MIT Industrial Liaison Program Faculty Knowledgebase Report

Digital Twins

December 7, 2023 11:00 am - 1:10 pm

11:00 AM

Welcome & Introduction
Yuri Ramos

Program Director, MIT Industrial Liaison Program

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Yuri Ramos brings 20 years of international experience, having worked with Information Technology for multinational companies in his native Brazil, throughout South America and in the United States. Before MIT, Yuri was with Santander Bank N.A., where he first worked as a Sr. Manager for online and mobile initiatives, and then as Chief of Staff for the CIO of Digital Channels.

Prior to Santander, Yuri was the co-founder and CEO of 2 startups in the EdTech space. In both endeavors he was responsible for strategy, business development and operations. Before this entrepreneurial period, Yuri held positions at Universo Online – Brazil's largest Internet portal - as Director of Operations and Senior Manager; at ACISION as Engineering Manager (Latin America Operations) and Senior Project Manager; and at Nortel Networks as Project Manager.

Yuri earned his Bachelor's degree in Mathematics at the University of Brasilia, and his MBA at MIT where he was a Sloan Fellow.

11:05 AM

Model Enabled Manufacturing and Practical Application
Brian W Anthony

Principal Research Scientist, Department of Mechanical Engineering
Associate Director, MIT.nano
Director of Technical Operations, Center for Clinical and Translational Research

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Dr. Brian Anthony is a leading expert in the design of intelligent, or smart, instruments and methodologies for monitoring, measuring, and controlling complex physical systems. His interdisciplinary work spans mechanical, electrical, and optical engineering, seamlessly integrated with computer science and optimization, to deliver innovative solutions across manufacturing, healthcare, and other industries.

At the core of Dr. Anthony's research is computational instrumentation—the development of advanced tools and techniques to observe and manage intricate systems, particularly in manufacturing and medical diagnostics. His contributions include pioneering measurement and imaging technologies that enhance precision and performance in both industrial and clinical settings.

With over 30 years of experience, Dr. Anthony combines deep academic insight with practical industry expertise in technology innovation, product development, and entrepreneurship. He has successfully guided market-driven solutions from concept to commercialization, especially at the intersection of information technology and advanced manufacturing. His achievements include receiving an Emmy Award from the Academy of Television Arts and Sciences for technical innovation in broadcast engineering.

In the classroom, Dr. Anthony is dedicated to teaching the modeling and analysis of large-scale systems to support decision-making in domains such as manufacturing, medicine, and entertainment. He also leads efforts in developing optimization algorithms and software tools for system design and evaluation.

Dr. Anthony's dual roles in academia and industry position him as a bridge between cutting-edge research and real-world application, driving impactful technologies that shape the future of engineering and innovation.

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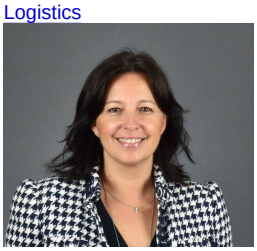
Amid a digital technology boom and a dynamic global market landscape, the manufacturing landscape is poised for a transformation from automated to autonomous operations. This evolution promises more adaptable flow chains, expediting the transition from conceptualization to commercially viable products. The key to unlocking this potential lies in the seamless integration of digital technologies - comprising sensors, data, computation, and information.

To fully realize the capabilities of digitally native production systems, characterized by high-value and customized products, a comprehensive framework of digital twins (aka models) is indispensable. These digital replicas extend beyond the product itself, encompassing materials, manufacturing processes, supply chains, and production lines. This integrated approach facilitates efficient simulations and harnesses sensor data for robust data analytics.

In essence, digital twins are sophisticated models grounded in both physics and data. They serve as invaluable design and decision-making tools in the realm of manufacturing. To demystify their complexity, it's essential to recognize them as tools that blend the physical and the digital, providing a bridge between conceptualization and realization. We'll delve into concrete examples that illuminate the practical applications, achievable now, of these transformative digital companions.

11:30 AM

Unlocking the Potential of Digital Twins in Supply Chains
Maria Jesus Saenz
Executive Director, MIT SCM Blended Master's Program
Director, MIT Digital Supply Chain Transformation, MIT Center for Transportation and Logistics



Maria Jesus Saenz
Executive Director, MIT SCM Blended Master's Program
Director, MIT Digital Supply Chain Transformation
MIT Center for Transportation and Logistics

Dr. Maria Jesus Saenz is the Director of the research area on Digital Supply Chain Transformation at the MIT Center for Transportation and Logistics, as Research Scientist. The primary research examines new collaborative paradigms that arise while implementing different new digital technologies in supply chains. Our research domains are multidimensional collaboration, digital supply chain capabilities and AI in supply chains. We apply quantitative research methodologies in order to assess how data-driven ecosystems create value.

Dr. Saenz also serves as the Executive Director of the MIT Supply Chain Management Blended Masters Program, an elite MIT degree that allows learners to combine the MITx MicroMasters credential with one+ semester at MIT.

Dr. Saenz teaches various courses at the Master, Ph.D., and Executive Education levels on Digital Transformation, Supply Chain Management, Collaboration, Risks, Resilience, and Project Management. Regarding her education, Dr. Saenz is certified in Participant Centered Learning by Harvard Business School. She received Cum Laude and the Outstanding Doctoral Award for her Ph.D. in Manufacturing and Design Engineering from the University of Zaragoza, where she previously obtained her M.Sc. in Industrial Engineering while she also studied Mathematics Sciences for several years. In 2003, she received her tenure as Associate Professor in the School of Engineering at the University of Zaragoza. In 2004, she joined the newly-formed research institute MIT Zaragoza Logistics Center as Professor, and she has also served the Center as its Executive Director. She was also the Director of the Spanish Center of Excellence in Logistics. Dr. Saenz has also led various international research projects for the European Commission, as well as for companies on Supply Chain Management innovation, such as P&G, Carrefour, Clariant, Dell, DHL, Leroy Merlin, and Caterpillar. She is a co-author of more than 80 publications, including books and articles in leading international Journals. Her knowledge transfer work has received 15 awards, and her research was cited in the media, including MIT Sloan Management Review, Forbes, Financial Times Press, and Supply Chain Management Review. She also regularly interacts with business leaders in more than 15 countries.

Digital twin technology has been adopted across many industries and become more accessible and affordable, yet it remains underutilized in supply chain management. This is partly explained by the complex nature of supply chains themselves and partly due to misunderstandings about the technology's applications, capabilities, and potential value.

In this webinar, Professor Saenz will present the research work of the MIT Digital Supply Chain Lab, discussing how, with a proper adoption and implementation strategy, digital twins can deliver immense benefits across a wide range of supply chains. As companies optimize a wide range of end-to-end supply chain functions with digital twins, the technology's immense potential is gaining further recognition.

11:55 AM

Navy Digital Twin for Operational Availability

Michael Robert
Technical Program Manager
Naval Surface Warfare Center, Carderock Division, U.S.Navy

Dr. Michael Robert will provide insight into how NSWC has been applying the principles of Digital Twins for capability developments that can increase platform operational availability.

12:15 PM

Electrical Digital Twin: Unlocking Safety, Sustainability, and Efficiency in a Connected World

Phanney Kim Brevard
Chief Strategy Officer & CIO
ETAP (a Schneider Electric Company)

Just as mobility has undergone a transformative journey with the rise of digital technologies, the Electrical Digital Twin is set to redefine how we approach safety, sustainability, and efficiency for electrical systems. In this webinar, Phanney Kim Brevard will leverage parallels between mobility and the electrical digital twin to guide you through its impact on the electrical world and its potential for proactive maintenance, intelligent energy management, and seamless integration within the digital ecosystem.

12:35 PM

Yorinde Lokin
Growth Manager for the Americas Region
Kongsberg Digital

Megatrends like the energy trilemma and new technologies drive the need to change the way the heavy asset industry works today. The future of digital twins is bright, and a rapidly increasing number of companies are moving away from traditional point tool solutions or visualization tools to an all-encompassing single work surface. In this webinar, Yorinde Lokin will present how digital twins can maximize value and minimize risk and environmental impact throughout each stage of the heavy asset lifecycle.

12:55 PM

Digital Twins: From KPIs to KPAIs
Michael Schrage
Research Fellow, MIT Initiative on the Digital Economy, MIT Sloan School of Management

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Research Fellow, MIT Initiative on the Digital Economy
MIT Sloan School of Management

Michael Schrage is a research fellow with the MIT Sloan School of Management's Initiative on the Digital Economy. His research, writing, and advisory work focuses on the behavioral economics of models, prototypes, and metrics as strategic resources for managing innovation risk and opportunity. He is author of the award-winning book The Innovator's Hypothesis (*MIT Press*, 2014), Who Do You Want Your Customers to Become? (*Harvard Business Review Press*, 2012), and Serious Play (*Harvard Business Review Press*, 2000). His latest book, Recommendation Engines, was published in September 2020 by *MIT Press* as part of its Essential Knowledge series. He's done consulting and advisory work for Microsoft, Procter & Gamble, British Telecom, BP, Siemens, Embraer, Google, iRise, the Office of Net Assessment, and other organizations

Schrage has run design workshops and executive education programs on innovation, experimentation, and strategic measurement for organizations all over the world and is currently pioneering work in selvesware technologies designed to augment aspects, attributes, and talents of productive individuals. He is particularly interested in the future co-evolution of expertise, advice, and human agency as technologies become smarter than the people using them.

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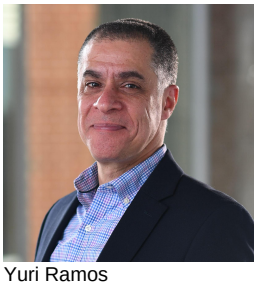
Drawing on recent research in strategic measurement, predictive analytics, and generative AI, these remarks briefly review preliminary findings and best practices around how digital twins help KPIs become KPAIs.

1:10 PM

Closing Remarks and Adjournment
Yuri Ramos

Program Director, MIT Industrial Liaison Program



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