



33rd Annual **INCOSE**
international symposium

hybrid event

Honolulu, HI, USA
July 15 - 20, 2023

www.incose.org/symp2023
#INCOSEIS

New Spaces, New Places

how SEs influence and impact in our changing times

Dr. Donna H. Rhodes

Massachusetts Institute of Technology

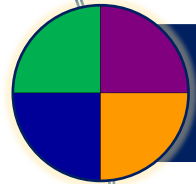
rhodes@mit.edu

Systems Engineering: Fundamental Limits and Future Prospects (Sage, 1981)

*Although much has been accomplished with respect to successful application of systems engineering to important contemporary issues, **much remains to be accomplished in the development of interrelationships and systemic processes to cope with modern sociotechnical issues***



framing



new spaces, new places



tensions and opportunities



value through systems methodologies

“new”

Oxford Languages

- *not existing before; made, introduced, or discovered recently or now for the first time*
- *already existing but seen, experienced, or acquired recently or now for the first time*
- *just beginning or beginning anew and regarded as better than what went before*
 - superseding another or others of the same kind, and advanced in method or theory
 - reviving another or others of the same kind

Autofarm (A.D. Hall, 1977)

- WASHINGTON — A computerized agricultural control system, called the **Autofarm was patented this week** by a University of Pennsylvania professor who is also an electrical engineer.
- Arthur D. Hall was granted what he termed a jumbo patent. Instead of the average seven pages, including two, and a half sheets of drawings, it comprises a total of 101.
- Autofarm, which is **not yet in physical existence**, will use a small computer to receive information on soil moisture, nutrient levels and pathological and other conditions and send signals to a variety of control devices, 'using, the same, digital data transmission network, for sending and receiving.



The New York Times Archives

....but was unable to make the leap from invention to true innovation. It was an early, but failed attempt at "green" farming.

“new” is respective to context

Images: Deere.com

Autonomous sprayer

This novel autonomous sprayer is lighter than a conventional self-propelled sprayer and has a 560 litre spray tank. It can enter fields after rain without causing any soil compaction. The high ground clearance of 1.9 m and four-



Large spraying drone (VoloDrone)

The large drone developed jointly by John Deere and Volocopter has a diameter of 9.2 m and is powered by 18 rotors. It has a fully electric drive with replaceable lithium-ion batteries. One battery charge allows a flight time of up to 30 minutes, and the VoloDrone can be operated both remotely and automatically, on a pre-programmed route. The drone frame is equipped with a flexible structure for mounting various devices such as sensors, cameras, and protection devices. The spray bar can be adjusted to a width of up to 60 m and a flow rate of 6 ha/hr can be achieved.



See & Spray

With See & Spray technology, high-resolution cameras capture 20 images per second. Based on the images and artificial intelligence, the system recognises the difference between cultivated plants and weeds so that individual plants can be specifically treated. With this new generation of weed control, the use of pesticides can be greatly reduced.

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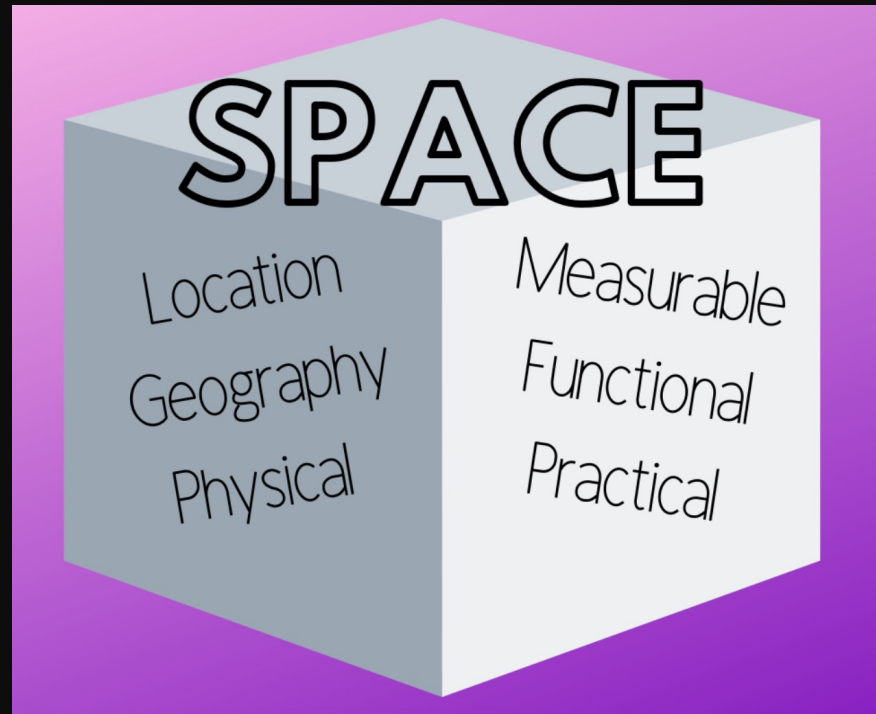


Image created via Canva by Madeline Fink

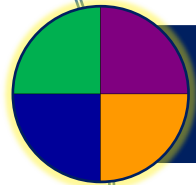


Image created via Canva by Madeline Fink

Fink, M., 2019, Everyday Anthropology: Space vs. Place



framing



new spaces, new places

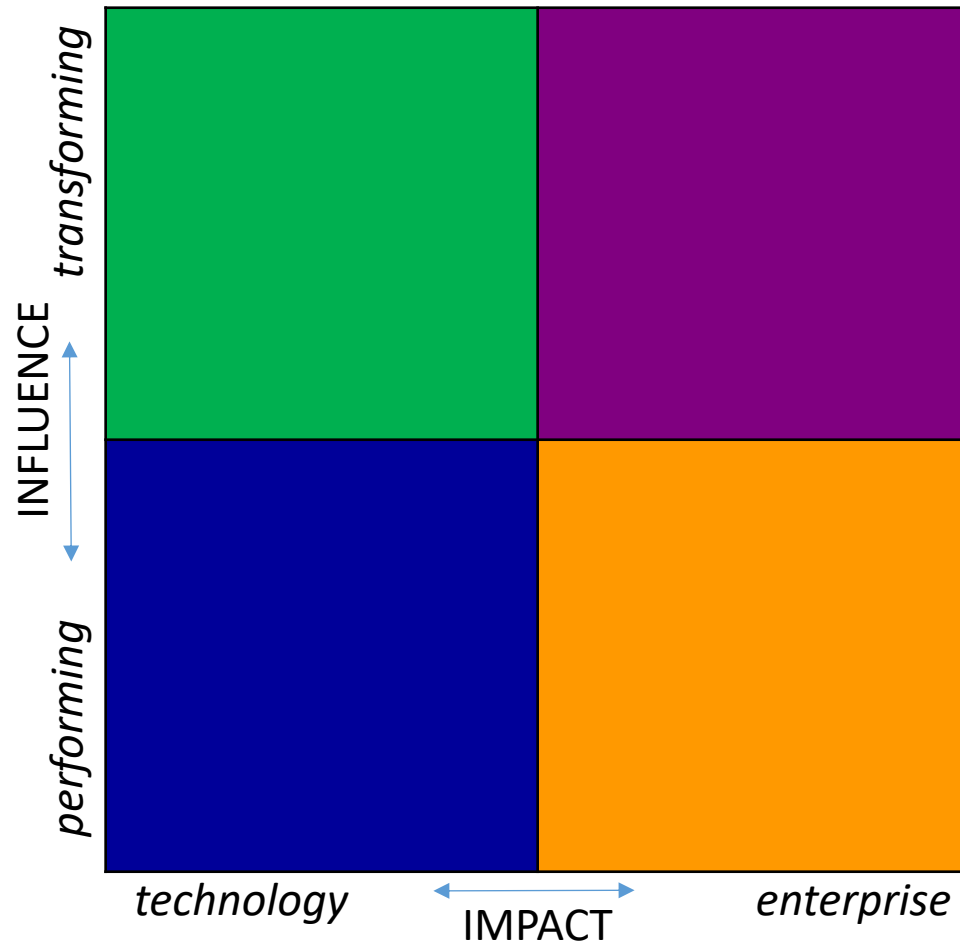


tensions and opportunities

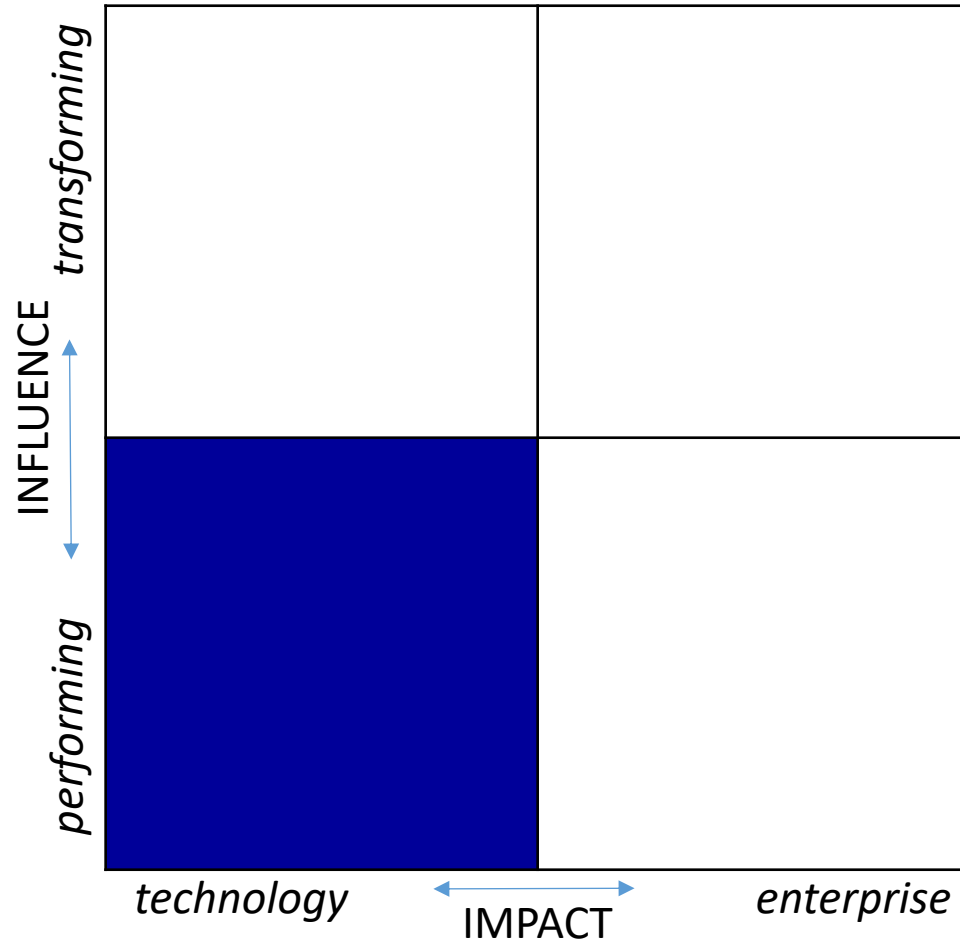


value through systems methodologies

influence and impact

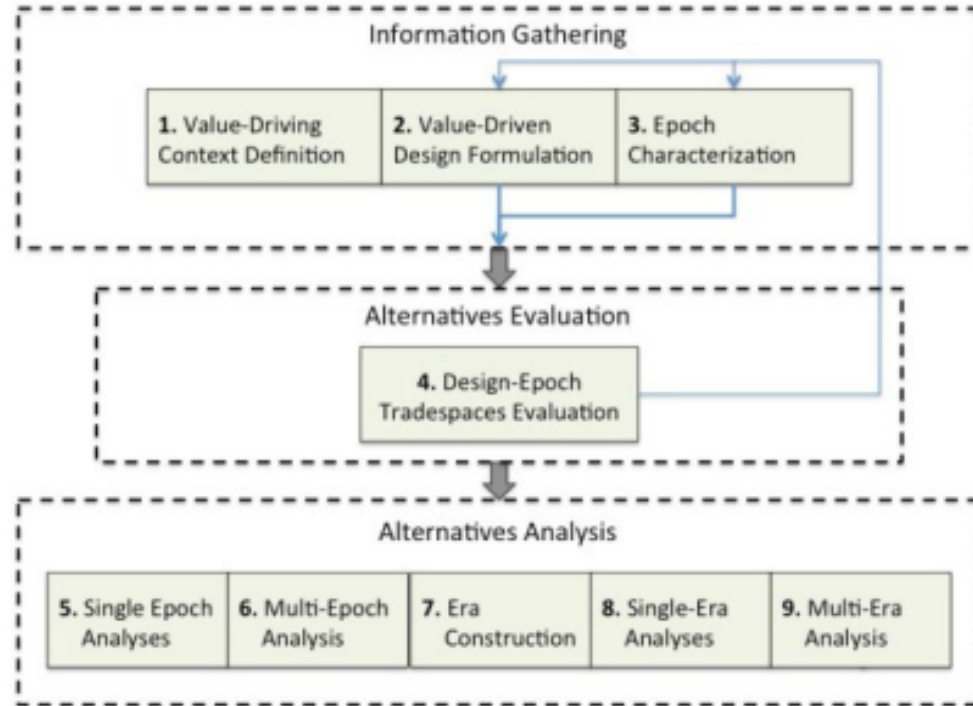


influence and impact



performing influence, technology impact

MIT Responsive Systems Comparison (RSC) Method

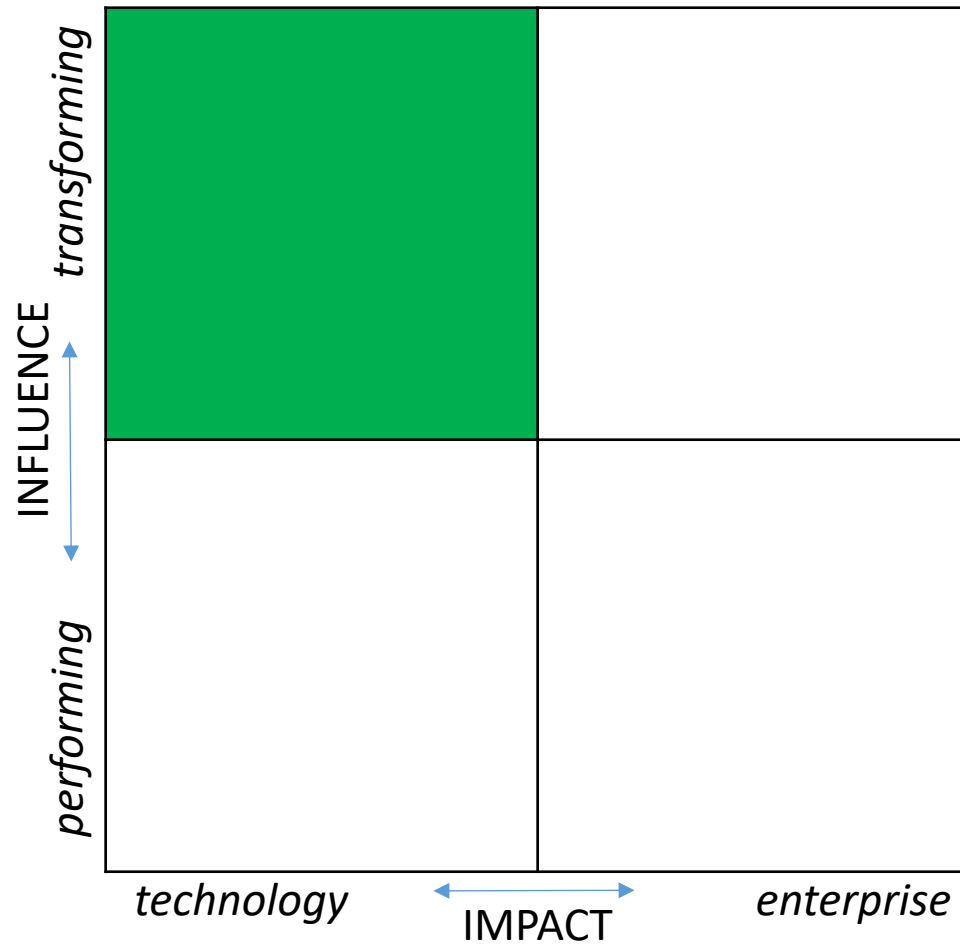


Mobile Plant Cultivation Containers



Cardoso, J. and Rhodes, D. (2023) Exploring design tradespace of MPCC under alternative contexts

influence and impact



transforming influence, technology impact

THE **RAND** BLOG

Tech Alone Isn't Enough to Create a Successful Smart City

COMMENTARY (Route Fifty)



Photo by metamorworks/Getty Images

by Jared Mondschein, Aaron Clark-Ginsberg, Andreas Kuehn

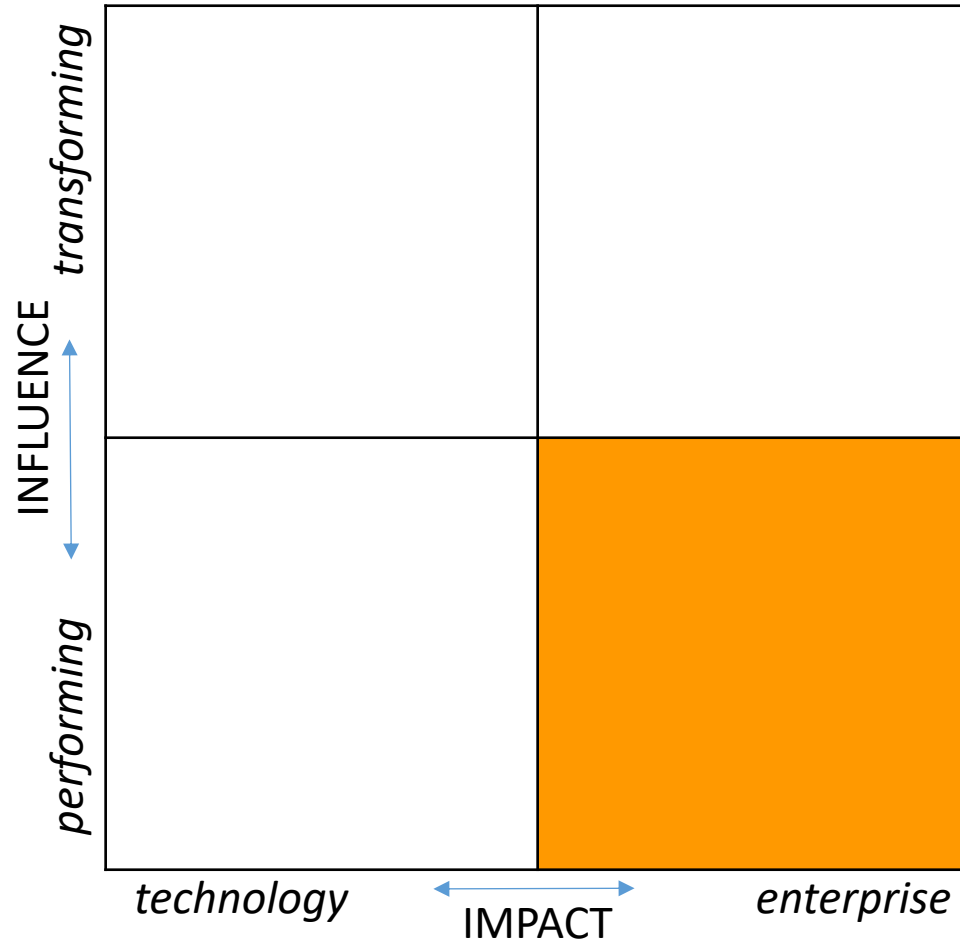
February 10, 2021

Surprisingly, we have found that such challenges don't solely relate to the complexity of the technology itself, but rather the longstanding and persistent obstacles associated with navigating the incredibly complex social and organizational processes that underpin the smart city environment

There need to be dedicated efforts toward facilitating the integration of infrastructure into the complex stakeholder ecosystem that characterizes every U.S. community, regardless of size or budget. Making smart cities work will require reconciling and/or aligning the conflicting interests of disparate stakeholders and making deliberate trade-offs between stakeholder goals and objectives

Mondschein, et al. 2021

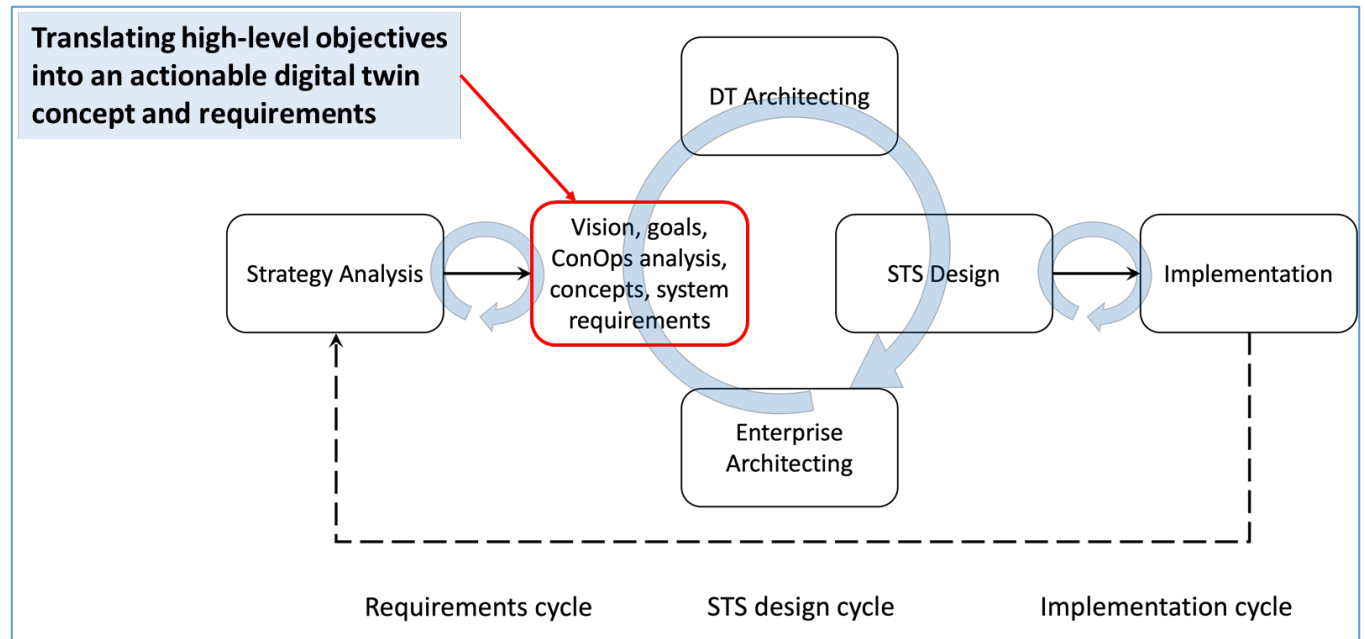
influence and impact



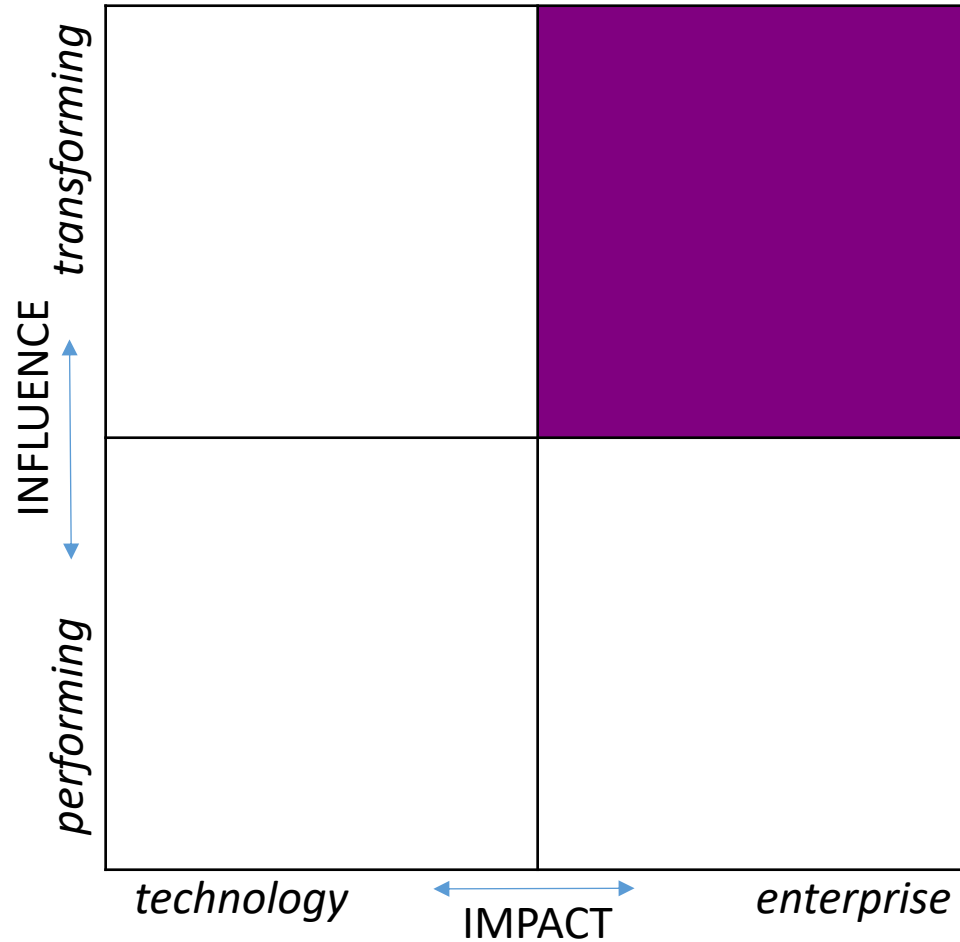
performing influence, enterprise impact

Transformer 4.0 (TRF4.0) seeks to **reinvent the industrial processes** of power transformers **using digitalization**, primarily digital twins

Empowering
the Future.



influence and impact



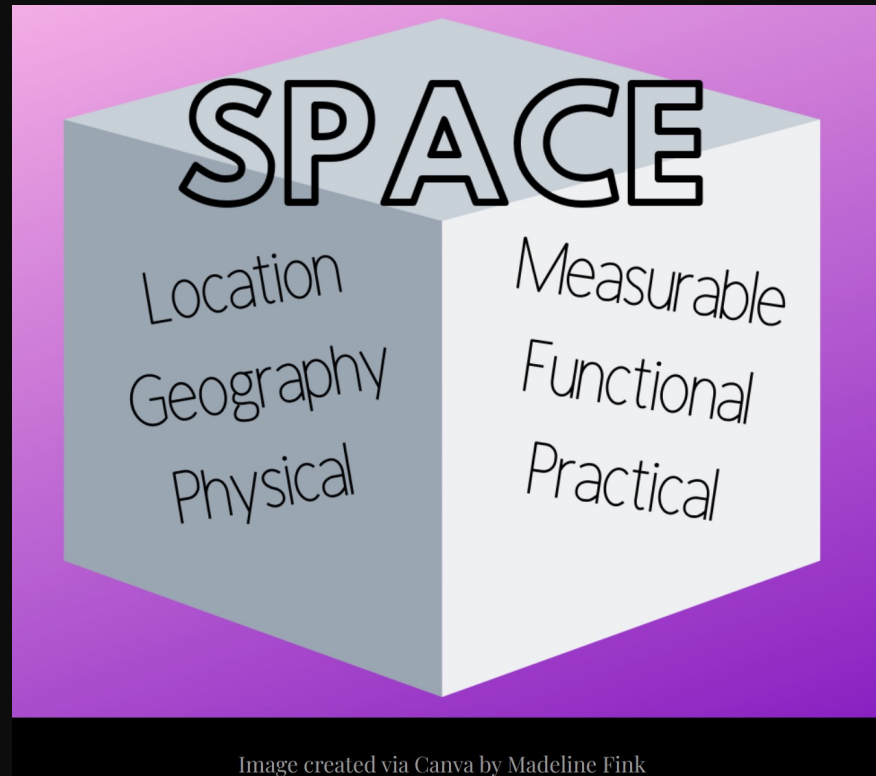
transforming influence, enterprise impact



With significant Government investment, Digital Manufacturing Ireland is responsible for transforming the manufacturing value chain through innovative technology across the integrated pillars of technology, supply chain, operations and skills and culture transformation

<https://www.dmireland.org/>





Fink, M., 2019, Everyday Anthropology: Space vs. Place

transforming influence, enterprise impact



Transcending-Futures.com

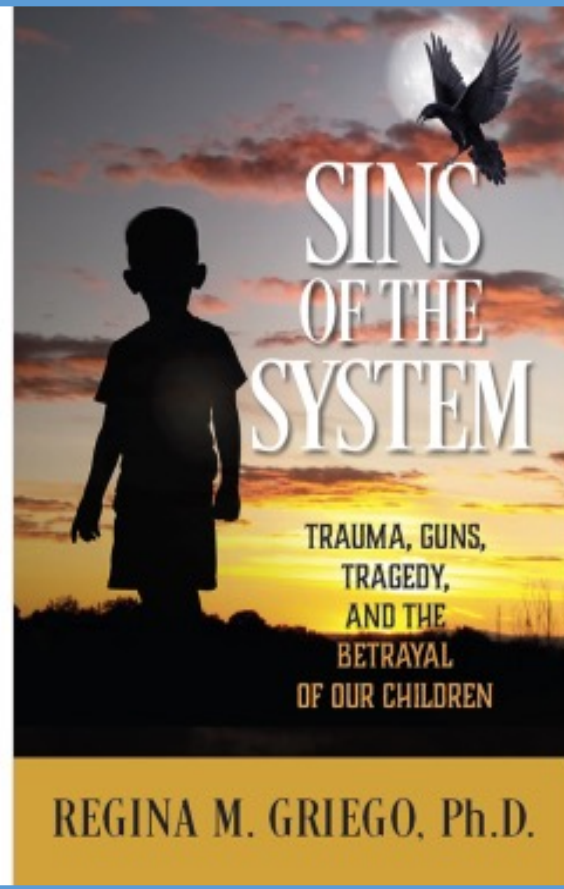
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The National Award:

1st place national award in the National Federation of Press Women's Communications Contest category of Writing - Autobiography or Memoir.

The judges wrote *"This is a bold and intimate autobiography presented in an authoritative, journalistic style. Exceptional writing makes this a compelling book well beyond a personal perspective."*

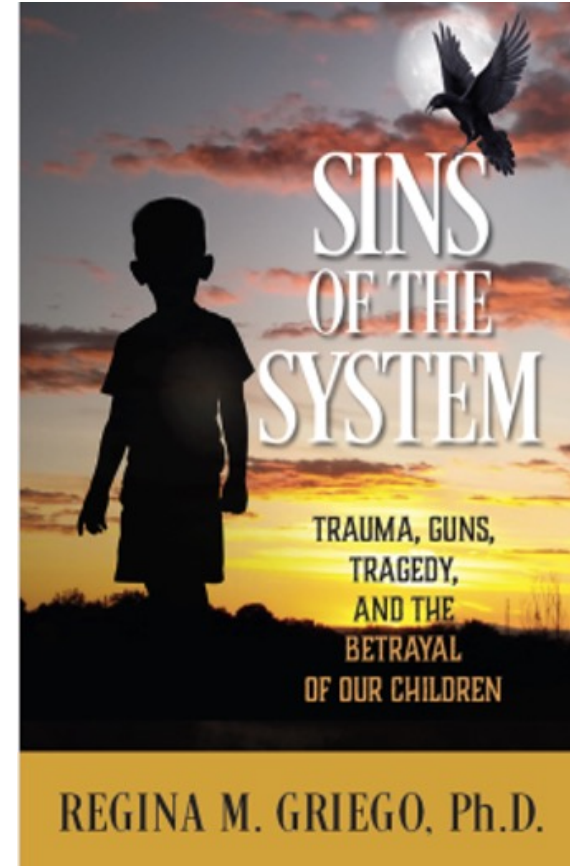
The International Award:

Winner, in International Book Awards - category of Social Change.



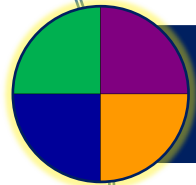
systems that failed (Griego, 2022)

- Mental health systems
- Family systems
- Social safety net
- NM Department of Education system
- Justice System
- National/State Safety Systems
- + two national wicked problems





framing



new spaces, new places



tensions and opportunities



value through systems methodologies

sources of tension

- Known experts vs “incognito”
- Shiny technology -- methodology
- Hackathon -- dwelling in ambiguity
- Exploratory/“tourism” -- regulated

tension •

the act of stretching or straining •
the state of being stretched or
strained

opportunity • a favorable
junction of circumstances

<https://www.merriam-webster.com/dictionary>

The paper shows that a hackathon grounded on systems engineering approaches and structured around the technical functions within an engineering company, has the capability and capacity to communicate a coherent vision and rationale for the conceptual design of a complex engineered product.

Saravi, Sara, et al. "A systems engineering hackathon—a methodology involving multiple stakeholders to progress conceptual design of a complex engineered product." *Ieee Access* 6 (2018): 38399-38410.

tensions and opportunities

2016



Flight FAA Gives Flying Car Prototype the Go-Ahead as a Light Sport Aircraft

Terrafugia's flying car prototype can't meet a few key FAA regulations, but the startup just received an exemption.



BY JAY BENNETT PUBLISHED: JUN 23, 2016

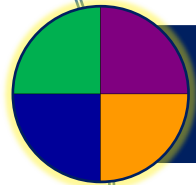
2023



New York (CNN) — The Federal Aviation Administration has certified for testing a vehicle that a California startup describes as a flying car — the first fully electric vehicle that can both fly and travel on roads to receive US government approval.



framing



new spaces, new places

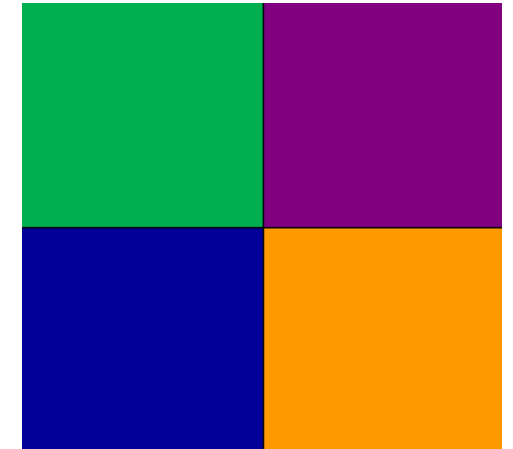


tensions and opportunities



value through systems methodologies

foundational methods + “new”



Objectives for application of SE to contemporary large scale issues (Sage, 1981) - <i>selected objectives</i>	
To anticipate alternative futures such as to prepare the decision maker(s) for contingencies	Anticipatory systems methods
To encourage understanding of the role of all stakeholders in resolution of complex large-scale issues	Stakeholder salience analysis
To encourage consideration of different value perspectives, needs perspectives and technology perspectives	Adapted CONOPs
To encourage communication between decision makers and all stakeholders throughout the process	Design thinking and focus groups

The methodologies of systems engineering complement human thinking in a most fundamental manner.

They enhance human intellectual capacities for planning and decisionmaking and extend these capacities into environments of organized complexity.

Systems Engineering: Fundamental Limits and Future Prospects (Sage, 1981)

Questions and Reflections?

