Industrial and Business Systems for Smart Cities

Ben Amaba

PhD, PE, CPIM®, LEED® AP BD+C

IBM Corporation Worldwide Executive, Miami, Florida USA

baamaba@us.ibm.com

ABSTRACT

To truly develop Smart Cities a combination of multi-media, human factors, and user-centered systems methodology and design principles will have to be applied. Large capital projects and development of Smart Cities could turn to the use of cloud, analytics, mobile, social and security solutions, which could change the outcomes of economic investments and employment opportunities. In addition, the 'Internet of Things', the interconnection of sensors, devices, and everyday objects, requires a standard platform and 'battle-tested' framework for the next generation of Smart Cities. Improved productivity, asset health, profitability, quality, employee safety, and environmental impact are the desired outcomes. Capitalizing on technology to deliver positive results and preventing 'black swan' events or accidents is a complex puzzle. Legacy infrastructure adopting new technologies, gaps in the workforce, regulatory guidelines, safety performance criteria, unexpected risks, and political challenges can add to the complexity and difficulty. We are finding ourselves in a dilemma where detailed specifications, changes and relationships among key elements in the market are needed but still are ambiguous, changing, and untraceable. In order to be successful, critical best practices in process, requirements, engineering, and risk modeling using interdisciplinary engineering practices could enable successful and rapid transformation. In response to these increasing challenges; governments, academics and industry are increasingly leveraging the systems and software engineering best practices developed in fail-safe industries such as nuclear power, aerospace, defense and capital intensive heavy industries, to aid in optimally balancing competing interests and dealing with increased complexity to deliver results. The presentation will introduce "Systems Thinking", "Continuous Engineering" and "Internet of Things" concepts and technologies to describe how they can be successfully leveraged in the transformation to Smart Cities.

This presentation shows the need and importance of combining different points of view coming from different disciplines. This way of thinking is crucial to many areas, going beyond the Web and will in time lead to a new genre of computational social sciences that transcend specific applications. Systems Thinking or Systems Engineering differs from downstream engineering disciplines in that the outcomes for downstream engineering are implementations, while the outcomes for systems engineering are specification and governance. Systems engineering is a hybrid engineering discipline focused on the characterization of system properties, such as requirements, design, analysis, and process governance. The primary activities of systems engineering include: Identification of customer needs, Promoting engineering collaboration, Continuous validation and verification, Strategic knowledge reuse, and Systems governance throughout the life cycle

The Systems Thinking process described provides an integrated set of state-of-the-art best practices for engineering complex systems. These best practices have matured in industries concerned with the design, construction and operation of complex, safety critical systems in highly regulated environments, yet are applicable in almost any system today. These best practices may be most productively implemented with a robust technology platform to improve quality, improve overall system safety, lower development and delivery costs, and improve delivery predictability through the creation of reusable assets such as processes, requirements, inspection lists, models, patterns, and test. The approach and platform to be presented is arguably applicable for Smart Cities and has been tested in other safety critical industries, including aerospace, defense, nuclear, automotive and medical projects, products and programs.

Categories and Subject Descriptors
H. Information Systems H.0 GENERAL

General Terms
Human Factors, Systems, Software Engineering

Biography
Dr. Ben Amaba's expertise is in executive management, strategic planning, operations, and engineering. He is responsible for manufacturing, energy, petroleum, chemical, nuclear, government and logistics industries for

systems and software engineering. Dr. Amaba is focused on Systems Thinking for the Internet of Things, the interconnection of sensors, devices, and everyday objects to drive economic improvements and sustainable architectures. Dr. Ben Amaba holds a PhD. degree in Industrial & Systems Engineering from the University of Miami in Miami, Florida; a M.B.A./M.S. degree in Engineering and Operations, and a B.S. degree in Electrical Engineering from Christian Brothers University in Memphis, Tennessee. Dr. Amaba is a registered and licensed Professional Engineer with International Registry; certified in Production, Operations, and Inventory Management by APICS ®; LEED® Accredited Professional (Leadership in Energy & Environmental Design); and certified in Corporate Strategy by Massachusetts Institute of Technology in Cambridge, Massachusetts. Dr. Amaba holds positions as Executive Board Member of Applied Human Factors and Ergonomics (AHFE), Founding member to the Institute of Advanced Systems Engineering, Founding member to the Center of Advanced Supply Chain Management, Board member of the Florida Energy Systems Consortium (FESC), member for Citizens for Clean Energy, Editorial Board of The Open Cybernetics and Systemics Journal, and Executive Advisory Board Member to the University of Miami and University of Central Florida. Dr. Amaba holds a copyright for Process Activity Flow Framework®, for requirements, design, architecture, simulation, and application development techniques. Dr. Amaba is prominently featured in "Giving 2.0," by Laura Arrillaga-Andreessen, which details contributions to bolster and promote STEM education and careers, and is an Alexis de Tocqueville Society/United Way Member, which recognizes local philanthropic leaders.

References

[1] K. Söderholm, B. Amaba, S. Bergqvist, P. Lusardi, J. Tuunanen, "Licensing Process Characteristics of Small Modular Reactors and Spent Nuclear Fuel Repository.", Nuclear Engineering and Design, Elsevier Science 2014.

[2] P. Fechtelkotter, G. Bleakley, B. Douglass, B. Amaba, "Model-Driven Development for Safety-Critical Projects in Intelligent Energy." Society of Petroleum Engineers 2013, Dubai, United Arab Emirates, October 2013.

[3] K. Söderholm, J. Tuunanen, S. Bergqvist, B. Amaba, P. Lusardi, "SMR Licensing Process Characteristics Compared with Final Repository Licensing." American Nuclear Society 2013, Helsinki, Finland, October 2013.

[4] T. Ahram, W. Karwowski, B. Amaba, "Building Sustainable Human-Centered Complex Systems." 48ème congrès international. Société d'Ergonomie de Langue Française. Paris, France 2013.

[5] T. Ahram, W. Karwowski, B. Amaba, A. Soyler, "Applications of Systems Engineering for Workforce Skills and Performance Improvement in Service Industry – Case Study Based on the IBM Rational Software Platform." INNOVATE 2013, Orlando, FL, June 2013.

[6] T. Ahram, W. Karwowski, B. Amaba, "A Complex Adaptive System-of-Systems Engineering Approach to Leadership and Innovation: Sustainable STEM Education and Workforce Development through the Smart Cities Initiative." World Congress on Engineering Education (WCEE), Doha, Qatar, January 2013.