

Transcending Boundaries: Igniting SE Innovation Worldwide

A Rapid Immersion into Systems Thinking: Part 3 Reflections on INCOSE International Workshop 2024



PPI SyEN

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www.ppi-int.com

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PPI SyEN (PPI Systems Engineering Newsjournal) is published monthly.

Archived editions and subscriptions to future editions are available for free at: https://www.ppi-int.com/syennewsjournal/

WELCOME

Dear PPI SyEN Readers,

Welcome to the February 2024 edition of the PPI Systems Engineering Newsjournal (SyEN). As the editor, I am excited to present another insightful collection of articles, news updates, and resources from the world of systems engineering.

In this edition, we bring you a diverse range of topics that reflect the thriving status of the systems engineering field. From celebrating the achievements of outstanding professionals in the INCOSE Awards & Recognition Yearbook 2023 to exploring the latest advancements in system dynamics with the System Dynamics Society 2024 Leadership Updates, there is much to anticipate in terms of progress with societies, new SE publications, tools updates, and more. Additionally, our conference, webinar, and meeting highlights offer valuable opportunities for learning and networking in the realms of digital transformation, human systems, requirements engineering, and many others!

In the Feature Article section, John Fitch continues with the third installment of the reader-favorite series, 'A Rapid Immersion in Systems Thinking'. John builds on his reflections. In the second article, I share some reflections from the recent INCOSE Workshop and will be following this article with more detailed, topic-specific reflections in upcoming editions of PPI SyEN.

As always, our Systems Engineering Resources section is packed with valuable tools, publications, and learning resources to support your professional development journey. Whether you're a seasoned practitioner or just starting out in the field, there's something here to inspire and inform.

Finally, don't miss our SyENNA Spotlight feature on a systems engineering analysis of a hip replacement system, showcasing realworld applications of systems engineering principles in healthcare. We hope you enjoy reading this edition of SyEN and find it both informative and engaging. As always, we welcome your feedback, suggestions, and contributions for future editions.

Warm regards,



Managing Editor (on behalf of the Editorial Team)

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Views expressed in externally authored articles are not necessarily the views of PPI nor of its professional staff.

START A NEW CHAPTER IN YOUR CAREER?

Already an outstanding SE professional? Ready for a career and lifestyle change?

Project Performance International (PPI) seeks top-notch SE Professionals worldwide to meet the skyrocketing demand for our training and consulting. Opportunities exist for online and in-person delivery in most regions. A rigorous qualification process applies; this itself is career-boosting.

There are opportunities to join our team through one of three engagement models:

- o full-time employment
- part-time employment
- independent contractor, perhaps with your own trading entity, with exclusivity to PPI for SE-related training, otherwise free to consult independently.

Interested? managingdirector@ppi-int.com

PPI Systems Engineering Newsjournal (PPI SyEN) seeks:

- To advance the practice and perceived value of systems engineering across a broad range of activities, responsibilities, and job-descriptions
- > To influence the field of systems engineering from an independent perspective
- To provide information, tools, techniques, and other value to a wide spectrum of practitioners, from the experienced, to the newcomer, to the curious
- To emphasize that systems engineering exists within the context of (and should be contributory toward) larger social/enterprise systems, not just an end within itself
- To give back to the Systems Engineering community

February 2024

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PPI defines systems engineering as:

an approach to the engineering of systems, based on systems thinking, that aims to transform a need for a solution into an actual solution that meets imperatives and maximizes effectiveness on a whole-of-life basis, in accordance with the values of the stakeholders whom the solution is to serve. Systems engineering embraces both technical and management dimensions of problem definition and problem solving.

Recent events and updates in the field of systems engineering

INCOSE Awards & Recognition Yearbook 2023



INCOSE has announced the publication of the 2023 Awards and Recognition Yearbook. This yearbook showcases INCOSE's volunteers who have gone above and beyond to further the awareness and implementation of Systems Engineering.

The yearbook recognizes the recipients of the following awards:

- INCOSE Fellows
- Chapter Awards
- INCOSE Pioneer Award
- INCOSE Founder's Award
- Systems Engineering Influencer Award
- Outstanding Service Awards
- Systems Engineering Journal Outstanding Paper Awards

Download the 2023 Yearbook.

• System Dynamics Society 2024 Leadership Updates



The System Dynamics Society (SDS) has announced 2024 updates to the Society's leadership team. Noteworthy changes include:

- <u>Allyson Beall King</u> takes over as President in 2024 from Brad Morrison. King brings leadership experience as director of the Washington State University School of the Environment.
- <u>Inge Bleijenbergh</u> assumes the role as Vice President of Memberships for the Society, complementing her work as professor in Action Research at Radboud University.
- <u>Bob Eberlein</u>, a founding member of SDS and contributor to the development of system dynamics modeling software (Vensim and Stella Architect), will serve as Vice President of Publications.
- <u>Cleotilde (Coty) Gonzalez</u> will join the SDS Policy Council, leveraging her insights as Research Professor at Carnegie Mellon University and director of the <u>Dynamic Decision Making</u> <u>Laboratory</u>.
- Hazhir Rahmandad, professor at the MIT Sloan School of Management will also join the Policy Council, bringing expertise in organizational dynamics and public health.

See the full SDS 2024 leadership announcement.

Data Distribution Service (DDS) 20th Year Anniversary



The Object Management Group® (OMG®) <u>Data Distribution Service (DDS)</u> is a proven data connectivity (middleware protocol and API) standard for the Industrial Internet of Things (IIoT). It integrates the components of a system together, providing low-latency data connectivity, extreme reliability, and a scalable architecture that business and mission-critical Internet of Things (IOT) applications need.

The <u>DDS Foundation</u>, launched by the OMG, exists to drive the adoption, interoperability and success of DDS. The Foundation governs a global community of vendors, users, government institutions and universities to realize the potential of the DDS standard in all industries.

To commemorate the 20th anniversary of the DDS, the Foundation is running a year-long celebration to highlight the 14 specifications in the DDS standard, along with selected real-world use cases.

The first presentation in this series, *DDS, the US Navy, and the Need for Distributed Software*, took place on 18 January. Access the video <u>here</u>.

Join the DDS Foundation Mailing List to be notified of upcoming DDS anniversary events.

Access DDS resources including the online DDS Guidebook.

View and search for previous and upcoming OMG presentations here.

INCOSE Guide to Writing Requirements (GtWR) referenced in Automotive SPICE

Automotive SPICE (ASPICE) is a maturity model for the automotive industry, promoted by the <u>German</u> <u>Association of the Automotive Industry (VDA).</u> The latest version (4.0) of ASPICE, including both a process reference model and process assessment model, was released on 29 November 2023. Download ASPICE 4.0 here.



ASPICE Version 4.0 has referenced the INCOSE Guide to Writing Requirements (GtWR) as a source for defining the characteristics of well-formed system, software and hardware requirements. Such characteristics, as noted in the GtWR and common to other referenced standards, include verifiability, unambiguity, freedom from design and not contradicting other requirements.

Version 4.0 of the GtWR is available in the INCOSE Store.

PPI SyEN congratulates the <u>INCOSE Requirements Working Group</u> on its contribution to development process maturity in the automotive industry.

More information concerning the GtWR are available on the INCOSE RWG YouTube channel.

GENESYS 2023 R2 Release

GENESYS is Zuken Vitech's flagship MBSE software. The company has announced the release of

GENESYS 2023 R2, highlighting two significant capability updates:

- Enhanced ability to manage and visualize data via *Matrix Views*: The Matrix Views feature allows a user to take advantage of customized visual representations of how entities are related within a specified class and scope. This capability provides a visual indication of the completeness of a system design and uncovers gap in the system model.
- Strengthened workflow to digital thread broker *SBE Vision*: SBE Vision is a digital engineering threading tool. The R2 software allows the round-tripping of data between associated projects in other MBSE tools. This streamlines the synchronization and refresh workflow with the SBE Vision Adapter, while also improving performance.

For additional details, see <u>What's New in GENESYS 2023 R2.</u>

A series of articles titled "Unveiling Table Views in GENESYS 2023: A Comprehensive Guide" has also been recently posted to the <u>SYSTEMS-WISE.COM</u> blog. These articles explain ways to exploit the Table Views capability in GENESYS to support various systems engineering tasks:

- Part 1: Requirements Management Activities
- Part II: System Architecture Activities
- Part III: Managing Risks and Concerns Using Table Views

In August 2023, Vitech announced the end-of-life plans for its original CORE MBSE tool, which was first introduced in 1993. Learn more about the migration from CORE to GENESYS <u>here</u>. Investigate <u>Zuken Vitech's products and services</u>.

Engineers Australia: The Engineering Profession - A Statistical Overview

The Engineering Profession: A statistical overview



Engineers Australia has released the 15th edition of its flagship report, *The Engineering Profession: A Statistical Overview*. The report is generated every five years after the release of Australian census data to make available important facts and

figures concerning the engineering workforce in Australia.

Based on 2021 census data, this version of the report is accompanied by an interactive dashboard that allows anyone to explore the engineering workforce across Australia by multiple factors, e.g., industry/sector, occupation, location, etc.

Access the report and interactive dashboard <u>here</u>.

See the <u>LinkedIn announcement</u> of this report for more details.

Follow Engineers Australia on LinkedIn.

SE Tools Database (SETDB) Updates



The Systems Engineering Tools Database (SETDB), developed by PPI in partnership with INCOSE, provides a virtual platform for engineering tool vendors to communicate their offerings.

Recent SETDB updates, including both new tools and updates to existing tools, include:

Vendor: <u>AUTOSAR</u>

- <u>Foundation</u>: The purpose of the Foundation standard is to enforce interoperability between the AUTOSAR platforms. Foundation contains common requirements and technical specifications (for example protocols) shared between the AUTOSAR platforms.
- Standards: The AUTOSAR layered architecture is offering all the mechanisms needed for software and hardware independence. It distinguishes between three main software layers which run on a Microcontroller (μC): application layer, runtime environment (RTE), and basic software (BSW).
- Classic Platform: The AUTOSAR Classic Platform architecture distinguishes on the highest abstraction level between three software layers which run on a microcontroller: application, runtime environment (RTE) and basic software (BSW).
- <u>Adaptive Platform</u>: Implements the AUTOSAR Runtime for Adaptive Applications (ARA). Two types of interfaces are available, services and APIs. The platform consists of functional clusters which are grouped in services and the Adaptive AUTOSAR Basis.
- Application Interface: AUTOSAR standardized a large set of application interfaces in terms of syntax and semantics for the vehicle domains. The application interfaces are released as a subset of the classic platform release.

Vendor: Frontline Systems, Inc.

• <u>Analytic Solver®</u>: The built-in Solver Engines included with Analytic Solver can handle problems with thousands of variables and constraints and offer great performance at no extra cost.

Vendor: <u>Hexagon AB</u>

- <u>ADAMS</u>: Helps engineers to study the dynamics of moving parts, and how loads and forces are distributed throughout mechanical systems.
- Intergraph Smart® 3D: Provides all capabilities needed to design facilities and then maintain their 3D "as-built" representations for downstream uses in the lifecycle. It is specifically designed to deliver mission-critical project requirements and provides all the capabilities to design and maintain facilities.

Vendor: IncQuery Group

- IncQuery Desktop: Add-on to CATIA No Magic MagicDraw / Cameo Systems Modeler that lets you write and evaluate structured model queries right inside the SysML environment.
- <u>IncQuery AUTOSAR UML Bridge</u>: Ultimate solution for Assisted Documentation Creation and Automated Handover. It can streamline your automotive engineering workflow by generating high-quality UML models from AUTOSAR projects, with built-in ISO26262 and ASPICE compliance.
- <u>IncQuery Validator for Teamwork Cloud & Enterprise Architect:</u> Devops-ready solutions that provide automated model quality reports based on a CI/CD pipeline, powered by standard and custom rules.

- MatLab®: Programming and numeric computing platform used by engineers and scientists to analyze data, develop algorithms, and create models. MATLAB integrates with Simulink for model based design, multiple domain simulation, code generation and test and verification of embedded systems.
- <u>Statistics and Machine Learning Toolbox</u>: Provides functions and apps to describe, analyze, and model data. You can use descriptive statistics, visualizations, and clustering for exploratory data analysis; fit probability distributions to data; generate random numbers for Monte Carlo simulations, etc.

Vendor: Obeo

• <u>Eclipse SysON</u>: The Eclipse SysON project provides an open-source web-based tooling to edit SysML v2 models. It includes a set of editors (graphical, textual, form-based, etc.) enabling users to build the various parts of system models.

Vendor: Process Street

• Process Street: Process and AI powered workflow management solution intended for teams to create, manage, and follow step-by-step process workflows. It automates repetitive tasks using generative AI and built-in integration tools to reduce manual labor and free up valuable time.

Vendor: <u>SOFTEAM</u>

• Modelio Platform: Collaborative Business or Software Modeling Platform intended for business architects to do business architecture modelling compliant to the latest version of the ArchiMate 3.2 standard with the availability of auditing rules to facilitate the detection of errors in enterprise models.

Vendor: SPEC Innovations

• <u>Innoslate</u>: Innoslate, the first web based MBSE tool, was developed by SPEC Innovations to support the entire system or product lifecycle. This cloud or on-premise application simplifies system or product development while reducing time-to-market, cost, and risk.

Vendor: <u>SpicySE</u>

• SpciySE: Enables your team by providing unmatched accessibility to the world of SE. Define system boundaries and interfaces to aid collaboration easily, develop requirements, architectures, tests etc. like never before. Everyone can participate right from the start. Never lose any great ideas again!

Vendor: Visual Paradigm

• Enterprise Architecture Tools: Set of tools that support enterprise architecture, enterprise modeling, process design and digital transformation. TOGAF, DODAF, NAF, MODAF, ArchiMate and more - All the EA tools that support enterprise architecture and digital transformation.

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- <u>Archimate Modeling Tool</u>: Create Enterprise Architectures with a certified Archimate modeling tool that enables you to create professional enterprise architecture models quickly in a collaborative environment. The Archimate Modeling Tool supports all level of architect and modeler needs using Archimate 3.1.
- <u>SysML v1 Modeling Tool</u>: Represents requirements as connected model elements that have user defined types, properties and appearance. Block diagrams, parametric diagrams, activity diagrams, sequence diagrams, state machines, use case diagrams, and package diagrams are featured.
- <u>TOGAF ADM Software</u>: Visualizes TOGAF Architecture Development Method (ADM) phases and steps as a stack of visual process maps, which helps you navigate through the entire EA process. A full set of planning, design and development tools assist with the completion of ADM activities.
- <u>Business Process Design Tool:</u> Creates and animates business process diagrams. Supports operational procedure development, As-IS and To-Be process models, RACI and CRUD charts, animation and simulation of processes and other business process support features.
- <u>Project Management Diagram Tools</u>: Comprehensive diagramming tools to plan and track your project execution. Support includes scheduling, implementation, migration, tasking, pert Charts, Work and staff planning, radar charts, mind maps, fishbone diagrams and more.

Vendor: Zuken Vitech Inc.

 GENESYS Pro: Built upon the proven Comprehensive System Design Language (CSDL), GENESYS delivers integrated support for model-based systems engineering from first concept through definition of behavior, physical architecture, and V&V delivering an effective system source of truth.

PPI SyEN readers are encouraged to check out these new and updated systems engineering tool offerings.

Access the <u>SETDB website.</u>

"

Management is directing; leadership is inspiring.

Robert Halligan

Workshop: Listening to the Voice of the Customer

The Product Development Management Association (PDMA) is sponsoring an online public workshop on 11-14 March 2024 titled "*Listening to the Voice of the Customer*". John Mitchell and Andrea Ruttenberg of <u>Applied Marketing Science</u> will introduce Voice of the Customer (VOC) market research and teach participants how to use this technique to accelerate innovation.

This course targets product developers, engineers, marketers, and managers who are responsible for product, service, and customer experience innovation in organizations large and small. The course consists of 4 half-day virtual sessions that will run from 10 AM – 2 PM EDT daily.

Expected learning outcomes include:

- How to correctly define the Voice of the Customer (VOC) and how VOC fits into the product development process.
- Successful techniques for scoping an effective VOC study.
- Strategies for choosing the right customers to interview, as well as how to structure and ask the right questions.
- Methods for analyzing customer interviews to extract customer needs.
- Quantitative methodologies to prioritize needs for product development.

Learn more and register here.

Digital Transformation Learning Opportunities



The Digital Twin Consortium (DTC) will host two learning-focused events in conjuction with the Object Management Group (OMG) quarterly Technical Meeting that will take place in Reston, Virginia, USA from 18-21 March.

Hands-on Workshops: Digital Twin Training

The DTC will host a full-day interactive digital twin training event in Reston on 18 March. Participants will have the opportunity to select two of four half-day workshops to gain hands-on experience building and working with digital twins. Workshop options include:

- Assured Digital Twins: Digital Property Compliance with Dr. David McKee, CEO, Counterpoint Technologies
- *Composing Digital Twins Benefits and Values* with Pieter Van Schalkwyk, CEO, and Gavin Green, VP Strategic Solutions, XMPro
- Tabletop Training (TTX) for Interactive Threat Scenario Management with David Shaw, CEO, Intuitus Cyber Security
- Building Digital Twins for Real-Time Analytics and Simulation with Many Data Sources with Dr. William Bain, CEO, ScaleOut Software, Inc.

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Learn more about Digital Twin Training <u>here</u>. Register <u>here</u>.

The Impact of a New Era in Digital Transformation Across Industries

This in-person conference on 21 March 2024 in Reston will showcase winning strategies for achieving digital transformation across technologies and industries.

Session topics include:

- OMG Consortia Community Value and Digital Transformation
- Augmented Reality (AR) & Digital Twins
- The Benefits and Challenges in Al
- Digital Transformation and Rol
- How to Digitally Transform
- Navigating the Interplay of 5G and XR Technologies
- Digital Twins Unveiled: Applications, Enabling Technologies, and Infrastructural Insights

Learn more and view the detailed agenda <u>here</u>. Register <u>here</u>.

Learn more about the Digital Twin Consortium here.

NDIA 2024 Human Systems Conference



The U.S. National Defense Industrial Association (NDIA) is hosting its 2024 Human Systems Conference in Arlington, Virginia, USA on 21-22 March 2024. This in-person conference will take place on the campus of George Mason University with the theme of *"Next Generation Platforms and the Evolving Role of*

the Human".

Conference Description:

As technology advances, the role of the human evolves. With these changes, it becomes ever more important to involve the end-user directly in technology design from the conception of the idea to the delivery, maintenance, and sustainment of the final product. This year's conference will feature conversations related to implementation of Human Systems Integration (HSI) within existing defense platforms, as well as an activity designed to help designers and acquisition managers keep pace with the evolving role of the human to meet user needs and minimize lifecycle costs. In addition to this discourse, we will hear from industry, Government, and academic partners about ongoing HSI work and how the evolving role of the human leads to new dynamics between warfighters and the systems they use.

The keynote speaker for the conference will be <u>Blaine Summers</u> of the Naval Air Warfare Center.

Learn more about the conference <u>here</u>. View the <u>full agenda</u>. Register <u>here</u>.

ProjectWorld * BusinessAnalystWorld Conference



The International Institute of Business Analysis[™] (IIBA®) is a professional association with over 30,000 members that helps the global business analysis community to achieve better outcomes through better analysis. IIBA® has endorsed the

ProjectWorld * BusinessAnalystWorld conference that will take place in Toronto, Ontario, Canada from 25-28 March 2024. The theme of this in-person conference is *"Future Forward"*.

Keynote talks will address topics such as:

- Building Real Connections in a Remote-First Workplace
- Invisible Leadership: Discovering the Secret Impact of Transformational Leaders
- <u>Starting From the Top: How Leaders Can Advance Equity</u>
- Pushing the RIGHT Buttons

A sample of the challenging subjects to be tackled during symposium sessions includes:

- After 2000+ projects, I have learned a thing or two
- Are you a J.E.D.I? Advancing Responsible Use of Al in the Universe
- Bamboozled! Are your Requirements Psyched Out? Using Critical Thinking for Better Decisions and Requirements
- Business Case Realization: The Goal of Mature Project Management Practice
- <u>Context Diagrams: The first and strongest go-to tool in your BA kit!</u>
- <u>Current Trends, Future Strategies for Project Teams</u>
- <u>Cybersecurity requirements-how to build them INTO your solutions</u>
- <u>Moving to Embodied Decision-Making</u>
- <u>Narrative Revolution: Elevating Product Ownership with AI-Powered User Stories and</u> <u>Acceptance Criteria</u>
- No Fumbles: Handing Off from Projects to Maintenance
- <u>Reconciling Project Management with Agile Delivery in the Enterprise</u>
- <u>Strategic Business Analysis Psychometrics</u>
- The Customer is Always. Right? Build Better Products By Understanding Customer Needs
- The Failure of Change Management and How to Fix It
- <u>Unleashing Organizational Potential: Harnessing Flow Metrics and the Project to Product</u>
 <u>Approach</u>

View the full symposium program.

Workshops will address key capabilities such as:

- 7 Powerful Analysis Techniques Up your analysis game
- Delivering Complex Projects
- <u>Strategic Decision-Making for PMs & BAs</u>
- The Who, What, When, Where, Why (and HOW!) of Requirements

Download the <u>conference brochure</u>. <u>Learn more</u> and <u>register</u>.

Learn more about <u>IIBA</u>.

Conference on Requirements Engineering: Foundation for Software Quality (REFSQ 2024)



The 30th International Working Conference on Requirements Engineering: Foundation for Software Quality (REFSQ 2024) will take place on 8-11 April 2024 in Winterthur, Switzerland. The theme of this in-person conference is *"Out of the Lab, into the Wild!"*. The REFSQ working conference is a leading European conference series on

requirements engineering. The goal of REFSQ is to foster the creation of a strong European Requirements Engineering (RE) community across industry and academia.

Keynotes for REFSQ 2024 will include:

- Equitable Privacy: Understanding Privacy Requirements of Marginalised and Vulnerable Populations (Awais Rashid, Professor of Cyber Security, University of Bristol)
- Sustainable Software or Sustainable Business Models (Lorenz M. Hilty, Professor of Informatics and Sustainability, University of Zurich)
- Unlock revenue by understanding your users: industry practices and pitfalls revealed (rina Koitz, computer scientist and digital product innovator, Director Product Data, Kenvue)

This multi-track conference will address a wide range of relevant topics. A sample of the content accepted per track is shown below:

<u>Research Track</u>

- Candidate Solutions for Defining Explainability Requirements of AI Systems
- Exploring LLMs' ability to detect variability in requirements
- Learning to Rank Privacy Design Patterns: A Semantic Approach to Meeting Privacy Requirements
- Requirements Engineering for No-Code Development (RE4NCD): A Case Study of Rapid Application Development during War
- Towards a Comprehensive Ontology for Requirements Engineering for AI-powered Systems

<u>Workshops</u>

- <u>11th International Workshop on Creativity in Requirements Engineering (CreaRE'24) at</u> <u>REFSQ'24</u>
- <u>AgileRE workshop</u>
- <u>Green Digital Design How can modern RE of digital products contribute to more</u> <u>sustainability?</u>
- NLP4RE workshop at REFSQ 2024
- <u>RE4AI 2024: 5th International Workshop on Requirements Engineering for Artificial</u> Intelligence
- Virtues and Values in Requirements Engineering 2024 Workshop (VIVA RE'24)

Check back on the REFSQ 2024 conference website for more details on the evolving program,

particularly the <u>Industry Track, Education/Training Track</u> and <u>Doctoral Symposium.</u> <u>Register</u> for REFSQ 2024.

Prostep ivip Symposium 2024



The prostep ivip Association is an international association, in its 30th year, headquartered in Darmstadt, Germany. The association has committed itself to developing innovative approaches to solving problems and modern standards for product data management and virtual product creation.

The prostep ivip Symposium 2024 will take place in Munich, Germany, on 10-11 April 2024. The theme of the symposium is "*Digital Engineering – Ready for Seamless Collaboration*". Topics addressed during this event include:

- Digital Transformation
- Al
- Systems Engineering/MBSE
- Digital Twins
- Internet of Things
- Industry 4.0.

See conference details <u>here.</u> <u>Register</u> for prostep ivip Symposium 2024.

Learn more about prostep ivip here. Subscribe to the Association <u>newsletter</u>.

Building Business Capability 2024 Conference (bbc 2024)



The International Institute of Business Analysis[™] (IIBA®) is hosting the Building Business Capability (bbc 2024) conference in Orlando, Florida, USA from 15-19 April 2024. The theme of this in-person conference is *"Igniting Your Potential"*. The goal of the bbc 2024 conference is to enhance

participants' ability to advance People, Product, Data, and Knowledge, to build core leadership skills, to create a customer centric organization, and to deliver digital transformation.

The five-day conference will feature 7 content tracks, 20 tutorials, 108 sessions and 86 speakers to serve the anticipated 1000+ delegates.

A small sample of the presentations planned for the conference includes:

- Adventures in the Wild World of Cybersecurity by Mark Cross, Envista Consulting Limited
- Agile Transformation Simulation Game by Aaron Kopel and Steve McQueen, Project Brilliant, LLC
- Bottom-up Business Architecture: Exponential Impact on a Shoestring Budget by Amy Albus, Thomson Reuters
- Engineering the Business Experience: How Processes, Rules and Requirements Can All Work Together by Gladys S.W. Lam, Business Rule Solutions

- Fearless and Unapologetic Diagramming by Colleen Cristarella, Simmons Foods and Laura Robey, Walmart
- Surprising Things AI is Teaching Humans about Innovation by Thomas Thurston, Ducera Partners
- The Crucial Analysis Skill Unlearning by Jamie Champagne, Champagne Collaborations, LLC
- The Future of Work: Automation, Augmentation, and AI by Michael zur Muehlen, Stevens Institute of Technology

Presentations and panels will be organized into capability focused tracks:

- Building People Capability
- Building Product Capability
- Building Data Capability
- Building Knowledge Capability
- Foundational
- High-Impact Techniques
- Practitioner's Chat

These capabilities will cut across various elements of the business analysis process model aka "trails", including Business Analysis, Business Architecture, Business Design and Business Leadership.

A small sampling of the tutorials, to be delivered on April 15-16, finds topics such as:

- Becoming Nimble: Igniting the Adaptable Organization through BA by Filip Hendrickx, altershape and Fabricio Laguna, Gigante Consultoria Empresarial Ltda
- Concept Modeling: Smarter Data Design and Much More by Ronald G. Ross, Business Rule Solutions
- Decision Modeling for Digital Service Transformation by Jan Vanthienen, KU Leuven
- How to Survive and Thrive in a Digital Transformation by Kent McDonald, KBPMedia
- The Core Concepts of Business Architecture by Roger Burlton, Process Renewal Group

View and search the full program here.

<u>Learn more</u> about bbc 2024 and <u>register</u>. Learn more about <u>IIBA</u>.

Call for Abstracts: Zuken Innovation World Americas - Integrate24



Zuken Vitech has issued a Call for Abstracts for the Zuken Innovation World Americas (ZIW 2024) - Integrate24 conference to be held in Cleveland, Ohio, USA on 17-19 September 2024. ZIW 2024 will focus on the pivotal role of Digital Engineering in modern product development. As organizations face increasing product complexity and a need for streamlined development processes, digital

engineering solutions play a vital role. The combined ZIW and Integrate24 conference agenda will feature comprehensive courses on the Digital Engineering process, covering topics such as model construction, architecture optimization, and integration with detailed design, demonstrating a complete design process.

Integrate24, an international symposium for Digital Engineering, will again be co-located with ZIW, expanding the agenda to include model-based design and systems engineering topics. Attendees will have access to both conferences with a single registration.

Topics of interest fall into three tracks:

- Digital Engineering (systems engineering, model-based design, and the digital thread)
- Electrical-based system design (wire harnesses and control panel design, including manufacturing)
- Electronic-based system design (architecture optimization, PCB layout, SI/PI/EMC, ECAD/MCAD co-design, and IC packaging)

Presentations should:

- Be targeted to fit within 45-minute technical sessions.
- Be noncommercial in content and tone.
- Provide valuable insights into technology, techniques, or methodologies.

Case studies and innovative best practices are favored.

The deadline for submission of abstracts (100 words + speaker biography) is 8 March 2024.

L<u>earn more</u> about the conference. View the <u>Call for Papers.</u> Submit abstracts <u>here</u>.

Call for Papers: ACM-IEEE 27th International Conference on Model Driven Engineering Languages

MODELS, the 27th International Conference on Model-Driven Engineering Languages and Systems will be held in Linz, Austria on 22-27 September 2024. MODELS 2024 is a forum for participants to exchange cutting-edge research results and innovative practical experiences around modeling and model-driven software and systems. Sponsored by the ACM and IEEE, this year's conference provides an opportunity for the modeling community to further advance the foundations of modeling and generate innovative applications of modeling in emerging areas of cyber-physical systems, embedded systems, socio-technical systems, cloud computing, big data, machine learning, security, open source, and sustainability.



Technical track submissions for MODELS 2024 are sought in the following topic areas:

- Fundamentals of model-based engineering (MBE).
- New paradigms, formalisms, applications, approaches, frameworks, or processes for MBE.
- Definition, use, and analysis of model-based generative and re-engineering approaches.
- Model-based monitoring, analysis, and adaptation heading towards intelligent systems.
- Development of model-based systems engineering approaches and modeling-in-the-large, including interdisciplinary engineering and coordination.
- Applications of AI to model-related engineering problems.
- MBE foundations for AI-based systems (modeling for AI).
- Human and organizational factors in model-based engineering.
- Tools, meta-tools, and language workbenches for model-based engineering.
- Hybrid multi-modeling approaches.
- Evaluation and comparison of modeling languages, techniques, and tools.
- Quality assurance of models and model transformations.
- Collaborative modeling to address team management issues.
- Evolution of modeling languages and related standards.
- Modeling education.
- Modeling in software engineering.
- Modeling for specific challenges such as collaboration, scalability, security, etc.
- Modeling with, and for, novel systems and paradigms in rapidly evolving fields.
- Empirical studies on the application of model-based engineering.

View the MODELS 2024 Technical Track Call for Submissions.



MODELS 2024 will be co-located with the <u>System Analysis and Modelling (SAM 2024</u>) conference. SAM 2024 will address the most recent innovations, trends, experiences and concerns in modeling, specification, analysis, implementation, and monitoring of complex systems using ITU-T's Specification and Description Language (SDL-2010)

and Message Sequence Chart (MSC) notations, as well as related system design languages, including but not limited to UML, ASN.1, TTCN, SysML, and the User Requirements Notation (URN).

The Call for Papers for SAM 2024 is in process – interested parties are encouraged to check back for updates <u>here</u>.

Call for Presentations: NAFEMS Iberia and France Conferences

NAFEMS has issued a Call for Presentations for two of its 2024 Regional Conferences that will take place in November 2024.

NAFEMS Iberia Conference (14 November 2024 in Madrid, Spain)



The NAFEMS Iberia Conference 2024 will bring together participants from diverse organizations and industry sectors to discuss the trends, challenges, best practices, and advances in simulation and data science related to process and product design.

The conference will provide a forum to explore:

- Advanced simulation methodologies including up-front and reduced modeling.
- The role and use of Artificial Intelligence and Machine Learning.
- Digital twins and virtual manufacturing applications.

- The use of simulation for environmental benefits and sustainable engineering.
- Building confidence in simulation credibility for engineering, including Validation and advanced physical testing technologies.

View the Call for Presentations (abstracts due by 12 September).

NAFEMS France Conference (19 - 20 November 2024 in Senlis, France)



The NAFEMS France Conference will focus on simulation solutions to address the challenges of tomorrow. Digital simulation is significantly impacted by technological developments, in particular generative AI, and digital twins, by changes in the demand for personalized products, the management of complex systems, and the consideration of environmental impact, leading to the implementation of new tools, standards, data

management and organization.

Presentations are sought in topics such as:

- Biomechanics and Life Sciences
- Data and Process Management (DPM) and ALM
- Digital Twins
- Electronic and mechatronic simulation
- Fluid Dynamics (CFD) and Meshing
- Governance and democratization
- Information Technology (IT)
- Multi-scale, multi-physics analysis
- Optimization and lightening of structures
- Robust and generative design
- Simulation of manufacturing processes
- Smart factory
- Smart Grid (Energy)
- State-of-the-art technology and trends by sector or discipline
- Stochastic models
- System Simulation & Modeling
- VR and AR (Augmented Reality)

View the Call for Presentations.

A Rapid Immersion in Systems Thinking - Part 3

by John Fitch

Project Performance International

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Authored for PPI SyEN

Introduction

In the third article in this series, we transition from consideration of Systems Thinking "Habits" as presented in fifteen courses offered online by the Waters Center for Systems Thinking to System Archetypes (behavioral patterns) that are taught in a set of nine companion courses. The archetypes include:

- Fixes that Backfire
- Success to the Successful
- Limits to Growth/Success
- Escalation
- Shifting the Burden
- Drifting Goals
- Tragedy of the Commons
- Accidental Adversaries
- Repression and Revolution

In Part 1 and Part 2 of this series, we looked at the Waters Center's perspective on systems thinking and design through the "lens" of experienced systems engineering practitioners and attempted to highlight differences between the mental models of the two communities. In this article, the author hopes to map the system archetypes to systems within his experience, i.e., to restate the principles of each pattern in terms of simple, but hopefully familiar (to the readers) systems and system viewpoints. Part 3 will provide an overview of system archetype concepts and present alternate ways to visualize these scenarios. The first four on nine archetypes will be explored. A future article (Part 4) will complete the review of the archetypes and summarize key lessons from the series. Readers are reminded that these articles represent a learning "work in process", not an authoritative treatise on systems thinking or system dynamics. Experienced practitioners in these domains may say "Duh!" to the author's real-time mapping of concepts to his systems engineering experience. The author eagerly invites comments or critique that can deepen the understanding of the PPI SyEN readership. Please send such inputs to PPISyEN@PPI-Int.com.

February 2024

What is a System Archetype?

The Waters Center defines system archetypes as "*multi-loop, causal loop diagrams that represent behavior seen commonly in complex systems.*" Archetypes provide visual templates that support analysis of system behavior, tell a story about system structure (its elements and their interdependencies) and can communicate the dynamics that result from this structure. System archetypes include the following concepts and constructs:

- Causal Loop Diagram visualization of the feedback (causal relationships) within a system
- Delay time delays between cause-and-effect elements.
- Feedback Situation in which the effect of a cause ripples through the system to affect the next iteration of the cause.
- Interdependencies Relationships that express how the elements of a system affect one another.
- Leverage Recognition of where actions and changes in system structure can lead to significant improvements.
- Loop Dominance identification of causal loops that have the stronger influence on system behavior.
- System Structure The elements of a system and how these elements are organized and interrelated.

The Waters Center offers three tool-related courses that clarify how feedback is captured within causal loop diagrams:

- Tools Course #7: Causal Loop Diagrams Part 1: Reinforcing Feedback
- Tools Course #8: Causal Loop Diagrams Part 2: Balancing Feedback
- Tools Course #9: Causal Loop Diagrams Part 3: Bringing Reinforcing and Balancing Loops Together

In addition to gaining familiarity with the system archetypes, the author of this article hopes to gain further insights into the causal loop diagramming notation by mapping the Waters Center's graphical representation to the N-Squared Diagram format that is familiar to many systems engineering practitioners. For the first archetype, both visualizations will be shared and compared; the remaining archetypes will be presented in N-Squared format. Readers may view the Waters Center "originals" and download PDF templates for each archetype from within each of the archetype courses.

Archetype #1: Fixes that Backfire

The "Fixes that Backfire" scenario may exist when a short-term solution to a problem makes the problem worse in the long run. In the Waters Center's Causal Loop Diagram notation, this scenario may be visualized as:



Fixes that Backfire Archetype - Causal Loop Diagram © 2019 Waters Center for Systems Thinking

[Contents]

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The story told by this diagram may be summarized as follows:

- Problem Symptom: The actors (people or perhaps AI) involved in the situation recognize that a problem exists by its symptoms and perceive a need to act.
- An increase in the magnitude of the symptom(s), increases the urgency and perhaps scale of the fix required. This is denoted by the "s" (or "+") on the causal arrow that emerges from the Problem Symptom, where "s" implies that symptoms and fixes are positively correlated, i.e., move in the same direction. More of a symptom implies or demands more of a fix.
- Fix: A solution is implemented, but this solution may be a quick fix that reduces the symptom.
- Reducing the symptom relieves some or all of the pain that the participants in the scenario are experiencing. The "o" (or "-") on the causal arrow between the Fix and Problem Symptom implies that these elements are negatively correlated, i.e., move in opposite directions. More fix leads to fewer or less intense symptoms. The Problem Symptom -> Fix causal loop is known as a balancing loop, shown as the "B" icon.
- Unintended Consequences: After a delay (denoted by the "hash mark" or double slash symbols on the outgoing arrow), consequences emerge from the Fix. Increasing the scale of the Fix increases these consequences.
- Unintended consequences create a reinforcing feedback loop, shown as the "R" icon, through which symptoms progressively worsen, i.e., the reinforcing loop dominates the balancing loop.

Author's note: Unintended consequences are not inherently "bad"; some may create positive value for system stakeholders. However, human experience generally supports the belief that these unanticipated or unplanned consequences are problematic and should be avoided. Using the N-Squared Diagram format, this scenario might appear as shown below:

Problem Symptom	Implement solution	
Recognize symptom; perceive	(often a quick fix)	
need to act	[s]	
Reduces pain	Fix	Produces delayed
[0]	Addresses symptoms	consequences
		[s]
Consequences reinforce the		Unintended Consequences
problem and its symptoms		Emerge from fix
[s]		

Fixes that Backfire scenario as an N-Squared Diagram

The system elements in the scenario (Problem Symptom, Fix, and Unintended Consequences) are placed on the diagonal. Additional explanatory text may be included with the system elements to help with "readability" of the scenario.

Cause-effect interactions between the elements are shown in off-diagonal cells, with the diagram read in a clockwise direction, e.g., Problem Symptoms cause the Fix while the Fix causes a reduction in Problem Symptoms. The correlation between cause and effect is indicated by the "[s]" = same and "[o]" = opposite labels. Lacking white space for displaying symbols within each loop, the author chose to distinguish between balancing and reinforcing loops using text color and style. Balancing loops are shown in plain black text. Reinforcing loops are shown using bold, green, italicized text in the offdiagonal cells.

Use of the N-Squared format for a causal loop diagram assumes there is no more than one samedirection cause-effect relationship between each pair of system elements. This is consistent with the use of arrows in the causal loop diagrams associated with the nine system archetypes. Modeling of causality at a more granular level requires further decomposition of the system elements.

Reflections

The Fixes that Backfire scenario has been enshrined in metaphors and proverbs that highlight the perils of band-aid solutions or short-term "haste makes waste" fixes. One global example could be the destructive cycle of responding to either physical pain (an injury) or personal failure by overuse of alcohol or painkilling narcotics. While temporarily masking the pain, these excesses may lead to numerous severe and lasting complications due to the realities of chemical addiction.

The fundamental solution to the Fixes that Backfire scenario is to develop a long-term solution that minimizes undesirable consequences, i.e., breaks the causal cycle. An effective decision-making methodology which includes both short-term and long-term evaluation criteria should enable effective evaluation of multiple alternatives and support an eyes-open tradeoff that balances these factors. The use of TRIZ inventive principles [2] or Axiomatic Design techniques [3] for decoupling of functional requirements may aid in developing such alternatives.

Unintended consequences may also be uncovered proactively during the risk assessment portion of the decision analysis process.

Skilled use of Problem (Root Cause) Analysis techniques are another method to avoid the pitfalls of the Fixes that Backfire scenario. Problem Analysis discipline leads to a clear understanding of root cause and makes a distinction between root cause and symptoms/effects. This distinction clarifies whether the "fix" is focused on interim/adaptive actions that address symptoms or corrective actions that effectively resolve the root cause behind undesirable system behaviors.

In summary, a systematic thinking approach to avoid the Fixes that Backfire would include a sequence of rational processes [3]:

- Situation Appraisal (SA) to identify, separate, and prioritize multiple "presenting" issues (problems or symptoms)
- Problem Analysis (PA) to confirm the root cause of deviations from expected behavior
- Decision Analysis (DA) to identify, evaluate and select (commit to) the best "fix" or "fixes"
- Potential Problem Analysis (PPA) to anticipate additional problems that might emerge from any fix or change to the existing system, i.e., to protect the fix implementation from additional failures.

Archetype #2: Success to the Successful

The "Success to the Successful" scenario is present when one party ("haves") is allocated more resources than another party ("have nots"), increasing the likelihood of success for those receiving resources. This February 2024 [Contents]

scenario could be encapsulated in the saying, "The rich get richer; the poor get poorer". The premise of this archetype is that there are limited resources to allocate among the parties. This fact sets up two reinforcing loops that compete for these limited resources.

Party A accumulates resources, which increases their level of success. That success increases the *allocation* of resources to Party A and therefore their *accumulation*, which leads to even more success. Meanwhile, Party B receives less, accumulates less and therefore experiences less success. That decrease in success further starves Party B during the next round of resource allocation.

Resources to A	Increases A success [s]			
	Success of A	Increases A resource		
		allocation [s]		
Increases A resource		Allocation to A instead	Decreases B resource	
accumulation		of B	accumulation	
[s]			[o]	
			Resources to B	Decreases B success
				[s]
		Decreases B resource		Success of B
		allocation		
		[o]		

Success to the Successful scenario as an N-Squared Diagram

The big idea associated with this archetype is that the structure of the system, in this case the rules of the competitive game, generates its behavior. It is the structure of the game (as much as the skill of the players) that generates the outcome.

One example of the Success to the Successful archetype may be seen in the leadership dynamics of volunteer organizations. Group dynamics favors extroverts over introverts, such that extroverts gain leadership roles and associated planning inputs and "stage" time. These extroverted leaders plan events or media efforts that maximize and emphasize their contributions. Meanwhile introverts are relegated to follower/spectator roles and their level of participation decreases. A similar dynamic may be seen in the structure of churches, synagogues, etc. where the pursuit of "on-stage" quality in teaching or worship leads to the professionalization of such ministry roles. This relegates the non-professionals to serving as spectators, further decreasing their influence and commitment to the organization. This dynamic occurs despite the organization's commitment to value all members equally; the concentration of resources and therefore impact over time is a result of the system's essential structure, i.e., its design.

The fundamental solution to the downward spiral represented by the Success to the Successful scenario is to use system structure to "level the playing field". Emphasize collaboration that brings all parties into one reinforcing loop that represents fair allocation of resources. Create win-win situations that build on cooperation over competition. In the case of the extroverted leadership or professionalized ministry examples, this might lead to the redesign of events or roles to promote offline participation, e.g., writing, deep thinking, solo artistry or research in which introverted non-professionals can gain a platform for expression, influence and impact.

<u>Reflections</u>

History shows that any attempt to engineer fairness while leveling the playing field has an inherent risk of triggering the "fixes that backfire" archetype. It seems likely that these two archetypes will often be part of a larger system model.

The definition of "level playing field" or "fairness" may vary widely among stakeholders. The choice of which parameters drive resource allocation creates a new set of rules that may shift the system to a different, but not necessarily better Success to the Successful model. *You get more of what you measure and ... reward*.

A logical extension to this archetype would add a resource creation feedback loop that accounts for how the success of the "haves" might increase the overall pool of resources (aka wealth) available to all parties such that there need not be winners and losers. Without treading into the dangerous realms of global politics, this seems to be a primary distinction between capitalist and socialist economic models.

Archetype #3: Limits to Growth/Success

The *Limits to Growth* or *Limits to Success* pattern may be recognized when improvement efforts begin produce diminishing results, i.e., the same investments in improvement don't yield the expected level of performance gains.

The archetype begins with investment in efforts to improve system performance. The increased efforts yield increases in performance, i.e., there is a strong positive correlation between effort and performance outcomes - represented as a reinforcing feedback loop. However, this scenario includes a Constraint, that when reached, "pushes back" as a Limiting Action on performance growth. The strength of the Limiting Action grows as system performance increases. The constraint drives a balancing loop that impedes future performance improvements. In this scenario, the balancing loop becomes dominant, setting an upper bound on system performance or capacity.

Efforts	Increases performance [s]		
Increases investment / effort [s]	Performance	Increases limiting action [s]	
	Performance growth slows, plateaus or declines [0]	Limiting Action	
		Triggers limiting action [s]	Constraint

Limits to Growth/Success scenario as an N-Squared Diagram

Beyond the half-century use of Limits to Growth to model the environmental and resource constraints of the industrial world [4], a modern-day example of this scenario might be parental over-involvement in youth sports. Parents are often zealous promoters of their children's ability to succeed at sports.

Heavy monetary investment often occurs with year-round training and associated extremes of parental involvement, expectations and corrective oversight. At the beginning of a child's sports career these efforts may yield rapid growth in competitive skills, but they often trigger pushback (the Limiting Action) from the child through a perceived loss of independence (a Constraint associated with the child's motivation when sports are no longer perceived as fun). As the pressure to improve increases, the young athlete's performance may plateau or even decrease, particularly in the case of child athletic burnout caused by parental overcoaching.

A fundamental solution for the Limits to Growth archetype is to identify a balancing process before it begins to decrease success. This requires proactive analysis to anticipate constraints and increase the understanding of the impact of limiting actions on system performance.

Reflections

The Limits to Growth pattern could also benefit from a reinforcing feedback loop that accounts for relaxation of constraints through improved system performance. If system performance improvement can generate resources that weaken the dominance of a constraint and its associated Limiting Actions, then performance growth may be sustainable for longer and ultimately reach a higher level of value creation.

The Potential Problem Analysis or Risk Assessment processes associated with system design decisions should ask a Limits to Growth question to help uncover this type of future failure mode for solution alternatives. Asking "How might growth in system performance lead to increasing pushback as external constraints are approached?" might yield more comprehensive and precise risk identification than asking "What could go wrong with Alternative A?".

Archetype #4: Escalation

The Escalation scenario represents a situation where two competing parties of nearly equal power take actions to gain or maintain the upper hand in response to a perceived or actual threat from the other party. The competition may be over limited resources, authority (ability to control or decide) or even attention from other parties.

This archetype may be visualized as two balancing loops that each include:

- Level of actual or perceived threat.
- Activity that responds to the perceived threat.
- Results of the actions taken to address the threat.

The scenario continues with parties (A and B in the diagram below) oscillating or see-sawing back and forth in the pursuit of the dominant position in the relationship.

Threat to A	Perceived threat					
	triggers A activity					
	[s]					
	Activity by A	Improves A results				
		[s]				
		A's Results	Improves A			
			relative position			
			[s]			
Reduces			Results for A	Worsens B		
perceived threat			relative to B	relative position		
[o]				[o]		
				Threat to B	Perceived threat	
					triggers B activity	
					[s]	
					Activity by B	Improves B results
						[s]
			Reduces			B's Results
			perceived threat			
			[o]			

Escalation scenario as an N-Squared Diagram

Examples given for this dynamic include sibling rivalries, auctions and the global arms race. Almost any human conflict has the potential for the Escalation scenario. A verbal confrontation or joust of ideas may begin with another individual who is perceived as being "in the wrong". This may lead to an attempt by the confronted individual to win the argument. Counter-arguments are made with increasing emotional intensity. The scope of the conflict may expand to other topics or personal areas, resulting in loss of relationship (the ability to communicate with civility and open-mindedness) and damage to reputations from the conflict.

Fundamental solution(s) for the Escalation scenario include:

- Proactive relationship maintenance and vigilance to avoid this dynamic.
- Postponing or not taking an action that might be perceived as threat escalation.
- Mutual agreement to de-escalate by seeking better understanding of other party's perspectives.

Reflections

The implicit tone of the course is that all escalation scenarios can be resolved by de-escalating actions, but history has shown (sadly so) that appeasement in the face of a determined aggressor may require superior "firepower" in the end.

The Escalation pattern may often be super-imposed with the Limits to Growth archetype where resource competition is the initial perceived threat. The Escalation pattern may also trigger the Fixes-that-Backfire scenario if short-term, poorly analyzed adaptive actions are taken by the competing parties.

An interesting question for further research may be:

What distinguishes a pattern of healthy competition that triggers continuous innovation and wealth creation from the escalation dynamic? Simply the violation of mutually agreed rules?

Conclusions

System archetypes represent behavioral patterns that emerge from system structure. Given that system structure is the result of decisions, and such decisions follow patterns [5], there is value in further research to understand the Decision Pattern -> Solution/Design Pattern -> System Archetype/Behavior Pattern derivation thread.

Causal Loop Diagrams are a compact representation of the "story" behind a system archetype. The essential content of graphical Causal Loop Diagrams may be captured using the N-Squared Diagram notation. No judgment has been made herein concerning the quality of communication or insights that result from the use of either cause-effect modeling format.

There appear to be many ways that the system archetypes could be combined to create comprehensive models of complicated or complex systems. Future research is warranted to identify how these nine behavioral building blocks fit together to form high-level patterns. PPI SyEN readers are encouraged to look out for Part 4 of this series that will explore five additional system archetypes and dive more deeply into lessons learned thus far and questions to explore through follow-on research.

References

- [1] Altshuller, Henry. 1994. The Art of Inventing (And Suddenly the Inventor Appeared). Translated by Lev Shulyak. Worcester, MA: Technical Innovation Center. ISBN 0-9640740-1-X
- [2] Suh, N.P., 2001. Axiomatic Design: Advances and Applications, Oxford University Press, 2001, ISBN 0-19-513466-4
- [3] Kepner, C. and Tregoe, B. 1997. The New Rational Manager: An Updated Edition for a New World, Kepner-Tregoe, Inc., Princeton, NJ (US)
- [4] Meadows, D.H., et al. 1972. The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind. New York: Universe Books.
- [5] Fitch, J.A. 2021. An Introduction to Decision Patterns. Project Performance International. PPI SyEN Edition #107, December 2021.

About the Author



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Within the field of systems engineering, John's career has focused on decision management, requirements management, risk management, systems design & architecture, product/technology road-mapping and innovation. In addition

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Reflections on INCOSE International Workshop 2024: Navigating Complexity and Collaboration

by René King

Project Performance International

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Authored for PPI SyEN

The INCOSE International Workshop (IW) 2024, held in Torrance, California from January 27th to 30th, served as the first of two annual flagship INCOSE events for SE practitioners worldwide. For me, the Workshop stands out as one of my professional highlights of the year, where engineers converge to celebrate achievements, exchange insights, and chart the future course of systems engineering. Unlike traditional conferences, these Workshops foster hands-on collaboration, idea exchange, and problem-solving, providing a dynamic platform for networking, learning, and advancing the field. By bringing together diverse perspectives and expertise, INCOSE Workshops drive innovation and facilitate the development of best practices that shape the global landscape of systems engineering.

Setting the scene for progress

The Workshop's first day began with a stimulating opening plenary session, where keynote speakers highlighted INCOSE's achievements during the last year. Now with a total membership of 23,119, INCOSE has experienced a significant growth of 10% in the past year, reflecting its influence within the systems engineering community. Other statistics shared included member retention at 84.4% and approximately 12% of the total INCOSE membership being certified. In a message from INCOSE leadership, it was emphasized that while INCOSE as an organization is evolving, its core principles and values remain steadfast, ensuring continuity and coherence in its mission to advance systems engineering.

As Marilee Wheaton, the outgoing president, bid farewell, her words echoed the ethos of communal effort and shared purpose that underpins INCOSE's success. Reflecting on INCOSE, Wheaton attributed its success to the collective efforts of its members in organizing events and developing technical products. She emphasized the organization's resilience and growth during the pandemic, underscoring the joint leadership of herself and Kerry Lunney. As the new board of directors took office, they were sworn in by Kerry Lunney in the presence of the INCOSE community, marking a transition to a new era of leadership and continued collaboration within the organization.



Photograph of the swearing-in ceremony of the new board of directors conducted by Kerry Lunney in the presence of the INCOSE community.

The opening plenary featured the acknowledgment of exemplary contributions by active and dedicated Working Groups, highlighted through the presentation of the 2023 Working Group Awards. From the collaborative achievements of the Project Management-Systems Engineering (PM-SE) Integration Working Group to the efforts of the Competency Working Group, each accolade symbolized the dedication and innovation prevalent within the INCOSE volunteer-based community. Additionally, several individuals, including chapter leaders and technical pioneers, were honored for their commitment to advancing systems engineering.

A list of the key 2023 awards and recipients announced during the opening plenary:

- Collaboration Award: PM-SE Integration Working Group
- Outreach Award: Joint Translation of the Outreach Working Group by the German INCOSE Chapter (GfSE) and Swiss Society of Systems Engineering (SSSE)
- Achieving the SE Vision: Awarded to the Competency Working Group
- Sustained Performance: Awarded to the Requirements Working Group
- Service of the Year: INCOSE Professional Development Portal
- Product of the Year Awards:
 - Systems Engineering Handbook Fifth Edition
 - Systems Engineering Competency Assessment Guide
- Outstanding Service Awards:
 - o Ömer Ertekin: Turkey Chapter president for more than 10 years
 - Anabel Fraga: INCOSE Spain Chapter president, EMEA leader; the Spanish chapter grew significantly under her leadership.
 - Jean-Luc Garnier: AFIS Chapter leader, involved in SEH5E as well and a contributor to several standards.
 - Erik Herzog: Founder of the Swiss Chapter, involved in platform development for searching historical INCOSE IS papers.
 - Tami Katz: Joined in 2017, a very active member of the INCOSE RWG (which is the largest WG); under her leadership, two recent awards have been won by the RWG. Tami is also the new deputy technical operations chair.
 - Artis Riepnieks: Service at the regional level as chair of INCOSE Western States Regional

Conference

- David Schrunk: Science of law, outreach, and liaison to members of INCOSE and other organizations
- o Jessica Tucker: Contributions in establishing and growing INCOSE NZ Chapter

Several new Working Groups have recently emerged within the INCOSE community, each addressing distinct facets of systems engineering. Among these, the Innovation group explores novel approaches to innovation, while the Systems Adaptability group focuses on enhancing system flexibility and resilience. Additionally, the SE and Law-making group delves into the intersection of systems engineering principles and legal frameworks.

Meanwhile, several other Working Groups are currently in development, including those dedicated to Sustainability initiatives, Embedding SE into Enterprises, and the application of systems engineering principles within Industrial Engineering contexts.

In a significant shift concerning the review process for INCOSE events, technical reviews are set to undergo changes moving forward, with reviewers themselves subject to review.

Charting the Course for the Future

The second day of the Workshop witnessed attendees delving deep into the strategic imperatives shaping the future of systems engineering. President Ralf Hartmann's address underscored the importance of evolving principles in response to contemporary challenges, while staying true to the core values that define INCOSE's identity. The SE Vision 2035 emerged as a guiding beacon, challenging participants to transcend boundaries and embrace innovation as a catalyst for progress. The Future of Systems Engineering (FuSE) program took center stage, ushering in a new era of collaboration and knowledge exchange. Through a series of international events and working groups, FuSE continues to galvanize efforts to address emerging trends and technologies.

Since the relaunch of the Future of Systems Engineering (FuSE) initiative last year, several developments have transpired. The initiative has organized four international events and facilitated ten local events, fostering widespread engagement and collaboration within the systems engineering community. With an impressive 1500 Post-its placed and a turnout of 1000 attendees, these events have collectively contributed over 2000 hours of dedicated effort towards advancing systems engineering practices and knowledge dissemination. Furthermore, the initiative has successfully engaged 100 individuals not affiliated with INCOSE.

Cross-cutting sessions, such as the Safer Complex Systems keynote, provided a forum for introspection and dialogue. As the complexity of systems continues to escalate, the imperative for safety and collaboration grows more pronounced. Thought-provoking discussions underscored the need for holistic approaches, collaborative frameworks, and a nuanced understanding of system dynamics to navigate the complexities of modern engineering endeavors.

A key takeaway from the Safer Complex Systems discussion highlighted that while only a few individuals within an organization may hold specific safety roles, it's imperative to recognize that everyone bears responsibility for safety. Furthermore, it was emphasized that every process outlined in the INCOSE Systems Engineering Handbook Fifth Edition is inherently impacted by safety considerations.

There exists a prevalent mentality that must be shifted—an outdated belief that safety is solely the responsibility of designated personnel. The session underscored the necessity of integrating safety considerations throughout the entirety of a program's lifecycle, rather than treating it as an afterthought.



Photograph of a slide from the Safer Complex Systems opening plenary delivered by Duncan Kemp.

Addressing key safety challenges in engineering requires navigating several complex factors. Firstly, perspectives on safety vary among individuals and stakeholders, leading to diverse interpretations and priorities. Additionally, safety concerns often arise from unpredictable events and scenarios, making risk management challenging. The presence of fuzzy boundaries and significant interdependencies complicates the identification and mitigation of safety hazards. Engineering systems exhibit nonlinear and dynamic feedback, introducing complexities in predicting and controlling safety outcomes. The emergence of novel architectures and unparalleled phenomena adds another layer of intricacy to safety considerations, emphasizing the need for comprehensive risk assessment and adaptive strategies to ensure the integrity and reliability of engineered systems.

Bridging the Divide

The third day of the Workshop witnessed a convergence of industry leaders and INCOSE stakeholders in the CAB Executive Leaders Panel session. Facilitated by moderator David Long, the panel deliberated on pressing issues ranging from the adoption of Model-Based Systems Engineering (MBSE) to the transformative potential of artificial intelligence (AI). Insights gleaned from the panel highlighted the importance of human-centered approaches, actionable standards, and strategic collaboration between academia and industry.

Attendees engaged in lively discussions, probing panelists on strategies to bridge the gap between theoretical knowledge and real-world applications. Reflections were shared on the role of INCOSE in shaping the future of systems engineering education and practice, emphasizing the importance of aligning academic curricula with industry needs to nurture the next generation of engineering talent.

Embracing the Future

As the Workshop ended, participants reflected on the insights gleaned and milestones achieved over the preceding days. Notable highlights included Boeing's integration of SEBoK

principles to enhance sustainability in product development, signaling the tangible impact of INCOSE's initiatives on industry practices. The Safer Complex Systems sessions yielded valuable insights into the evolving nature of safety engineering, emphasizing the need for collaboration, education, and standardization to navigate the complexities of modern engineering.

Looking ahead, President Ralf Hartmann articulated a vision of collaboration, innovation, and strategic alignment as the cornerstones of INCOSE's future endeavors. Attendees echoed his sentiments, reaffirming their commitment to advancing the frontiers of systems engineering excellence in an ever-evolving landscape.

In closing, the INCOSE International Workshop 2024 served as a testament to the resilience, creativity, and collective spirit of the systems engineering community. Against the backdrop of a rapidly changing world, INCOSE and its members stand poised to embrace the challenges and opportunities that lie ahead, shaping the future of systems engineering for generations to come.

Beyond IW24, there is a compelling call to engage:

- Connect, establish relationships, and network
- Learn, ensuring all voices are heard and interacting with neighboring disciplines
- Lead, whether it's people, products, or services in your day-to-day work
- Prosper, acknowledging the responsibility to share the great work that INCOSE is doing.

This call extends an invitation to actively participate in the ongoing dialogue, collaboration, and advancement of systems engineering beyond the confines of the Workshop, embracing a collective responsibility to drive positive change and innovation in the field.



Photograph of Chris Hoffman, FuSE Methodologies Leader, calling for networking and leading beyond the *IW.*

Looking beyond IW24, there is a compelling call to engage further, extending an invitation to actively participate in ongoing dialogue, collaboration, and innovation to shape the future of systems engineering. In the upcoming edition of PPI SyEN, René King will delve deeper into key takeaways, including FuSE and SysML v2 discussions, offering valuable insights from this notable event.

About the Author



René King is a Senior Engineer and Business Development Manager at Project Performance International (PPI). René recently achieved her SE-ZERT® Level C certification. René acquired a BSc in Mechanical Engineering and a Master of Science (MSc) in Systems Engineering from the University of the Witwatersrand, Johannesburg. In her years as a junior engineer, René worked as part of the highpressure piping systems design team at Steinmüller Bilfinger and as a researcher for Transnet freight railway transportation systems in South Africa. Apart from her

engineering and business development manager roles in PPI, she is also Managing Director of PPI's daughter company, Certification Training International (CTI) where she works with a small, dynamic team to support engineers on their journey to SE certification.

René's professional interests revolve around the bridge between model-based systems engineering and digital engineering, exploring why highly intelligent engineers with good intentions still engineer systems in absence of proven beneficial practices, and lastly, leveraging diversity in organizations to improve systems engineering practices.

PPI RESOURCES

PPI offers a multitude of resources available to all our clients, associates and friends! Click on any of the links below to access these resources today.

Systems Engineering FAQ: https://www.ppi-int.com/resources/systems-engineering-faq Industry-related questions answered by PPI Founder and Managing Director Robert Halligan.

Key downloads: https://www.ppi-int.com/keydownloads/ Free downloadable presentations, short papers, specifications and other helpful downloads related to requirements and the field of Systems Engineering.

Conferences: https://www.ppi-int.com/resources/conferences-and-meetings/ Keep track of systems engineering-relevant conferences and meeting dates throughout the year.

Systems Engineering Goldmine: https://www.ppi-int.com/se-goldmine/ A free resource with over 4GB of downloadable information relevant to the Engineering of systems and a searchable database of 7,800+ defined terms. You can expect the content of the SE Goldmine to continue to increase over time.

Systems Engineering Tools Database (requires SEG account to log in from the Systems Engineering Goldmine): https://www.systemsengineeringtools.com/

A resource jointly developed and operated by Project Performance International (PPI) and the International Council on Systems Engineering (INCOSE). The SETDB helps you find appropriate software tools and cloud services that support your systems engineering-related activities. As a PPI SEG account holder, you have ongoing free access to the SETDB.

PPI SyEN Newsjournal (a substantial monthly SE publication): https://www.ppiint.com/systems-engineering-newsjournal/

You're already reading our monthly newsjournal! However, click on the link to access the history of 100+ monthly newsjournals containing excellent articles, news and other interesting topics summarizing developments in the field of systems engineering.

Useful artifacts to improve your SE effectiveness

INCOSE INSIGHT Practitioners Magazine: New Challenges and Advances in SE at French Universities

INSIGHT

The December 2023 edition (Volume 26, Issue 4) of INSIGHT, INCOSE's Practitioner Magazine published by Wiley, has been released. Electronic subscriptions to INSIGHT are available as a member benefit to INCOSE

members. Hard-copy subscriptions to INSIGHT are available for purchase by INCOSE members for one membership year, and to the public.

The focus of this issue is *New Challenges and Advances in SE at French Universities*. Contents of this 41-page document include:

AFIS Report on Challenges for the Near Future

by Christophe Alix, Jean-Luc Garnier, Mikael Le Mouëllic, Laurent Alt, Rob Vingerhoed and Mickaël Bouyaud

Systems engineering shall adapt itself with the changes of the world. System engineering communities like (AFIS 2022) and (INCOSE 2021) have been developing their visions with the identification of needs that systems engineering shall integrate to address new challenges. The systems engineering discipline shall be now considered at the enterprise level and be included in the governance of the project. Systems engineering and system thinking shall be deployed on all layers of the organization and horizontally to ensure the consistency the definition, production, and all phases of the lifecycle of the system within all involved organizations. The future is paved with unknowns. Systems engineering can integrate new methodologies, new posture to complete its analytical based tools to better face new kinds of complexity. These new challenges are often due to the reallocation of functions and responsibilities between human and machine in the context of autonomous systems. These collaborative socio-technical systems induce new questions for systems engineering which needs to integrate new domain of skills and interacts with new disciplines from the soft sciences.

<u>Challenges in Early Verification and Validation of System Requirements</u> by Cyril Bacquet, Pascale Marangé, Éric Bonjour and Alain Kerbrat

Today, requirements engineering (RE) is a key process in the development of complex systems - (ISO/IEC/IEEE 2015). Requirements containing quality issues such as ambiguity or inconsistency can lead to late error detection in systems design, resulting in high project cost overruns. This paper presents challenges for early system requirements verification and validation associated to an executable model-based requirements engineering (eMBRE) process proposal.

<u>Challenges in Developing a Method to Support the Adoption of a Model-Based Systems Engineering</u> <u>Methodology</u>

by Léa Kozak, Eric Bonjour, Frédérique Mayer and Jean-Pierre Micaëlli

To improve design performance and achieve sustainability, organizations are looking to change their systems engineering practices. A model-based systems engineering (MBSE) methodology provides a framework for integrating, associating, orchestrating, and connecting executable and interactive models. It improves early verification and validation of system specifications and architectures, as well as communication and collaboration between project stakeholders. In this sense, MBSE has a truly systemic aspect. The variables to be considered when designing a support strategy are numerous and multidimensional. As a result, this situation can lead to contradictions in the choice of actions to be implemented, or to paradoxes that are likely to slow down the progress of the deployment project with the engineers. Currently, there is no method to support teams in charge of a methodological transformation (for example, in MBSE) to facilitate the adoption of this methodology. This article identifies the main challenges involved in developing such a methodology.

<u>Understanding the Indirect Effects of Interactive Systems Within Systems of Systems</u> by Laetitia Bornes, Catherine Letondal and Rob Vingerhoeds

Until recently, research into the sustainable design of interactive systems has primarily focused on the direct material impact of a system, through improving its energy efficiency and optimizing its lifecycle. Yet the way a system is designed and marketed often has wider repercussions, such as rebound effects, and systemic change in practices. These effects are harder to assess (and to anticipate) than the direct physical impact of the construction and use of the system itself. Current tools are unable to account for the complexity of these effects: the underlying causal mechanisms, their multi-level nature, their different temporalities, and the variety of their consequences (environmental and societal). This is why we are seeking to develop a specific methodology and tool, inspired by systemic design and system dynamics. These are intended for decision-makers and designers of interactive systems within systems of systems (for example, in the fields of agricultural robotics or public transportation). In this paper, we present this modeling approach and our prototype tool through the example of a second-hand clothing sales platform.

WONKA: An Ontology-Aided Model-Based Systems Engineering Analysis for Early V&V on Heterogeneous Systems and Applications

by Romain Delabeye, Olivia Penas and Régis Plateaux

This research is undertaken as part of the EU-funded EnerMan project aiming at improving the energy sustainability of manufacturing systems. In such a large project, with 22 partners over 10 countries, a first challenge addresses the collaborative design of an energy management system (EnMS) for the improvement of energy sustainability, while offering the flexibility and agility necessary for the diversity of the industrial cases studied and the partners involved. In a second stage, industrial use cases are generally too constrained to easily proceed to the verification and validation (V&V) of the scientific approaches tackling their challenges. In this context, our research contributions consist of methodologies and automated approaches to: (i) ensure the consistent collaborative integrability of developments, in a sustainable manufacturing context, and (ii) perform the verification and validation of such contributions on multiple systems, assessing their scalability on heterogeneous systems, environments, and missions in a V&V context.

<u>Project Engineering for the Depollution of Industrial Sites: A Model-Based and Systems-of-Systems Approach</u> by Chebbi Mayssa, Vincent Chapurlat, Jean-Samuel Wienin, Laurent Aprin and Philippe Girones

This work addresses the challenges associated with depolluting brownfields or industrial sites, emphasizing the significant societal, financial, and environmental implications. Current depollution February 2024 [Contents]

projects are often treated in an ad-hoc manner, lacking a systematic and industrial perspective, despite the growing number of such projects. The proposed method advocates for a structured approach grounded in systems engineering principles, aiming to enhance collaboration among stakeholders, preserve knowledge, and facilitate the industrial transformation of depollution efforts. The method encompasses elements such as establishing a common vocabulary, employing modeling languages, implementing a double operational approach, providing supportive tools, and managing shared knowledge to improve project design, execution, and collaboration across multiple companies.

Early Validation of Functional Requirements

by Yasmine Assioua, Rabea Ameur-Boulifa, Renaud Pacalet and Patricia Guitton-Ouhamou

Technical specifications and intended functionalities are often gathered in documents that include requirements written in constrained natural language, that is, natural-like language with restricted syntax. In the automotive industry one challenge is the ability to produce safe vehicles, emphasizing the importance of safety by design. In the framework of case studies based on functions of autonomous vehicles, we introduce a systematic process for building formal models from automotive requirements written in constrained natural language, and for verifying them. By allowing formal verification at the earliest stages of the development cycle our aim is to avoid the costly discovery of errors at later stages.

Interoperability Forum for Requirements Exchange

by Christian Koumlah Mbey, Frédéric Darré, El-Mehdi El Amrani, Albert Lévy and Pascal Hubert

This article illustrates requirement exchanges based on the STEP AP242 application protocol. These results are the outcomes of the systems engineering interoperability forum (SE-IF) of the ATLAS program, a working group sponsored by the French industry and the French government. The SE-IF is composed of manufacturers, who define use cases and assign priorities and solution providers, who implement the standard, carry out interoperability tests and establish recommended practices. The objective of this forum is to enable exchange of requirements and their attributes in a fluid and tool-agnostic way, to facilitate collaborative work in the context of the extended enterprise. This work gives promising perspectives for standardized transfers of all other systems engineering data.

<u>Model-Based Systems Engineering Approach for an Indoor Multi-Usages System Development</u> by Eric Razafimahazo, Pierre de Saqui-Sannes, Rob Vingerhoeds, Julien Soula and Romain Mège

This paper discusses the design of multi-usage systems able to perform various missions inside buildings, including inspection, digitization, monitoring of construction work, and evaluation of technical performances of the building. Designing such systems, carrying out various missions in different operational environments, is a complex task and requires adopting a well-defined engineering approach. A model-based systems engineering (MBSE) approach is proposed and applied to address the complexity of the indoor multi-usages system and to lead its development. The proposed method provides several complementary and comprehensive views of the system.

Join INCOSE <u>here</u> to access this rich systems engineering resource. Download the entire issue of INSIGHT Volume 26, No. 4.

All Things Innovation Posts

All Things INNOVATION

The <u>All Things Innovation website</u> provides access to a wide range of resources related to the topic of innovation, research, development, and data science. Content includes articles, interviews, discussions, summaries of the latest industry research and virtual gatherings.

<u>Innovation resources</u> of particular interest to systems engineering practitioners include a series of one-page blog posts that summarize 1–15-minute videos, organized by the following innovation themes:

Business Innovation

Business Innovation features a range of helpful information on current business trends, business innovation ideas, innovation ecosystems, future of work, growth innovation, supply chain innovation, finance innovation, and more. This area further looks at business transformation, strategic innovation, stakeholders, collaboration, and other foundational knowledge and business innovation ideas for the innovation expert and novice alike. Recent articles in this topic include:

- Delivering the Right Data to the Right Audience
- <u>Champion Innovation by Engaging with Stakeholders</u>
- Strengthen the Supply Chain to Build the Product Pipeline
- The Progress of Innovation

Customer Innovation

Customer innovation focuses on innovation efforts with a primary emphasis on understanding and meeting the specific needs, preferences, and desires of customers. In this context, customer innovation would involve creating products, services, or solutions that are highly tailored to customer requirements and deliver exceptional value to them. Key aspects of customer innovation might include customer-centric approaches, customization, feedback and collaboration, agile and iterative development, user experience (UX) design, customer experience trends and data analytics. Recent Customer Innovation articles include:

- Growing the Green Economy through Sustainable Innovation
- <u>Connecting Human-Centered Design to Innovation</u>
- <u>Unleashing Innovation with UX Design</u>
- The Value of Insights for Innovation

Innovation Strategy

Innovation strategy is a carefully planned and organized approach that an organization or business develops to systematically foster, manage, and leverage innovation leadership to achieve specific objectives and gain a competitive advantage. It is a high-level framework that outlines how the organization will generate and implement new ideas, products, services, processes, or business models. An effective innovation strategy and framework aligns innovation activities with the overall business strategy and goals. Topics recently addressed in this area include:

- Innovation Principles, 4/7 The Innovation Spiral
- Innovation Principles, 3/7 End-to-End Product Innovation Framework
- Finding the Voice of Humanity-Centric Innovation
- Shaping the Future with Disruptive Technology

Innovation Technology

Innovation technology can refer to the application of technological advancements or digital tools in the process of innovation within a business or organization. In this context, technological innovation in business encompasses various technologies and tools that support and facilitate innovation activities, such as idea generation, product development, and the overall management of the innovation process. Key elements of innovation technology may include idea management platforms, collaboration and communication tools, data analytics and artificial intelligence (AI), prototyping and simulation tools, digital product development and design, open innovation platforms, project management and workflow automation, virtual reality (VR) and augmented reality (AR), Internet of Things, cloud computing, blockchain, digital marketing and customer analytics. Recent Innovation Technology posts include:

- The Impact of Al on Innovation
- Measuring Innovation Performance
- Living in A Digital Transformation World
- <u>Advancing Universal Interaction</u>

Process Innovation

Process innovation refers to the creation and implementation of new or significantly improved methods, systems, or procedures within an organization to enhance efficiency, reduce costs, improve quality, and achieve better outcomes. It involves making changes or introducing novel approaches to how tasks, operations, or workflows are carried out, with the aim of optimizing the entire process. Key characteristics of process innovation include efficiency enhancement, cost reduction, quality improvement, speed and throughput, resource optimization, customer satisfaction, and competitive advantage. Recent topics in this area include:

- Embracing Open Innovation
- Inviting Interdisciplinary Innovation Collaboration
- People Remain the Critical Link to Innovation
- Bringing Collective Intelligence to the Innovation Process

The All Things Innovation website also provides a summary of upcoming <u>innovation-related events</u>, <u>research reports</u> on innovation trends and <u>discussions</u> on a diverse range of topics.

Subscribe to All Things Innovation <u>here</u>.

System Dynamics Review



The System Dynamics Review, published quarterly by Wiley on behalf of the <u>System Dynamics Society (SDS)</u>, typically provides non-member access to a select set of journal articles. Four recent open access articles illustrate the diversity of systems that may be addressed by dynamic modeling:

<u>From low-hanging fruit to high-impact sustainability transformations: unpacking dynamics of intra-</u> <u>and interorganizational capability traps</u> Authors: Jeroen Struben and Florian Kapmeier

Abstract: Why are organizations and markets slow to transform toward sustainability despite the

abundant well-recognized opportunities it provides? An important subset of the phenomena this question addresses involves decision-makers recognizing the existence of opportunities but failing to undertake ambitious, effective, sufficient, or timely action. Building on existing research on capability traps, market formation, and managing sustainability, we focus on the forces constraining organizations from developing the capabilities and market infrastructures required for sustainability transformations. We characterize types of sustainability initiatives and, using causal loop diagramming, visualize structures that enable and constrain how organizations can navigate individually and collectively worse-before-better dynamics resulting from uncertain, nonlinear, and delayed returns. Being under day-to-day pressures and deeply intertwined within their environment, organizational actors find it difficult to recognize, undertake, maintain, and coordinate necessary efforts internally and externally. We discuss research implications and directions for future research on avoiding these traps and accelerating sustainability transformations.

<u>Uncovering dynamic complexity in annual reports: a methodological approach using resource</u> <u>mapping</u>

Authors: Martin Kunc, Federico Barnabè and Maria Cleofe Giorgino

Abstract: This study explores the role of qualitative system dynamics (SD) models in representing and analyzing the information of corporate annual reports by uncovering their hidden "dynamic complexity." The study employs a specific qualitative SD technique, resource mapping, and outlines a methodology to apply it in practice. This study has several contributions. First, it provides methodological guidelines and practical insights on how to apply qualitative SD, using stock-and-flow diagrams, in the field of corporate reporting to represent visually and analyze the dynamic complexity implicit in businesses. Second, it underlines the performative role of accounting together with qualitative SD. Specifically, it provides useful insights into how to use qualitative SD in the accounting field to enhance both internal analysis and external communication, thereby supporting decision-making processes. Third, it shows how to integrate different discipline-related technical languages, thereby bridging differences in backgrounds, skills, and expertise that might characterize intended readers and users.

Dynamics of interdisciplinarity: a microlevel analysis of communication and facilitation in a group model-building workshop

Authors: Nici Zimmermann and Katherine Curran

Abstract: Participatory system dynamics is assumed to generate inter- and transdisciplinary understanding and whole-system perspectives via scripted workshop structure, facilitation, and the use of visual boundary objects. However, there is little research into how exactly workshop activities and facilitators affect communication dynamics during a workshop and create an interdisciplinary perspective. Thus, we offer an innovative dynamic understanding via a rare microlevel analysis of facilitation and dynamics of communication and interdisciplinarity in a group model-building workshop. We investigate how the conversation focus unfolds over time and examine in depth disciplinary transitions as well as the facilitator's role. We also analyze participants' perceptions of interdisciplinarity from the workshop and provide a research framework for workshop microlevel analysis. Based on the workshop's heritage science setting, we discuss the recursive nature of generating joint meaning and the use of participatory system dynamics for managing interdisciplinarity in a research project and make recommendations.

Feedback dynamics of the low-income rental housing market: exploring policy responses to COVID-19Authors: Katherine E. Marçal, Patrick J. Fowler and Peter S. HovmandFebruary 2024[Contents]39

Abstract: The economic impact of COVID-19 threatened mass housing insecurity undermining the health and financial recovery from the pandemic. Unprecedented federal policy responses halted court-ordered evictions and injected billions of dollars in rental assistance, but questions remain whether housing interventions adequately accounted for dynamics that drive landlord-tenant interactions, including accumulations of rental and mortgage arrears, rental unit availability, and low-income housing options. A system dynamics model probes complex feedback dynamics driving tenant and landlord decision-making in the low-income rental housing market pre- and post-pandemic protections. Feedback loops highlight trade-offs considered by low-income tenants and landlords in the context of scarcity and uncertainty. Simulations suggest the eviction moratorium and federal emergency rental assistance prevented a tidal wave of evictions, but rental arrears, overcrowding, and homelessness remain elevated. Failure to address underlying financial hardship and limited affordable housing undermines COVID recovery.

The latest edition of the Review (<u>Volume 39, Issue 4 – October-December 2023</u>) includes one article that is available to members only:

<u>Disequilibrium supply-and-demand allocation with differentiated products</u> Author: George Backus

Abstract: Although a multitude of allocation schemes exist, none deal with the combined supply and demand dynamics of differentiated products under disequilibrium conditions. This note describes a framework to re-examine the market dynamics of supply and demand in times of disequilibrium and equilibrium.

Learn more about the System Dynamics Review <u>here</u>. Join the SDS to gain full access to the System Dynamics Review.

New System Dynamics Resources



The System Dynamics Society (SDS) continues to curate and/or recommend a variety of system dynamics resources in the form of blogs, videos and papers. Here are some of the latest open-access resources to check out:

- Autonomous vehicle market development in Beijing: A system dynamics approach (Wei Mao, Simon Shepherd, Gillian Harrison and Meng Xu)
- <u>College Competition and the Connection to Rising Student Costs</u> (Abigail Rose Lindner, Worcester Polytechnic Institute)
- <u>Critical Thinking Skills Enhancement through System Dynamics-Based Games: Insights from the</u> <u>Project Management Board Game Project</u> (Federico Barnabè, Stefano Armenia, Sarfraz Nazir and Alessandro Pompei)
- <u>Descriptive design structure matrices for improved system dynamics qualitative modeling</u> (Rameez R. Qureshi, David N. Ford and Charles M. Wolf)
- Keynote on System Dynamics Model Quality and Credibility (Yaman Barlas, Boğaziçi University)
- <u>Machine Learning and System Dynamics: A Threat or an Opportunity? (</u>Hesham Mahmoud, Radboud University)
- <u>Managing Complex Tasks with Systems Thinking</u> (Book, edited by Hassan Qudrat-Ullah, York University)
- <u>Navigating Client Dissatisfaction</u> (Dennis Sherwood, Silver Bullet Machine)*

- <u>Navigating community engagement in participatory modeling of food systems</u> (Chelsea Wentworth, et al.)
- <u>Recalibration of limits to growth: An update of the World3 model</u> (Arjuna Nebel, Alexander Kling, Ruben Willamowski and Tim Schell)
- <u>Residency Program Cultures: Dynamic Interactions Shape Learning Outcomes</u> (J. Bradley Morrison, Lori Berkowitz and Rebecca Minehart)
- <u>Systematic Review of Agent-Based and System Dynamics Models for Social-Ecological System</u> <u>Case Studies</u> (Supradianto Nugroho and Takuro Uehara)
- <u>Systemic innovation for countering violent radicalization: Systems engineering in a policy</u> <u>context</u> (Timothy Clancy, Bland Addison, Oleg Pavlov, Erika Palmer and Khalid Saeed)
- <u>Systems Thinking Through Storytelling</u> (Linda Booth Sweeney, Toggle Labs and Philip Ramsey, Massey University)
- <u>Towards a behavioural system dynamics: Exploring its scope and delineating its promise</u> (Operational Research Society webinar; David C. Lane, University of Reading and Etienne Rouwette, Radboud University)
- <u>Zooming in and out the landscape: Artificial intelligence and system dynamics in business and</u> <u>management</u> (Stefano Armenia, Eduardo Franco, Francesca landolo, Giuliano Maielli and Pietro Vito)

* open access to presentation overview, but restricted access (members-only or for-pay) to the recording

The SDS also offers the opportunity to contribute to industry research by participation in a survey titled <u>"Using an Integrated Approach of System Dynamics Modeling and Wargaming to Understand a</u> <u>Complex Problem."</u>

Join the SDS to gain access to additional members-only content.

Featured Organization: International Society for the Systems Sciences (ISSS)



The International Society for the Systems Sciences (ISSS) is among the first and oldest organizations devoted to interdisciplinary

inquiry into the nature of complex systems, Established in 1956 as the Society for General Systems Research, an affiliate of the American Association for the Advancement of Science, the Society adopted its current name in 1988 to reflect its broadened scope. ISSS exists *"to encourage the development of theoretical systems which are applicable to more than one of the traditional departments of knowledge"*.

Principal ISSS aims include:

- Investigating the isomorphy of concepts, laws, and models in various fields, and to help in useful transfers from one field to another.
- Encouraging the development of adequate theoretical models in areas which lack them.
- Eliminating the duplication of theoretical efforts in different fields.
- Promoting the unity of science through improving communication among specialists.

More recently, ISSS has added a focus on the practical application of systems methodologies to

problem solving and providing a forum for interdisciplinary sharing of ideas among academic, business, government, and non-profit communities.

ISSS activities are organized around <u>Special Integration Groups (SIGs)</u>. Current SIGs are shown below:

The ISSS hosts an <u>Annual Meeting</u> which has spanned the globe and publishes an <u>academic journal</u> that includes proceedings of this event.

The ISSS Library contains a diverse set of resources for society members, including:

- Newsletters
- Yearbooks
- Primers
- Videos
- Podcasts
- Books
- World of Systems Map
- System mapping tools

ISSS members are active contributors to the INCOSE <u>Systems Engineering Body of Knowledge (SEBoK)</u>.

Learn more ISSS <u>here</u>. Join ISSS.

Simple SysML for Beginners: Using Sparx Enterprise Architect



Beginning system modelers with access to Sparx Enterprise Architect software will appreciate David Hetherington's new book, *Simple SysML for Beginners: Using Sparx Enterprise Architect*.

This book is designed help readers take initial steps toward proficiency at SysML v1 modeling. It covers all nine SysML diagram types, using over 50 example models and

400+ annotated screen shots to show detailed steps to construct simple models that demonstrate key concepts for each diagram type.

Simple SysML for Beginners: Using Sparx Enterprise Architect is available in multiple formats:

- Print version from Amazon
- <u>Kindle version from Amazon</u>

Learn more <u>here.</u>

Top Business Analysis Resources from 2023



The International Institute of Business Analysis (IIBA) is providing open access to some of its top business analysis resources published in 2023.

Recommended open access webinars and podcasts include:

- Business Analytics Series: 16 Visio Tips in 60 Minutes
- ChatGPT and Business Analysis
- Deal Makers vs. Value Creators Creating Exceptional Business Value Through Business
 <u>Analysis</u>
- <u>Requirements Engineering and Business Analysis</u>
- <u>Running Effective Meetings</u>
- <u>Top 9 Business Analysis Skills</u>

In addition to open access resources, the IIBA provides online members-only access to a range of popular business analysis books:

- Business Analysis Techniques: 123 Essential Tools for Success
- Introduction to Business Architecture
- <u>The Business Analysis Handbook: Techniques to Deliver Better Business Outcomes</u>
- <u>The Business Analyst's Handbook</u>
- <u>UML for the IT Business Analyst: A Practical Guide to Requirements Gathering Using the</u> <u>Unified Modeling Language</u>

Join the IIBA to access these resources.

Learn more about the <u>IIBA</u>.

Cyber Resilience Weapon Systems Body of Knowledge (CRWS-BoK)



In 2021, the U.S. Department of Defense (DoD) launched the Cyber Resilience Weapon Systems Body of Knowledge (CRWS-BoK) to support the systems security engineering community. Since then, the CRWS-BoK has expanded to include over 600

resources, vetted to ensure that the platform provides current industry standards and best practices.

Maintained by the System Security (SysSec) Directorate in the Office of the Under Secretary of Defense for Research and Engineering (OUSD(R&E)), the CRWS-BoK provides rich guided search and custom search capabilities and regular news updates. Registered users have access to email alerts of changes to their favorite resources and saved searches, plus direct access to view and the ability to annotate PDF files online.

Access the CRWS-BoK here.

Upcoming PPI Live-Online [™] Systems Engineering Five Day Courses

Click <u>here</u> to view the full schedule or register for an upcoming course.

P006-936-1	Asia SGT 5:00 (UTC +8:00) PPI Live-Online™	18 Mar - 22 Mar 2024
P006-936-2	Oceania AEDT 8:00 (UTC +11:00) PPI Live-Online™	18 Mar - 22 Mar 2024
P006-937-1	North America EDT 8:00 (UTC -4:00) PPI Live-Online™	18 Mar - 22 Mar 2024
P006-937-2	South America BRT 9:00 (UTC -3:00) PPI Live-Online [™] (Exclusive to South America)	18 Mar - 22 Mar 2024
P006-938-1	Europe CEST 9:00 (UTC +2:00) PPI Live-Online™	08 Apr - 12 Apr 2024
P006-938-2	United Kingdom BST 8:00 (UTC +1:00) PPI Live-Online™	08 Apr - 12 Apr 2024
P006-938-3	South Africa SAST 9:00 (UTC +2:00) PPI Live-Online [™] (Exclusive to South Africa)	08 Apr - 12 Apr 2024
P006-938-4	Turkey TRT 10:00 (UTC +3:00) PPI Live-Online™	08 Apr - 12 Apr 2024
P006-938-5	Saudi Arabia AST 10:00 (UTC +3:00) PPI Live-Online™	08 Apr - 12 Apr 2024
P006-939	Eindhoven, the Netherlands CEST 8:30 (UTC +2:00) In-Person	10 Jun - 14 Jun 2024
P006-940	Las Vegas, USA PDT 8:00 (UTC -7:00) In-Person	17 Jun - 21 Jun 2024
P006-941-1	Asia SGT 6:00 (UTC +8:00) PPI Live-Online™	24 Jun - 28 Jun 2024
P006-941-2	Oceania AEST 8:00 (UTC +10:00) PPI Live-Online™	24 Jun - 28 Jun 2024

FINAL THOUGHTS FROM SYENNA

Artificial Hips and More

Syenna had the recent privilege of playing the role of support coach for a dear relative that had a total hip replacement. During the run up to the surgical operation, there came a flood of information concerning the procedure and much was made of the artificial hip product itself. Comprised of shiny titanium and durable ceramics, this *system of interest* was center stage – a modern medical marvel that promised decades of restored pain-free mobility.

Ever alert to the bigger picture, Syenna couldn't resist silent musings about various systems engineering constructs associated with the upcoming event.

System Boundary

What is the real system of interest for a human being facing loss of mobility from a decrepit hip joint? The Artificial Hip *Product Breakdown Structure* might include a small list of very expensive titanium and ceramic parts, but the functionality of the restored hip joint is critically dependent on how these parts mesh with living flesh and bone. There is a multi-week dance after the operation during which the bone (specifically the femur) grows into the rough surface of the titanium rod that is literally pounded into the femur cavity. Therefore, the Artificial Hip *System Breakdown Structure* certainly must account for body parts and systems that build this biomechanical interface. A loose rod banging around within the femur would not deliver the desired mobility functions or performance.

Syenna's takeaway: The system boundary is an artificial, but useful and flexible mental construct. The system breakdown structure must account for elements that are often outside the scope of the engineered product.

Enabling systems

Syenna's musings on system boundaries and breakdowns gave way to considerations of the life cycle of the artificial hip. Best practice guidance recommends that we concurrently engineer the system of interest and the systems that enable it across the full system lifecycle. In this case, there is certainly a *deployment system* that includes a surgeon and various human assistants, an amazing multi-purpose facility typically known as the operating room, surgical tooling and equipment, an anesthesia-delivery system and personnel, etc. The artificial hip deployment system ran like clockwork in "our" case; in a few hours the patient was in a hospital room conversing with Syenna. There may have been a few issues with the anesthesia or perhaps at the anesthesia-antibiotics-body-brain interface; several humorous conversations ensued over the next day as the patient experienced chemically induced "hospital delirium". No harm done.

Syenna's takeaway: *Enabling systems are critical to the success of what we often call the "product".* Less emphasis appears to be placed on the artificial hip *support system* design. The critical role of the support coach became apparent, though few clear criteria for support coach selection were highlighted in the pre-surgery educational videos and handouts. For approximately six weeks after this surgery, the patient is to avoid various movements and postures that could lead to "popping" the hip out of joint with the attendant pain, trip to the emergency medical facility and other potential complications. A patient on strong pain medications, perhaps not 100% in their right mind in the days after the operation, could very easily fail to adhere to these restrictions. The onus is on the support

FINAL THOUGHTS FROM SYENNA

coach to proactively prevent such failures as the patient returns to the routines (hip-enabled use cases) of daily living. A set of support tooling is provided or prescribed to assist the support coach and patient in maintaining compliance. A subset of this support system is shown below.



Total Hip Replacement Support System Components

Now over to you. Can you name each component and identify the function(s) allocated to it?

- Item 1:
- Item 2:
- Item 3:

Please send your answers to <u>PPISyEN@PPI-Int.com</u> and we will post the best solution in next month's edition.

Regards, Syenna