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The Architectures Collaborative Systems Excellence

The Engineering Professional of the 21st Century

Executive Summary



The Collaborative Shift is, in its essence, a Paradigm Shift requiring “Systems Architecture” to fuel and sustain it.

Vision for the Engineer of 2020

Powerful forces in global business are driving the need for far greater collaboration within all types of organizations. But there is a massive chasm between the level of collaboration needed to be successful and the engineering educational system’s capability to deliver what’s required.

The National Academy of Engineering (NAE), recognizing the Engineering Profession of the 21st century will be dramatically different from the last century, has identified key areas where new thinking and new skills will be required to keep up with the times. (We call this the “Collaborative Shift”)

- **Adapting to Change:** “Most importantly, can the engineering profession play a role in shaping its own future? How can engineers be educated to be leaders, able to balance the gains afforded by new technologies ... without compromising the well-being of society and humanity preparing citizens for a broad range of creative career opportunities?”
- **Leveraging Inter-Disciplinary Interaction:** “The challenge is to ensure core knowledge advances in technology [along with similar advances in cross functional integration] can to achieve inter-disciplinary solutions... Innovation is the key and engineering is essential to this task; but will only contribute to success if able to continue to adapt and educate the next generation of students armed with tools needed for the world as it will be, not as it is today.”
- **Systems Perspective:** “[Rapid technological advances] have spawned new micro-disciplines within engineering increasingly requiring a systems perspective.... based on the principle that structured [socio-technical] methodologies can be used to integrate [diverse] components and technologies. ... The systems perspective ... looks to achieve synergy and harmony among diverse components of a larger scheme... requiring new ways of doing engineering.”

Collaborative Excellence – the Engineering Game Changer

- **Working in Inter-Disciplinary Teams:** “Because of increasing complexity and scale of systems-based engineering problems, there is a growing need to pursue collaborations with multi-disciplinary teams of experts across multiple fields.... Flexibility, receptiveness to change, and mutual respect are essential. ...These challenges will continue to grow in importance as systems engineering becomes more pervasive.”
- **Complexity:** “Engineers must ... incorporate [socio-technical] elements into a comprehensive systems analysis of their work. This changing landscape for engineering is not just a narrow technical challenge... the landscape and constraints that will characterize the way the challenge is addressed [will determine] how and why engineers approach problems.”
- **Continuous Learning:** “It is imperative that engineers become life-long learners ..., not only because technology will change quickly, but also because the career trajectories of engineers will take on many more directions.....”

The Paradigm Must Shift

This vision from nearly 15 years ago has yet to be fulfilled – it is long overdue.

- But why has the shift taken so long to materialize?
- What can be done by leading edge universities to accelerate the collaborative?
- Is today’s approach to Engineering Education is running headstrong with legacy thinking?

What’s been Missing? We have missed one fundamental point:

NAE’s Vision of the 21st Century Engineer has been ephemeral because it is a **Paradigm Shift** requiring a new **unifying systems design architecture** for implementation – thus **requiring new mind-sets and new frames of reference** to empower massive networks of interaction – neither engineering nor business schools possess this kind of concentration. Simply injecting *another course* into the curriculum is grossly insufficient because this doesn’t fix the deficiency of a foundational Systems Architecture to transform thinking and culture.

This paper outlines the design systems architecture to achieve the Collaborative Shift.

***The Engineering Profession is positioned to be the “lead arrow”
aiming at a bold new future by harnessing the Power of Collaborative Systems Excellence.***

What’s been blocking? Here are some of the obstacles preventing/retarding the *collaborative shift*:

- **Misconceptions & Misguidance:** Too many leaders are guided by fallacious *adversarial* myths like “survival of the fittest.” In reality, *collaboration* is by far the most effective means of addressing complexity and connectivity. While *adversarial* interaction makes good drama, it seldom produces systems integration, innovation, teamwork, and value creation.
- **Trapped in Three Muddled Cultures:** Fundamentally, there are three archetypal modes of thinking: *adversarial*, *transactional*, and *collaborative* – which have become muddled, convoluted, and juxtaposed – obfuscating and diminishing the real value produced by collaboration.
- **Beyond Management:** Even when engineers earn their MBA, they soon realize their managerial skills neither catalyze nor sustain change. In the future, Engineering Professionals must act as “systems architects” capable of designing the future and leaders who can orchestrate change.
- **Beyond Best Practices:** While practices are useful component in business, they can be deceptively alluring, seeming to provide a pathway of improvement, yet giving a very incomplete framework for senior engineers to understand, communicate and implement real systematic growth.



Into this vacuum engineering professionals are thrust into a conglomeration of intermingled conflicting models, counter-productive operational processes and a muddled morass of cultural dynamics, which in turn produce enormous amounts of “friction,” manifesting as silos, sluggish performance, non-value added work, misaligned processes, poor innovation, and frustrating human aggravation. With no guiding cognizance or practical solutions, engineers either change jobs, remain unhappy, or retire.

This is the resulting condition from training engineers to be expert technicians with limited ability to change the human side of the equation.

Thomas Edison, the master of innovation and invention, warned that the “dynamos of our technology were terribly out of alignment and balance with our equally important dynamos of humanity.” That was the greatest challenge of the post WWI era. Now, ninety years after his warning, the problem is only worse. We must change this imbalance and misalignment.



The Challenge and Opportunity for Engineering Schools

It’s time for Engineering Schools to seize the opportunity and provide leadership. Without a reevaluation of the ever-diverging gap between technology and humanity, engineers will only become more anxiety-ridden about their role in society and their failure to be accepted as worthy contributors to a bright future.

What’s needed is a simple but robust architecture that frames collaborative excellence to engage and energize people and trigger a quantum leap forward, while simultaneously converting the new architecture into productive, measurable actions. Here are the essential core frameworks what will trigger the collaborative systems leap:



Six Core Architectures (Frameworks) that will Power the Collaborative Systems Shift



1. Human Behavior & Trust
2. Collaborative Culture, Spirit, & Teamwork
3. Collaborative Innovation & Diversity
4. Value Creation (economics) & Collaborative Advantage
5. Collaborative Leadership & Alignment
6. Complexity, Connectivity, & Synergy

Value Proposition

Each of the Six Frameworks, through the “triumph of small numbers,” produces at least a 3%-5% advantage, which accrues to 25% or more, generating an extraordinary competitive advantage in terms of speed, innovation, productivity, and profitability.



Role of Engineering Education

There are two target learning groups for Collaborative Systems Excellence:

- Undergraduate and Graduate Students training to become Engineers
- Senior Engineers in the field needing to upgrade their capabilities.

The first group can be trained by case studies and practicums, while the second group will require an Executive Education adult learning methodology using advanced *Immersive Learning Experiences* to *imbed the new architecture deeply into the corporate culture* to make new ideas stick,

Road to the Future

Collaborative Systems Excellence is an idea whose time has come. The National Academy has outlined the vision, scope, and compelling rationale to create a bold new future for engineering.

***Does the Profession have the energy and commitment to lead the Collaborative Systems Shift?
The Course of Destiny lies with those who will seize the moment!***