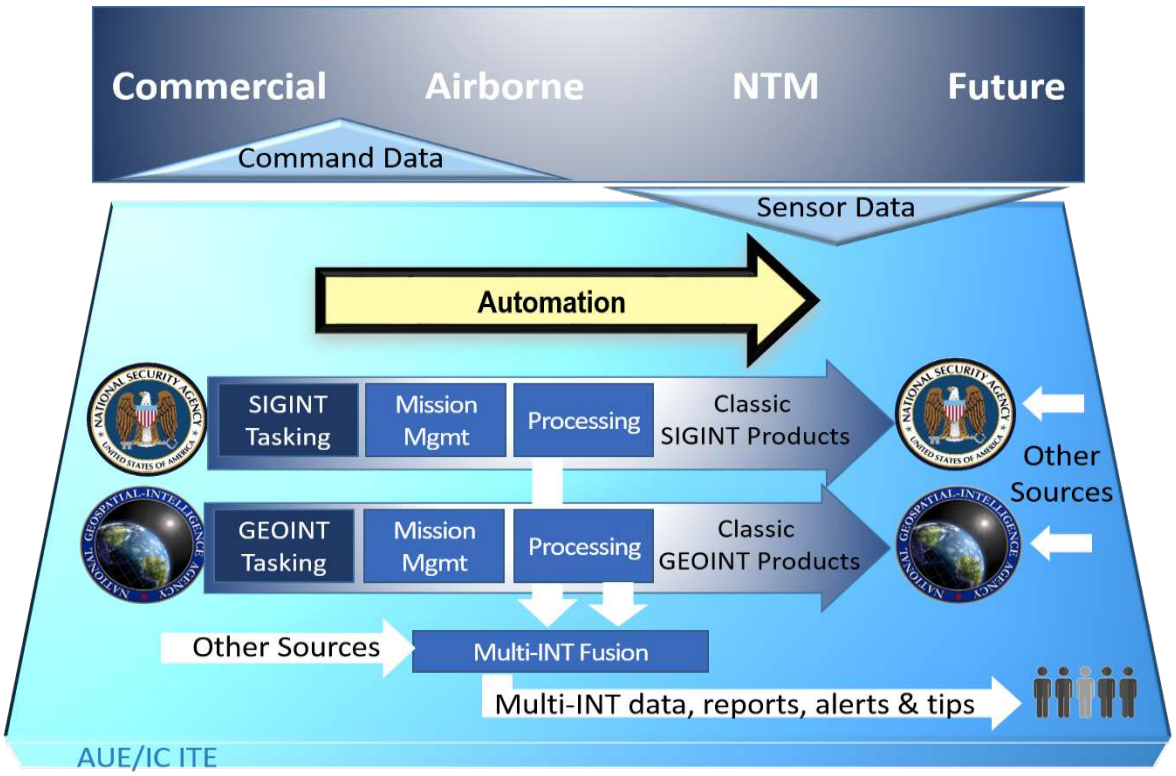

Figure 3. NRO's current ground architecture automates SIGINT, GEOINT and Multi-INT processing employing best-practice engineering principles to process and fuse data close to global sensor collection. Data and information distribution networks connect NRO results to the greater community. This architecture is consistent with the Automation Era.

Integrated data and information distribution networks with excellent oversight and management combined with automation are not enough to sustain and reinforce the desired integration of the diversity of government agencies across the IC and DoD. The disparity of organizational cultures often works against network and data sharing successes.[12] Thus, organizations will attempt to codify common understanding by standardizing policies and procedures to influence integration and support compliant flow of goods. In the case of the textile industry's production distribution of the late 1800's, four decades were spent to mitigate disagreements over who should control distribution and network resources key to national economic-health interests.[13] It was not until the creation of the nation's first federal regulatory agency, the Interstate Commerce Commission, that national interests allowing commerce and trade (flow of goods regardless of origin) were finally codified to be of priority over institutional interests. In the case of today's DoD, Joint Staff prescribes detailed network integration Concepts of Operations (ConOps,) principles, capabilities and attributes to ensure that Joint Forces function in a coherently integrated framework of human and technical connectivity and interoperability.[14] Institutional policy and procedures to compel integration when skewed "against the grain" of an organization's culture and commitments to allow free flow of goods are hard to enforce and sustain.[15] To bring light to these challenges, Rustan breaks down first-revolution automation and network integration opportunities into categories of culture, mission assurance, governance, technical and ConOps. Addressing these five areas during

the AR is not sufficient to fully achieve sustainable inter-organizational integration. The results of the Automation Era, with associated distribution networks, is a strong, diversified and decentralized community with independence of thought and production. Lacking, however, is an aggregation mechanism to fully and sustainably integrate the available data, information, knowledge, tradecraft and common interests of the industry. Lacking a self-interest-reinforced means to integrate, the community remains a mere federation. Fortunately, the second revolution, the Information Revolution, solves community integration sustainability challenges.

SECOND REVOLUTION: INFORMATION

Full adoption of automation and resultant distribution networks enable production to saturate markets resulting in high human capital demands and giving incentive and opportunity for new innovative uses of products within creative communities not anticipated by the producers. External demands for new products or policy changes often spurs healthy discussion at this point focused on two topics: 1) the struggle to address automation's inordinate human resource demands; and 2) the struggle between automation's command and control production tasking powers unable to sufficiently address community needs to receive timely, new and innovative products.

Discourse of this type indicates the start of the second revolution – a period in which the external culture, users, national interests and mission needs now urge end-use influences in the tasking, distribution and resource ownership of automation's production. Eventually, consumer feedback gains power to tune automation to user needs, which is a fundamental characteristic of the Information Era's accurate and timely production as shown in Figure 4. Command and control type of tasking associated with the AR (depicted in green) now shares tasking control with marketplace needs of the consumer community (depicted in blue). Resultant products are now not only precise, but also

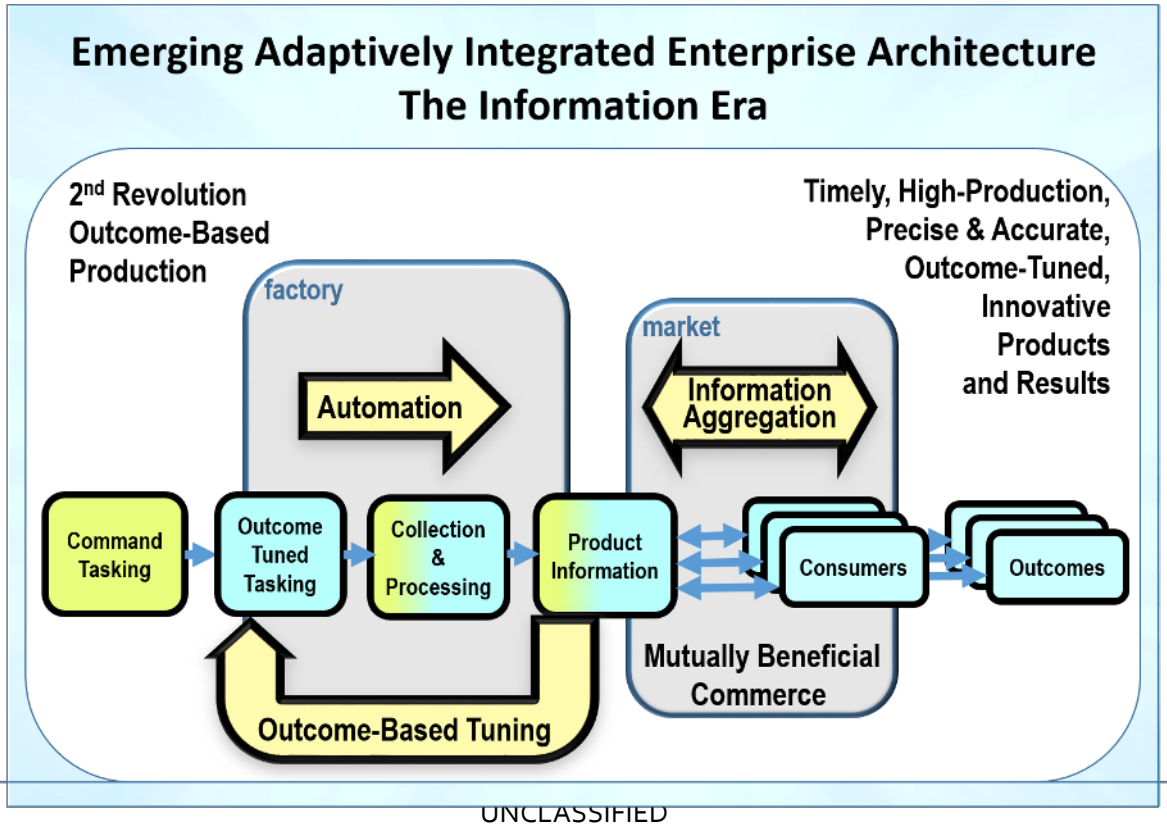

Figure 4. The Era of Information Tunes Internal "Factory" automated collection and processing to objective outcomes via "marketplace" information aggregation sensitive to the needs and contributions of any member of the consumer community.

timely, adaptively and accurately tuned to outcomes, the changing mission needs of the community. Simply stated, in the automation era, man serves the machine to sustain production. In the information era, the machine serves man using automated tuning to address the actual question at hand. [16] Focus of the automation era are inputs and throughputs. Focus of the information era are outcomes.

Further, the diversity, reach and first-hand-knowledge of consumers makes them the most innovative, far-reaching and insightful with respect to the mission usage outcomes. With production and distribution (trade and commerce) now sensitive to diversity of ideas and needs, tuned production outcomes become the key enabler, the key energizer and the key sustainer of community integration. Market contribution of one member of the community to hone collected data against a certain mission will benefit others in the community. Enthusiastic conversation, collaboration, and sharing of outcomes and tradecraft result. Exposure to new ideas and collaboration fosters new insights energizing further collaboration and conversation in how better to tune collection against mission or provide better mission-supporting capabilities. Controlling and adversarial trade of the Automation Era becomes mutually-beneficial market interchange with renewed focus on outcomes.[17]

"Goods for trade" become specialized data, information and automated cognitive tradecraft results available for use against diversity of need. "Commerce" becomes the distribution channels for global data and information.[18] Adam Smith's "Invisible Hand" now reinforces community integration energized by self-serving mission-derived insights beneficial to the greater community as a whole through market sharing as well as through further mission-tuned innovation with resultant accurate production. Market forces

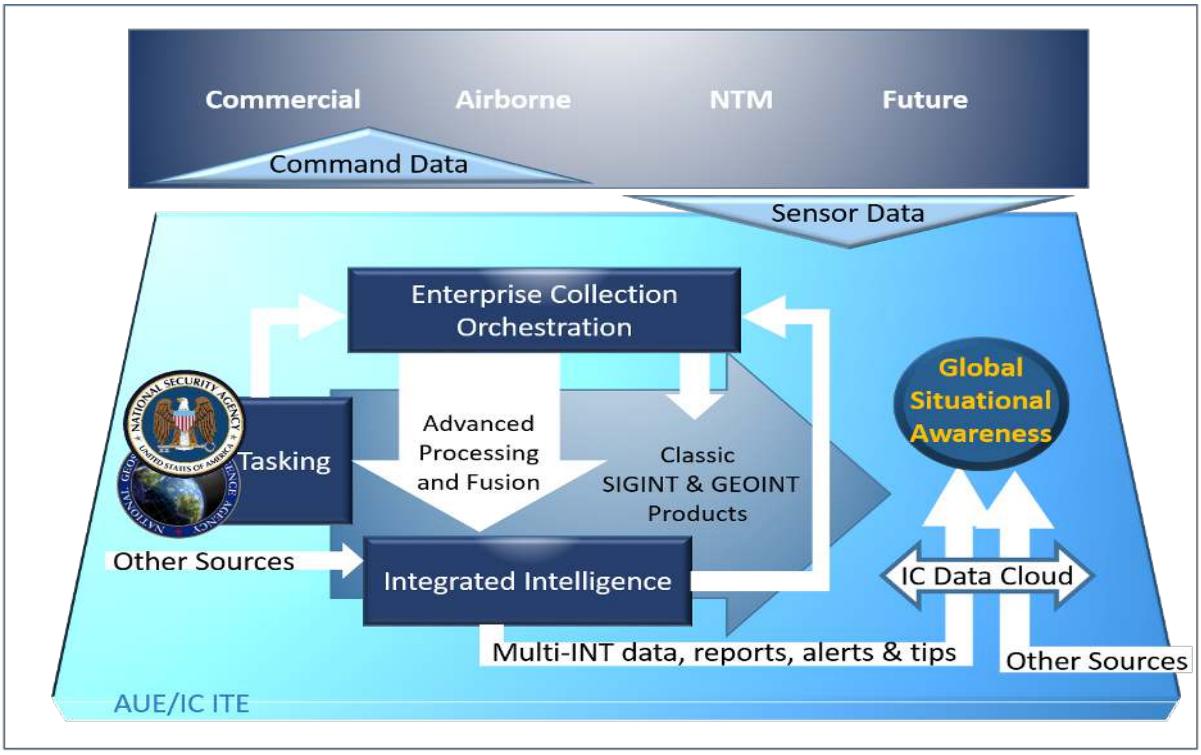

Figure 5. Future Ground Architecture (FGA) employs non-linear mission-tuned feedback control at the speed of compute to tune automated processing and collection.

now transform historic notions of "private goods" to gain acceptance as "public commodities."[19]

This integration-through-trade insight is demonstrated across time and cultures. Empowered trade and associated distribution networks transform loosely-coupled equally-statured coalitions of government agencies into a unified enterprise responsive to innovative ideas and needs of the community. Will Durant studied this phenomenon stating: "The crossroads of trade are the meeting place of ideas, the attrition ground of rival customs and belief; diversities beget conflict, comparison, thought; superstitions cancel one another, and reason begins."[20] Not only are outdated customs replaced, innovation through trade further increases as those who share and trade commodities "come back with changed perspective, and alert and open minds; they bring new ideas and ways, break down ancient taboos and sloth, and replace the familial conservatism of a rural aristocracy with the individualistic and progressive spirit of a mercantile civilization where old myths lose their grip on the souls of men, leisure rises, inquiry is supported, science and philosophy grow."[21] Close ties between production and users now enlighten and empower all within the production/collection/use cycle to contribute to better, new and innovative results. Increased diversity of collaborative perspectives better addresses increasing complexities of mission and community needs. [22] The boundaries delineating the functional system components stretch and extend to now include what used to be external members of the community empowering them now to function and contribute to the enterprise. When system boundaries extend to include the greater community, all within the production system regardless of organizational boundaries become cognizant of and energized by their responsibilities and contributions within the production cycle. Extending system boundaries, redefining "them" to now become "we" metamorphically and sustainably transforms the loosely-coupled coalition into an adaptively-linked enterprise. [23] The marketplace of the Information Era becomes the sustainable integrator of the community providing the necessary balance between two imperatives described by Surowiecki: "making individual knowledge globally and collectively useful, while still allowing it to remain resolutely specific and local." [24]

This marketplace integration concept applies across the diversities of economies fueling various industries. For example, in the private sector for-profit economy of the textile industry, the networked interactions of marketplace participation results in sector integration allowing creation of new and innovative products based upon, and even dependent upon, resources provided by others guided by high-utility outcomes. In the opposite extreme, the "gift economy" of the scientific research industry, the marketplace for trade includes peer-reviewed journals, technical conferences and even published tradecraft of patents integrating scientific communities to leverage, reuse, network and build upon works of others. Public sector economies lie somewhere between these two extremes, gift and for-profit, and, thus, respond in kind to information aggregation marketplace concepts, allowing new insights to be achieved based upon and even dependent on the networked production of others within and across the community. [25]

The Future Ground Architecture (FGA) proposed by Mr. Michael Hale, former Director NRO Ground Enterprise Directorate, was endorsed by the ODNI and approved for system acquisition in 2015. This architecture, depicted in Figure 5, is a responsive and mission-adaptable IC "cross-roads" of trade and commerce, key to sustainable IC integration and transformation, which focuses on outcomes by allowing end-result users to tune collection. In 2016, Ms. Betty Sapp, Director of the NRO, summarized this overhead collection and ground processing second revolution

architecture: "Fueled by the incredibly dynamic IT market place… we anticipate fielding a ground system able to direct appropriate multi-INT collection assets against intelligence problem observables able to rapidly redirect assets for additional collection to improve our knowledge and able to learn and adapt from what it has collected all before any human being sees what's happening. Imagine a ground architecture able to move at machine speeds to notice the unusual, hidden amongst the host of the usual, to anticipate the next move, not to just react to the one just made, and to use all our collection ability to best affect."[26]

THE PATH TO AN ADAPTIVELY-LINKED IC AND DoD ENTERPRISE: CHALLENGES AND OPPORTUNTIIES

Today, the IC is at the cross-roads of these two revolutions – the first well implemented and the second just beginning. Evidence includes the fact that, as the IC closes out the first forty years of integrating IC and DoD automated processing and distribution networks, today's production rates from IC automated systems overwhelm available human resources. Additionally, the IC heavily relies on command-and-control tasking information and automated processing as depicted in Figure 3. Lastly, the IC is today comprised of a federation of not yet fully-integrated members.

At the same time, the actions of the Nation's adversaries, who disclose only globally-disperse traces regarding their intent, spur development of near-real-time tasking cycles with global sensitivities. The Era of Information responds to these emerging threats adaptively tuning global collection against specialized needs. Contributing to this second revolution transformation is FGA tuning of worldwide collection by integrating diverse sensitivities to global mission insights provided by those at the outer reaches of the communities. CAS, as architected and enabled by FGA, structurally offers "neural-like networks of interacting, interdependent agents who are bonded in cooperative dynamic of common goal, outlook, need, etc." [27] As shown in Figure 1, the Information Era CAS enabled by FGA offers self-organizing changeable structures able to learn and adapt to creatively address non-linear problems via their comprising multiple, overlapping hierarchies. FGA thus architects an enterprise CAS capable of generating non-linear solutions to technically and culturally glue the community together, empowering through common values, vision and beliefs, and responsively adaptive to better inform global intelligence needs.[28] FGA is a technical architecture self-sustaining market aggregating diverse and independent perspectives from across the community.

The IC is entering a very exciting and transformative time. As Rustan discussed, there are five challenge and opportunity categories to characterize the full adoption of the AR with associated integrated IT distribution networks across the IC and DoD. [29] While the categories of challenges and opportunities the IC will encounter now at the start of the IRII remain the same, the scope of each is fundamentally different as tasking within the community will become hybrid with command giving way to become adaptively tunable to mission needs incorporating collective insights from across the IC and DoD. This new architected enterprise sensitivity results in a very different focus for each of the five opportunity and challenge categories. The path forward is illuminated by the footprints of other industries which successfully passed this way before.

CULTURAL CHALLENGE AND OPPORTUNITY

IC culture will change. The IC was organized decades ago as a community of common stature Agencies which work both separately and together to exploit different phenomenologies, gain data collection competencies and achieve manual intelligence production. Tuned automated production, data

sharing (trade) and integrated distribution (commerce) as architected by the technical non-linear architectures, such as FGA, will transform the IC into an adaptively-linked enterprise. Two cultural changes will occur.

First, emphasis on inputs (data phenomenology) will be replaced by a focus on outcome. New mathematical tradecraft will empower mission solutions derived from integrating data from a variety of sources creating insightful outcomes. The understanding that data in isolation has no value will be realized.

Second, cultural trust and inclusion of both people and machines will increase. Tasking of collection and processing will become more responsive to both automated and expert knowledge of real-time changes in world operations as informed by any sensor, man or machine across the community. Recognition will increase that the most outcome-impactful data may lie at the fringes of the community often in nontraditional locations. As a result, technical architectures, more extensible and sustainable than social architectures, will be constructed inherently sensitive to and able to integrate the smallest of clues left by adversaries in nontraditional locations as reported by man, sensor or machine from anywhere in the enterprise.

GOVERNANCE CHALLENGE AND OPPORTUITY

Tomorrow's governance environment will be energized by high-trust transparency of rules enabling and empowering distributed execution. Modernized data management policy must separate powers of policy-making (legislative), execution (executive) and court-like oversight (judicial) systems characterizing American government principles. [30] Four paradigm changes will occur in IC governance.

First, common "rules of play" policy will be clear, unwavering, not ex post facto, and known. In this environment, data and information can be shared freely, compliantly, within policy. Will Durant states that modernizing civilizations discovered that known policy is a great enabler: "Man became free when he recognized that he was subject to law."[31] The IR recognizes and exploits the fact that all members within communities, especially those comprised of highly trained personnel such as comprise the IC, have the desire, the passion, the capacity and the knowledge to share within policy constraints. Policies must exploit and enable this legally compliant passion for innovation and integration across the community regardless of Agency or origin.

Additionally, decentralized management empowers autonomy to adapt and collaborate requiring both governance and management decisions to recognize these added dimensions. Communication and understanding of the mission become even more critical. Governance principles become global rather than local. Power to allocate resources is now counter-balanced by responsibility recognizing that it is collective participation that solves the most challenging of problems. New "right versus right" problems will arise acknowledging that success may require participation by teams, sub-components of which may have conflicting resource priorities. New interconnectedness thus gives rise to integration management responsibilities to abandon and replace outdated inefficient policies no longer consistent with integrated community responsibilities.[32]

TECHNICAL CHALLENGE AND OPPORTUNITY

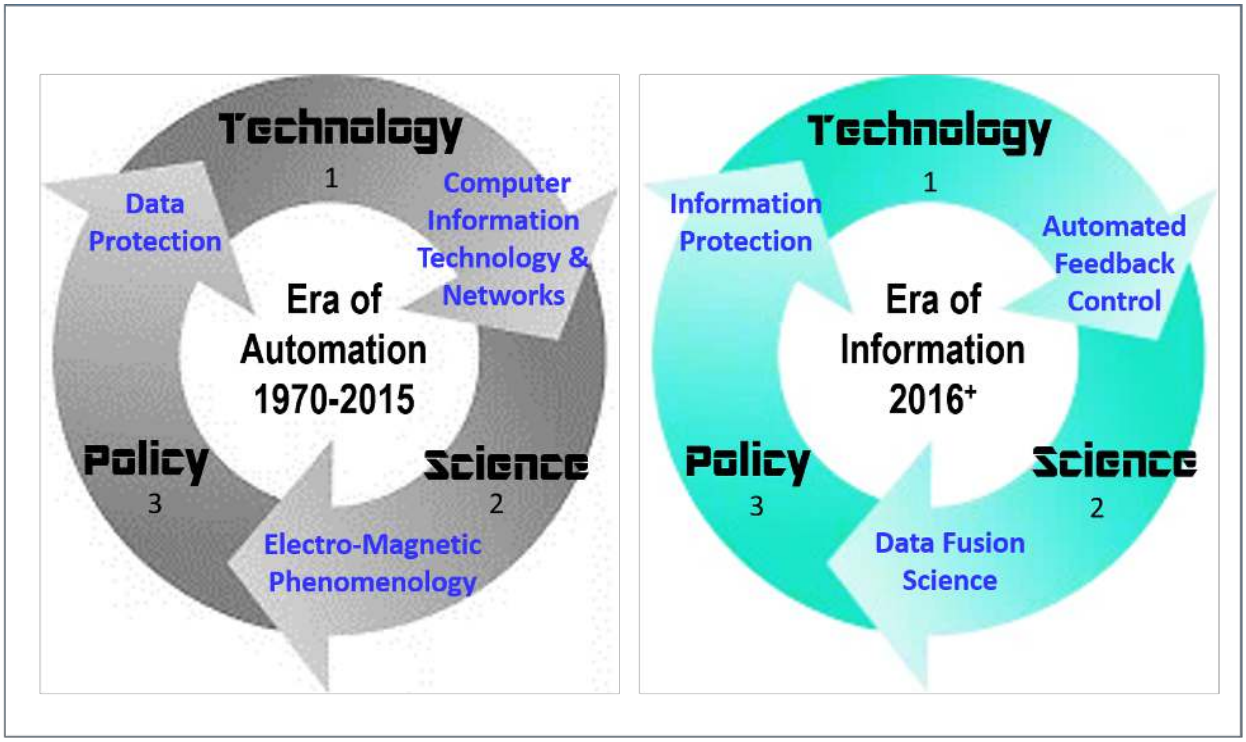

Figure 6. The Technology Adoption Cycle. Discoveries made through innovative use of technology (1) spur investment in sciences (2) to understand, leverage and optimize the technological advancement. Scientific understanding then informs the bounds which policy (3) uses to put into place the operational ability to use technology within limiting constraints. The Era of Automation within the IC focused on data. The Era of Information will focus on outcomes resulting from data fusion results: information.

The IRII will enhance IC technical competencies focusing on mission, collaboration and integration. The two largest of the technical challenges and opportunities which lie ahead are summarized below.

The IRII is a system architectural change from linear Tasking Collection Processing Exploitation and Dissemination (TCPED) strategy to non-linear informed and tuned collection and processing as can be noted by comparing the linearity of the current ground architecture of Figure 3 to the nonlinearity of FGA shown in Figure 5. Human-computer interfaces will translate mission information into the language of the factory to tune all processing and collection energies to produce the most accurate, timely and relevant product to support mission. Technical challenges await to perform this translation.

Today's existing data protection policy was put into place at a time when adversaries were geographically stationary and posed analytically simple threats. As shown in Figure 6 during the Era of Automation, technology, science and policy were thus aligned. Today however, adversarial threat is increasingly complex, innovatively changing and geographically disperse. Today the IC understands that resultant data fusion combinations have properties, and thus will need protections, separate and distinct from those of their atomic sources. As described in Figure 6, as the IC enters the Era of Information, a misalignment between technology, science and policy will quickly become apparent. Today,

technology (the ability to build non-linear processing architectures) has out-paced both science and policy (the allowance and understanding of the use of non-linear techniques.) Realignment and modernization of science-informed policy will occur to enable the use of today's advanced technology-based data-fusion results such as object, track, behavior, situation assessment, alert, change and inferred intent. Once science advances to support modernization of policy, the compliant operational use of data-science technology, collection and processing will advance mission understanding and sharing with a further boost to sustained community integration.

CONOPs CHALLENGES AND OPPORTUNITY

With renewed focus on outcomes, centrally-managed stovepipe organizational constructs will flatten to enable a more-timely and matrixed response of subject matter experts in adaptive fashion against any adversarial challenge. The change from central management to a more-hybrid approach offers three ConOps challenges and opportunities. [33]

Personal-relationship-dependent teams and resultant point-solutions characteristic of the Automation Era reinforce organizational embedded norms adding frictional drag to the community's ability to resolve highly complex problems. Successes achievable through adaptable and collaborative technical marketplaces pave the way around this frictional drag. Limiting embedded community norms eventually give way to modernized outcome-based aggregated yet autonomous solutions enabled by adaptable technical architectures. The frictional drag of embedded parochial culture gives way to high speed, highly-integrated, highly-innovative solutions..[34, 35]

Drucker states that massive re-engineering will occur as an industry moves into the Information Era. [36] These modernized architectures structurally and operationally assimilate a new sensitivity to information offered by enterprise specialists, experts who

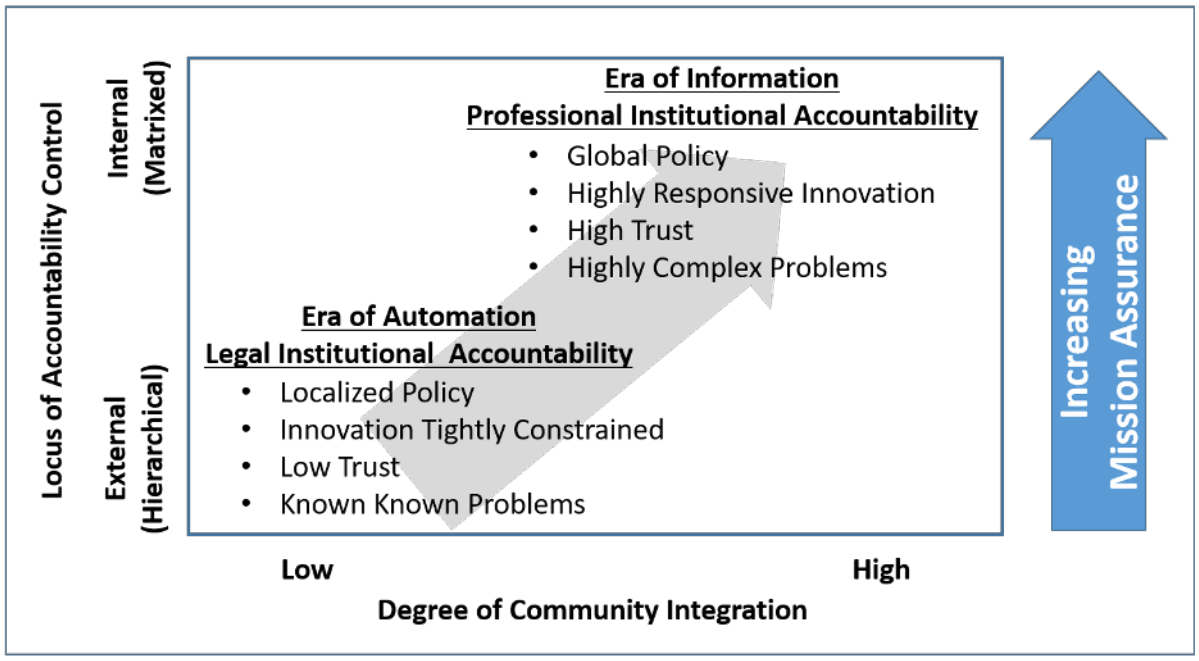

Figure 7. In the move from the Era of Automation to the Era of Information, the low-trust legal institutional accountability environment changes to a high trust professional accountability environment enabling the adaptively-linked integrated enterprise to solve complex problems compliantly. As a result of these changes, mission assurance increases, even in resolving highly complex problems solvable only through networked Agencies/teams.

know their jobs better than anyone else. The inspiring new ability to operationally collaborate across organizations through this new integrating CAS architecture organically makes the collective organization both a learning and a teaching adaptively-linked enterprise. The increase in specialization, the newly integrated roles, the need to teach each other, all reinforce collaborative responsibility for successful execution against objectives enabling each member success in their individual roles. Success becomes everyone's responsibility.

MISSION ASSURANCE CHALLENGE AND OPPORTUNITY

Context is a powerful successful outcome amplifier, especially in complex environments of rapid change and deception. Using high-confidence data as context for low-confidence data, critical clues, scarcely detectable, now increase clarity. The Era of Information enables low-confidence data to be placed in context with all other data. Figure 7 illustrates the increase in mission assurance resulting from culture, governance, technology as well as ConOps consistent with the Era of Information. Figure 7 also highlights the impact of institutional accountability type. Figure 7 shows that the Information Era is fueled by professional accountability institutional control.[37, 38] During the Automation Era, with little need for networked ties between Agencies, policy is localized amplifying external Agency control through external institutions. During the Automation Era, data sharing and distribution is tightly and locally controlled consistent with the simple Newtonian architectures allowed. As a result, community integration potential is inherently limited. Changing the locus of institutional accountability from externally controlled to internally networked, as a professional accountability, helps move the community into the Era of Information. Romzek and Dubnick document that the locus of control of institutional accountability when inconsistent with the complexity of organizational problem sets to be solved, can result in catastrophic failures, even in Government agencies not typically associated with protection of life.[39] Further, Huntington states that organizations with structured and differentiated roles and authorities have a harder time moving to inclusive participation than do organizations originally less rationalized.[40] The move to professional accountability allowing networked integration of specialized competencies from across the enterprise is critical to integrating the Community into an intelligence enterprise. Acknowledging embedded organizational cultures and high organizational differentiation based on data phenomenology today, this move to the Era of Information for the IC will be foreseeably challenging.[41]

CONCLUSION

The course of history across industries, whether a for-profit economy of the private sector, a "gift" economy of the scientific research sector, or somewhere in-between characteristic of the public sector, illuminates the way forward toward an adaptively responsive, highly integrated and innovative outcome-focused IC. As proposed by Hale in 2015, FGA is an example of an Era of Information complex adaptive technical architecture which provides fundamental non-linear re-engineering, the new "cross-roads of trade, the meeting place of ideas, the attrition ground of rival customs and beliefs," which will help transform how the IC works, the timeliness and accuracies of its global products, the responsiveness to age-old balances between organizational adaptive exploration and exploitation, and the interconnectedness of its members with resultant increased complexity levels of solvable problems. FGA advantages are derived from the fact that it is a self-sustaining technical integration of the community through trade fueled by enthusiasm focused on mission (outcomes) rather than a personality-based political integration.

History abounds with examples of the introduction of technology triggering an automation revolution (AR) within the industry followed decades later by an associated information revolution (IR) more beneficially transformative than the first. History teaches that the second revolution, an IR, is seeded when the first revolution, an AR, is started. History teaches that this second revolution tends to be self-sustaining as it exhibits Adam Smith's concept of the "Invisible Hand" reinforcing innovation, integration and community collaboration performance optimizing the value of contributions by both individual and community. The intelligence industry is next in line for this maturation.

This transformation will result in significant advancements in the IC's culture, technology, governance, ConOps, mission assurance. Understanding the transition challenges and opportunities to welcome the Information Era will enable the Community to embrace these logical maturations empowering collectively successful competencies against the emerging threat environment. The changes are welcome as the resultant Information Era is characterized by products which are now not only precise, but also timely, adaptively and accurately tuned to the changing needs of the community. FGA is a technical architecture enabling the IC to become a CAS enterprise empowered through self-motivated learning, creative non-linear problem solving with adaptive-capacity. Such a non-linear architecture is necessary to match the non-linear complexity of the emerging global threat environment.

Albert Einstein stated: "We must try to recognize what in our accepted tradition is damaging our fate and dignity – and shape our lives accordingly." The threat trajectory targeting modern civilization is known as are the traditions hindering the move to the Information Era necessary to act. This article summarizes those old embedded ways that will and must change.

Seeded forty years ago within the IC with the adoption of IT and the resulting integrated information and data networks, that next era has already begun. The IC has many levers to control the rate at which these impending changes will be allowed. Should it nurture this impending change politically or architect this change through technology? If the former choice is made, history shows that it will likely take multiple generations to progress into the Information Age due to embedded cultural inertia favoring institutions over national priorities. [42, 43] The latter choice, including the re-engineering architected technical solution offered by FGA, will be the faster road to an IC Enterprise consistent with the pace of threat-innovation facing the Nation by 2035.

A practical architecture which adaptively links mission teams with timely global information, once implemented, is an apolitical technical solution. That implementation, while architecturally and technically achievable, still faces the challenges of slower-paced embedded cultural changes including creation and adoption of outcome-focused global policy consistent with high-trust collaborative networked environments. If these slower implementation aspects of the IRII are not aggressively addressed, the resultant misalignment between today's input focus and that necessary to fully enter the Era of Information, outcomes, could result in catastrophic events. The move to the Era of Information, to follow the known path illuminated by those industries which tread this path before, must therefore be aggressively and knowingly pursued.

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Johns, K. Keene, O. King, M. McCarthy, D. Muhlbauer, R. Jeffries, B. Slivak and others.

[2] Wells, L., Hailes, T., Davies, M., *Changing Mindsets to Transform Security – Leadership Development for an Unpredictable and Complex World*, Ch. 11: "Building Creative Military Leaders: Challenges to Overcome," Center for Technology and National Security Policy at the National Defense University, Washington, D.C., p. 220.

[3] The Honorable James Clapper, Director of National Intelligence, GEOINT Symposium, May 17, 2016, available on www.DNI.gov.

[4] McGhee, S., "The Wicked Problem of Information Sharing in Homeland Security - a Leadership Perspective," *Calhoun Institutional Archive of the Naval Postgraduate School*, Monterey, CA, 2014

[5] ibid.

[6] The Honorable James R. Clapper, Director of National Intelligence, remarks made at the AFCEA/INSA National Security and Intelligence Summit, Thursday, Sept 18, 2014. Document available at DNI.gov

[7] Drucker, P. "Beyond the Information Revolution," *The Atlantic*, Oct 1999.

[8] The Honorable James Clapper, GEOINT Symposium, loc. cit.

[9] Rustan, P., founding Director, Ground Enterprise Directorate, 2008-2009, The National Reconnaissance Office, "Building an Integrated Intelligence Network: Challenges and Opportunities, Senior Leader Perspective," Air Force Space Command *High Frontier*, vol. 4., no. 4., Nov. 2008, pp. 10-14.

[10] Deseve, G. E. 2009. "Integration and Innovation in the Intelligence Community: The Role of a Netcentric Environment, Managed Networks, and Social Networks," published as Chapter 6 in *Unlocking the Power of Networks: Keys to High Performance Government*, eds. S. Goldsmith and D.G. Kettl, pp. 121-144, Washington D.C.: Brookings Institution.

[11] Quinn, K., "A Global Intelligence Enterprise," *Trajectory Magazine*, 2016, Issue 1. Available at https://trajectorymagazine.com/

[12] Deseve, loc. cit.

[13] Fukuyama, F., *Political Order and Political Decay from the Industrial Revolution to the Globalization of Democracy,* Chapter 11, Farrar, Straus and Giroux, 2014, pp. 165-173.

[14] U.S. Joint Staff, "Net Centric Operational Environment Joint Integrating Concept," Version 1, October, 31, 2005, Washington DC, http://www.dtic.mil/futurejointwarfare/jic.html

[15] Khademian, A., *Working with Culture, the Way the Job Gets Done in Public Programs***,** CQ Press, Washington D.C. 2002.

[16] Drucker, P., *Post-Capitalist Society,* Routledge Taylor and Francis Group, New York, NY, 1993, pp. 85.

[17] Page, S., *The Difference – How the Power of Diversity Creates Better Groups, Firms, Schools and Societies,* Princeton University Press, Princeton, NJ., 2007.

[18] Drucker, p. 46

[19] Smith, A., *An inquiry into the Wealth of Nations*. Strahan and Cadell, London. 1776.

[20] Durant, W. *The Life of Greece, The Story of Civilization*, Chapters VI, XI, XII, MJF Books, New York, NY, 1996, p. 135. The coalition of ancient Greek City-States, pursuing the new idea that trade and not war is the best path to supremacy, formed the Delian Confederacy of Equals to become the Greek Empire, a modernized civilization transformed through international trade to be "broad in scope and yet intense in action, open to every new idea and eager for intercourse with the world, tolerant, varied, complex, innovating, skeptical, imaginative, poetical, turbulent, free." (page 87)

[21] Durant, loc.cit. p. 176.

[22] Surowiecki, J., *The Wisdom of Crowds,* Anchor Books, New York, NY, 2005.

[23] Senge, P., *The Fifth Discipline, The Art and Practice of the Learning Organization,* Currency Doubleday, New York, NY, 1990, pages 17-118.

[24] Surowiecki, loc. cit, p. 72.

[25] Ibid.

[26] Sapp, Betty, Director of the National Reconnaissance, Keynote speaker at that 2016 GEOINT conference, May 15, 2016. Available on the USGIF site: https://trajectorymagazine.com.

[27] Uhl-Bien, M., Marion, R., McKelvey, B., "Complexity Leadership Theory: Shifting Leadership from the Industrial Age to the Knowledge Era," Leadership Quarterly, vol. 18., no. 4, 2007, p. 299.

[28] Uhl-Bien, Marion, McKelvey, op. cit. pp. 298-318.

[29] Rustan, loc. cit.

[30] Madison, J., *The Federalist Papers No. 47*, 30 Jan 1788.

[31] Durant, loc. cit. page 136.

[32] Drucker, op. cit., *Post-Capitalist Society,* Chapter 2, "The Society of Organizations," pp. 38-67.

[33] Brafman,O., Beckstrom, R., *The Starfish and the Spider: The Unstoppable Power of Leaderless Organizations,* Penguin Books, Oct. 2006.
[34] Granouetter, M., "Economic Action and Social Structure: The Problem of Embeddedness," *American Journal of Sociology*, Vo. 91, Issue 3, Nov. 1985, pp. 481-510.
[35] March, J., "Exploration and Exploitation in Organizational Learning," Organizational Science, Vol. 2, No, 1, Feb. 1992, pp. 71-87.
[36] Drucker, op. cit., *Post-Capitalist Society,* pp. 85.
[37] Romzek, B., "Dynamics of Public Sector Accountability in an Era of Reform," *International Review of Administrative Sciences,* vol. 66, March 2000, pp. 19-42.
[38] Romzek, B., Dubnick, M. "Accountability in the Public Sector: Lessons from the Challenger Tragedy," *Public Administration Review*, May/June, vol. 47, no. 3., 1987, pp. 227-238.
[39] Romzek. Ibid.
[40] Huntington, S., *Political Order in Changing Societies,* Yale University, 1968, p. 87.
[41] Granouetter, loc. cit.
[42] Cheung-Judge, M, Holbeche, L., *Organizational Development: A Practitioner's Guide for OD and HR,* CIP Group, London, UK, 2015, p. 318.
[43] Fukuyama, F. (*Political Order and Political Decay from the Industrial Revolution to the Globalization of Democracy.)* loc. cit. p. 169.