Human Systems Engineering™ - A Trilogy, Part III

Managing Projects Successfully in a World of Uncertainty [1]

William M. Hayden Jr., PhD

Abstract

In 1980, Dr. W. Edwards Deming said on NBC television, *"If Japan Can, Why Can't We?."* This became the force behind the quality movement.

About 1985, the Engineering/Architecture/Construction (E/A/C) industry learned from US federal and some US state agencies that project proposals with Quality Assurance (QA) plans were required or their submittals would not be considered.

While supporting E/A/Cs firms to first understand and then implement their organization and project quality system. . . . QC/QA/QM. . . I learned these firms had common challenges:

1. At least 60% of their firm's projects failed to meet contract requirements and,
2. Technical expertise had little to do with that failure.

Part I of the Trilogy, "Elephant in The Living Room,[2]" identified the following major conclusions:

1. Project outcomes routinely are lower than those expected by major stakeholders.
2. Organization's management of their projects allow significantly lower project results.
3. The main root cause that restrained project success was non-technical.

Part II of the Trilogy, "May The Force Be With You: Anatomy of Project Failures[3]" identified the following major conclusions:

1. Lack of education, training, and development for engineers to collaborate, cooperate and communicate creates fertile ground for conflict during project interactions.
2. The US ASEE/LEAD approved educational programs do not prepare technically capable engineers entering the workforce "How to play nice with others."
3. The level of psychological safety within a project/program/organization has a direct impact on the willingness to call for a "Project Phase Gate Review."

A systems approach is needed to lead and manage organizations and projects successfully.

Keywords: *Systems Thinking, Silos, Re-Engineering, Socio Mores, Analytic Thinking, Synthesis*

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[2] ASCE Leadership and Management in Engineering, April 2004, p.61-71

[3] ASCE Leadership and Management in Engineering, January 2006, p.1-11

1.0 Introduction

Engineers and technicians are expert in technical matters. The absence of an organizational cultural embodiment of "Systems Thinking" allows failures due to incorrect assumptions, communication, and the design of equipment and plant for maintainability. Domains of human factor errors include work quality, decision-making errors, and organizational culture.

Q. "Would you study a single tree to understand a rain forest?"

A. Time to go beyond linear thinking.

The E/A/Cs Organizational "Rain Forest"

ID	CONSTANTS	VARIABLES
1	BODs	SCHEDULES
2	C-SUITES	WORKLOAD
3	CLIENT SELECTION	DISCIPLINES
4	RESOURCE ACCESS	SCOPE/SCHEDULE/BUDGET
5	LEADERSHIP	ROLE/RESPONSIBILITY/ACCOUNTABLE
6	SYSTEM OF MGT.	CAREER DEVELOPMENT

The control of the above "Constants" rests with the occupants of the C-Suites. They may either continue or change such as they wish. The "Variables" are requirements to be adhered to by employees below executive levels. All of the above constants and variables constitute the system of management within which project work is done.

Dr. Russell Ackoff has stated "It is silly to look for an optimal solution to a mess. It is just as silly to look for an optimal plan. Rather we should be trying to design and create a process that will enable the system involved to make as rapid progress as possible towards its ideals, and to do so in a way which brings immediate satisfaction and which inspires the system to continuous pursuit of its ideals[4]"

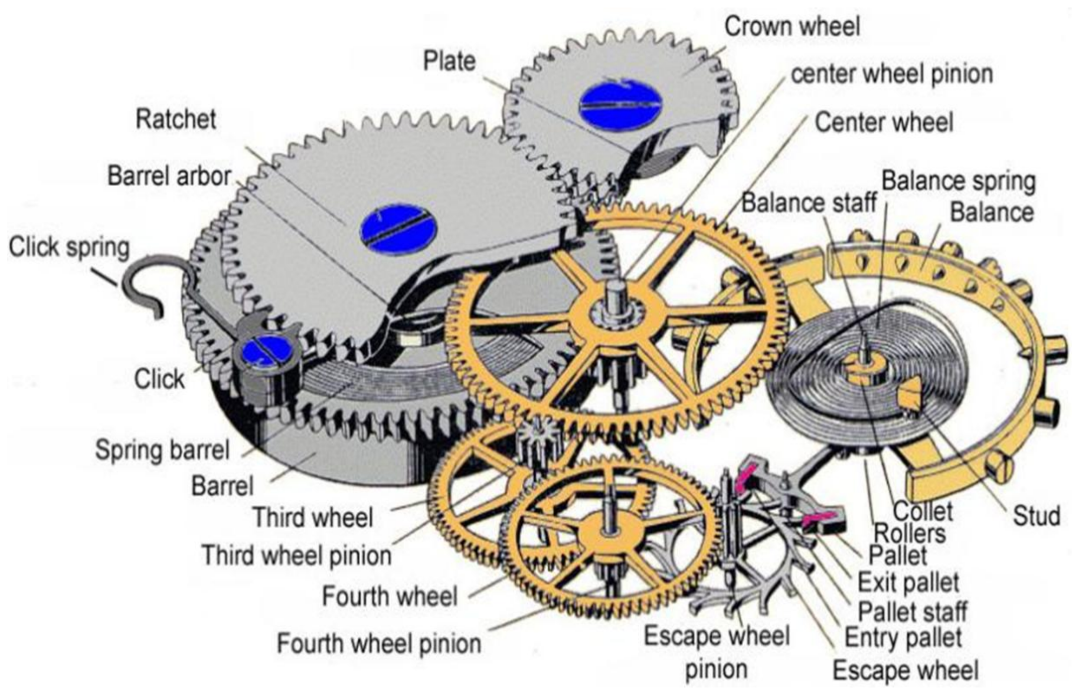
"Systems Thinking" will provide new perspectives when planning, designing, and incorporating your system's feedback loops, as well as critical changes in attitudes and behaviors from the C-Suites to the plant floor.

[4] Ackoff, RL (1977). *"Optimization + Objectivity = Optout,"* Euro JOpl Res 1: 1–7.

"A bad system will beat a good person every time!"

-W. Edwards Deming

2.0 SYSTEMS THINKING



Inner Parts of a "Grandpa Pocket Watch"

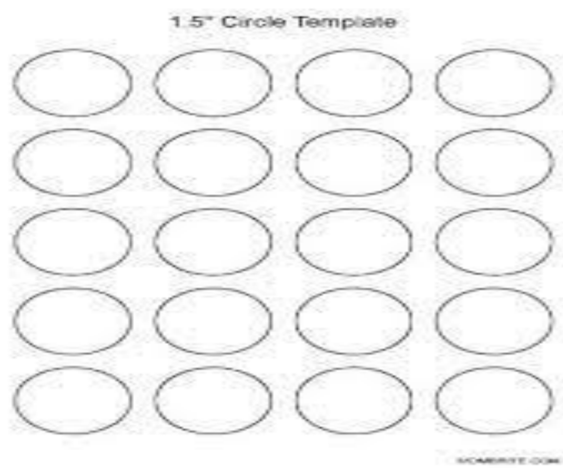
Imagine trying to tell the time-of-day with any part of the above system missing. Now imagine a project contract that is behind schedule, over budget, and portions of the scope either incomplete or incorrect. One of the org's technical discipline managers requests a time-out for a "Phase Gate Review" that includes technical leads, client and regulatory agency representatives as well as a vendor and subcontractor to participate.

Q. How often do you believe this will happen?

By and large, projects are not driven to failure by a lack of technical knowledge but by project behaviors that at this point may be reasonably anticipated**.** Project failure to meet objectives can be prevented by elimination or mitigation of the root causes. These causes are nontechnical in nature; none of their solutions require math. Unlike engineering problems that lend themselves to logical, sequential thinking using time tested formulas, these engineering problems require knowledge of Human Systems Engineering™, a term trademarked by the author to recognize, capture, discuss, and then explore the type of systems that require application of Deming's(1993) System of Profound Knowledge.[5]

2.1 Current vs. Recommended Systems Thinking Models:

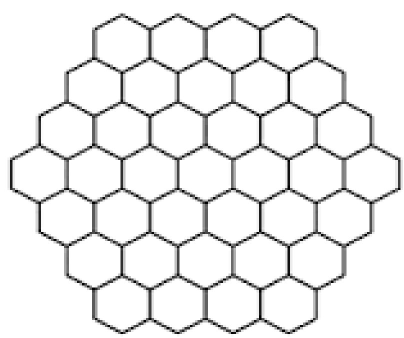
- **Present state** of "Silo-Collaboration," cooperation, and communication between the parties in the education, design, construction, and operations management industry.



The above simple graphic is what ignorance about "Systems Thinking" looks like.

> "Divided responsibility means that nobody is responsible."
> — W. Edwards Deming

- **Required future state** of re-engineered collaboration, cooperation, and communication between the parties in the education, design, construction, and operations management industry for the re-engineering of the professions.



"Improvement" asks "How can we do this better?"

[5] Leadership Manage. Eng., 2004, 4(2):61-71

"Re-Engineering" asks "Why do we still do this?"

2.2 Another Way to View Systems is by Understanding the Ripple Effect of Water

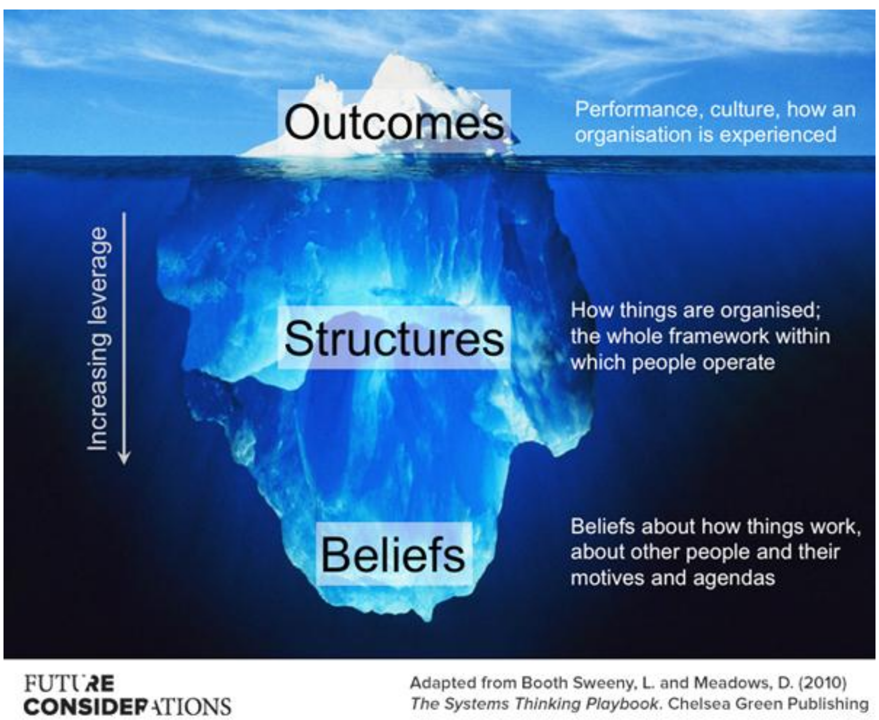
The ripple effect of water refers to how small changes in one area can create a series of interconnected consequences elsewhere. For instance, pollution in a local water source can eventually make its way to the oceans, where it might impact marine ecosystems and weather patterns worldwide. Similarly, changes in ocean currents, frequently brought on by climate change, can seriously disturb water systems worldwide.[6]

This example is part of the "Systems Thinking" model which may be applied to any related parts of a system. Consider major parts of the infrastructure system:

- ABET, ASEE, University Academic Engineering Education, Professional Societies for Planning, Design, Construction, Operations & Maintenance.

And within each element noted we have people, process, technology, and leadership.

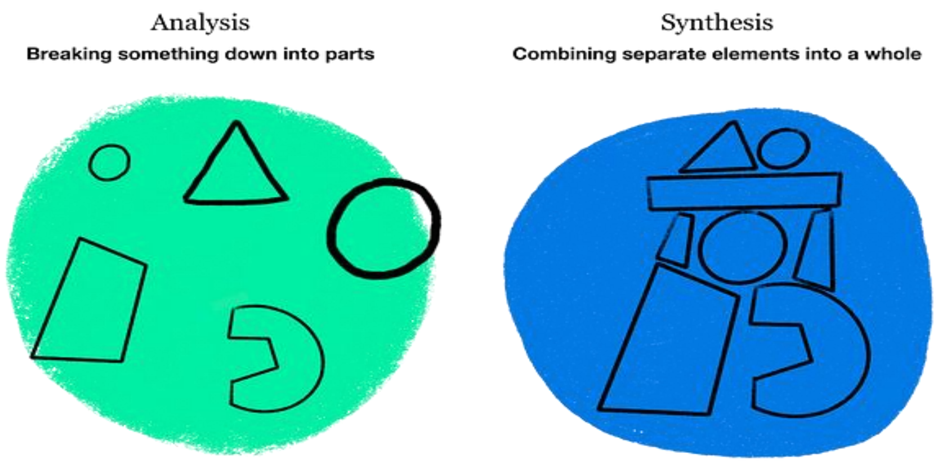
Then, within each organization contracted to perform their part of the work, we have various levels of clarity modeled by the "Iceberg Model."[7]



6. https://h2oglobalnews.com/the-ripple-effect-water-and-ocean-in-2024/

[7] https://futureconsiderations.com/iceberg-model/

2.3 Systems Thinking, [8]stated by Dr. Russell Ackoff, is a New Way of Thinking Which is Centered on the Synthesis Instead of Analysis Method.



In the Renaissance era, when the science as we know it today was born, a scientific inquiry method called Analysis was developed**.** Analysis comes naturally to us. Just watch kids breaking new things and being curious about the parts. The understanding of something follows a three step process in analytical thinking:

1. Take it apart
2. Understand (function, role, behavior) what the parts do
3. Assemble the understanding of the parts into understanding of the whole[9]

- **Our culture is built on analytical thinking**. For example, when you go to school to study business, you don't study business. You study marketing, finance, organization, logistics, etc. The assumption is that if you understand how the parts work you can assemble them together to gain the understanding of the whole. Corporations are run in a similar fashion. Running of the organization is divided into different parts-by products, geography, function, etc. and then you aggregate running of the parts into running of the whole-corporation.[10]10
- **Analytical thinking teaches us "how" and it never teaches us "why."** It gives you knowledge but not understanding. The understanding comes from Synthesis which explains "why." The explanation of a system always lie outside the system. For example, how do you explain why the engine is in the front of the car? The engine replaced the horse which used to be in the front of the carriage and soon what we call a car today was

[8] https://www.youtube.com/watch?v=IJxWoZJAD8k
[9] https://bencallahan.com/analysis-vs-synthesis
[10] Ibid

referred to as the horseless carriage. That is why the engine is located in the front of a car. You could not have figured this out by applying analytical thinking. [11][11]

- **To understand something using synthesis you:**

1. Ask "what is this a part of?" instead of taking the parts apart. You identify the containing whole. For example, to understand a car you identify the transportation system and to understand a corporation you identify the economy, etc.
2. Understand the behavior of the containing whole instead of understanding behavior and properties of the parts. For example, understand the transportation system and the economic system, re car and corporation respectively.
3. Dis-aggregate the understanding of the containing whole by identifying the function of the system you are trying to explain instead of aggregating the understanding of parts into the understanding of the whole. For example, understand the role a car plays in the transportation system and the role a corporation plays in the economic system.[12]

2.4 A System is a Whole and is Defined by its Function in a Larger System.

Every system is contained in a larger system and its role in that larger system defines it. For example, a car is defined by its function of transportation. An essential property of a system is that it cannot be divided into independent parts and its properties are derived out of interaction of its parts and not the action of its parts taken separately. For example, what makes a car is the interaction of the motor, engine, steering, etc. If you take a system apart it loses all its essential properties.[13]

3.0 Conclusions

- **The Interconnectedness of Everything. . . And Everyone**

For starters as we engineer our way collaboratively into and beyond 2026, we start by working to see the forest and the trees!

And we ask what our shared understanding is of "Systems Thinking" wherein people, process, technology and leadership reside.

[11] Ibid
[12] Ibid
[13] https://cdog.blogspot.com/2009/01/systems-thinking-as-taught-by-ackoff.hfml

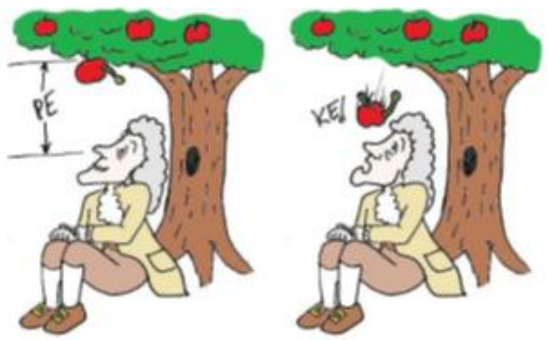
- **Recent Analyses:**

"The top five reasons for project failure were poor project management, poor design, frequent design changes, design errors, bureaucracy, corruption, poor quality, and poor site management."[14]

"Systems Thinking" will reveal that these reasons are all interconnected and part of a larger system.

- **Reflection:**

To: Decision-Makers in ABET, ASEE, University Academic Engineering Education, Professional Societies for Planning, Design, Construction, Operations & Maintenance.



Potential energy versus kinetic energy.[15]

The cartoon, so effectively used by Dr. Diehl, highlights the real-world life for an engineer.

Imagine this series continues to envelop the world the engineer will be part of once he rises and joins the rest of society involving their cultural and social mores.

Q1. What holds social groups together?

Q2. What separates them?

Q3. What and how will you lead the way into the increasing mobility, technological advances and challenges our engineers continue to face daily within the public, private and NFP sectors?

<>Consider having your discipline individually, and then collectively share the results of the "Appendix-Critical Project Element Issues."

[14] "Analyzing The Causes of Project Failure and Cost Overruns in Building Construction Industry by Using a Mixed-Methods Approach," Pakistan Journal of Humanities and Social Sciences, 2024-06, Vol.12 (2), p.1898-1916

[15] "Using Cartoons to Enhance Engineering Course Concepts," Dr. Edward James Diehl P.E., University of Hartford, ASEE 2018

Managing Projects Succesfuly **Appendix** **Personal Evaluation**

	PROJECT	ELEMENT	WORK	CATEGORY		
Critical Project Element Is	**PEOPLE**	**PROCES**	**TECH.**	**LDRSHP**	**100%**	
Client Selection					100	
Accepting *"Piecework"*					100	
Subconsultant Selection					100	
Ineffective Communication					100	
Required O&M Requirements					100	
Standard of Care Not Translated Into *"Language"* of Client					100	
Lack of Project-Specific QMP					100	
Accepting Lower Fee Than Required					100	
Not Clearly Documenting Client Rejecting Advice					100	
Confirm Project Requirements Meet Clients Contract Understanding					100	
Weekly (MON., 7:30 a.m.) Project Team Mtg.					100	
	Subtotals,				**1,100**	
Divide Subtotals by 11,					100	
<>Process Based on Your Project Experiences:						
For each critical project element, note the 4 percentages horizontally such that each adds up tc						
Once entire set of 11 issues done, vertically add up each of the four element work category colum						
Finally, divide each of your four grand totals by the number of issues, i.e., 11						
Q. When you review the noted 4 grand subtotals averaged, what do you conclude?						Jul-25

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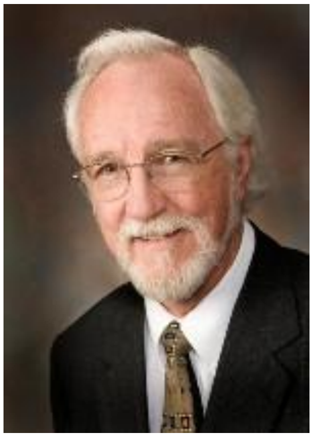
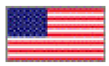
About The Author



Dr. William M. Hayden, Jr.

New York, USA



William M. Hayden Jr. holds a A.A.S. degree in Highway and Bridge Construction Technology, B.S. and M.S. degrees in Civil Engineering and a Ph.D. degree in Engineering Management. He was inducted into Chi Epsilon and Tau Beta Pi. He also holds a CMQ/OE certificate and was a Registered Professional Engineer from 1970 to 2006. With over 35 years of experience in project management, he has successfully overseen projects of varying sizes and complexities. From 1985 to 1997 he provided consulting quality management services to E/A/C private and public sectors organizations across the US, Canada, and parts of Mexico, Porto, Budapest, Riyadh, Tokyo, Seoul, and Manila. He was the COO for an E/A/C professional services firm with leadership and management responsibility for 130 persons across 3 Regional Offices, also as the Senior Partner, Human Resources. From 1998 to 2024 he was adjunct assistant professor in the University at Buffalo School of Management, teaching graduate courses in Project Management and Strategic Quality Management.

Dr. Hayden can be contacted at: https://www.linkedin.com/in/william-m-hayden-jr-phd/