Introduction to Systems Science Project

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Program: [Program Name]

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[Month day, 20yy]

Abstract

[Abstracts should not exceed 120 words. Note that abstracts in APA format are not indented. Write the abstract at the END of the project during Week 9 or Week 10. READ the section on abstracts in the *APA Manual* for guidelines and details. *Note*: An abstract is not an introduction to the paper.]

Table of Contents

Introduction to Systems Science Project

[Introduce the Project and cover what will be presented in this paper in less than a page. The project is: You have been asked to review a system of interest (artificial, biological, natural, or social) to better understand the "as-is" situation and to recommend an innovative "to-be" future version of the system.

Examples of artificial systems include cities, countries, software, hardware, networks ...

Examples of biological systems include any flora or fauna.

Examples of natural systems include the atmosphere, the biosphere, the earth, star systems, waterways, ...

Examples of social systems include corporations, small business, nonprofits, a community organization, a government agency/subagency, a military organization, an educational institution, or something else involving people, resources, and goals, such as a city, county, state, country, society at large, or a selected subset.

Replace instructional material within square brackets with your material.]

Introduction to Systems Science (Week 1)

Systems Science

[Summarize the history of systems science, basic concepts or principles of systems science, and at least two contemporary definitions in both narrative and set theory form.]

Systems Diagram

[Insert the selected systems context diagram as a figure here along with its title.]

System Description

[Describe this system in terms of its mission and goals if any, its geographical location, its boundary or what is in scope and out of scope; input and output materials, energy, and messages (MEM); primary systems process, life cycle stage, and tipping point(s), as needed to interpret the diagram. This section should be a narrative description of the systems diagram.]

Recommendations

[Recommend how this system could improve with a better understanding of systems science.]

Systems Thinking and Conceptual Frameworks (Week 2)

Interconnectedness

[List and describe some of the primary agents, components, or subsystems and how they relate or connect to each other.]

Feedback Loops

[Identify at least one positive-feedback loop and one negative-feedback loop in this system. Feedback loops are used here in the engineering sense of the term. That is, a positive-feedback loop is a reinforcing or amplifying loop and exhibits one of two possibilities: virtuous cycles or vicious cycles, depending on perspective. For example, if a savings account is increasing exponentially, this would be considered a virtuous cycle, whereas if a savings account was being depleted exponentially, this would be considered a vicious cycle. Negative-feedback loops are goal-seeking or regulating feedback loops.

Think of a thermostat as a good example. Other examples of a negative-feedback loop are the maintenance of inventory and staffing levels. Inventory is used up and needs to be replenished, and staff retire, leave, or whatever, and staffing levels may need to be maintained at a certain level to perform required tasks.]

Leverage Points

[Apply three or more of Meadows systems leverage points to help understand and improve the system of interest.]

Recommendations

[Recommend how this system could improve with a better understanding of systems thinking.]

Complexity Theory (Week 3)

Complexity Theory

[Define complexity theory, summarize its key principles, and finally apply some of these principles to the system of interest.]

Recommendations

[Recommend how this system could improve with a better understanding of complexity theory.]

Systems Archetypes and Disciplines (Week 4)

[If the system of interest is a social system, then this weeks work can be substituted for the work in Week 7.]

Archetypes

[Identify and describe three systems archetypes observed in the system of interest. Analyze and evaluate problems indicated by these archetypes (e.g., limits to success, tragedy of the commons, escalation, success to the successful, shifting the burden, growth and underinvestment, fixes that fail, or eroding goals) and develop potential solutions or interventions for your client. For example, if product sales have been slowing after years of growth, it may be because that the market has reached its limit with everyone having this product that wants one. This is called the product life cycle in sales and marketing, while it is called the limits to growth in systems theory. A potential solution is to launch a new and improved version of the product.]

Disciplines

[Summarize personal mastery, mental models, shared vision, team learning, and systems thinking, and provide examples of where these disciplines exist in your organization.]

Recommendations

[Recommend how this system could improve with a better understanding of systems archetypes and systems disciplines.]

Systems Modeling (Week 5)

Causal Loop Diagramming

[Use AI or other method to create a causal loop diagram for at least a part of the system. Provide a narrative description of this causal loop diagram.]

Stock and Flow Diagramming

[[Identify and describe at least three stocks and associated flows within the selected system. *Note*: A stock is an accumulator, such as buildings, cash on hand, employees, or inventory A stock is NOT a financial instrument in this context. Inflows to cash on hand might be deposits, and outflows might be withdrawals. Inflows to employees might be new hires, and outflows might be resignations, retirements, or outplaced.
Use AI or other method to create two or three stock and flow diagrams for at least a part of the system.]

Recommendations

[Recommend how this system could improve with a better understanding of the generated or created diagrams.]

Networks (Week 6)

Networks

[Identify and describe three different networks found in the system. A network is a set of nodes and links where nodes may be people, computers, documents, databases, subroutines, molecules, and such, while links are relationships, for example, reports to, collaborates with, manages, leads, and so on. Materials, energy, and messages flow across networks. Explain how each of these three networks might inform decision making in the client system. Examples of network typologies include: tree, ring, line, bus, mesh, fully connected, or star. Networks of people may be formal (well defined roles and functions), informal (few set roles and functions), or family. One example of a network is an

organization chart with nodes being people and relationships being *reports to*, *manage*, or some such terminology. Another example of a network would be a set of related modules in a software program.]

Recommendations

[Recommend how this system could improve with a better understanding of networks.]

Systems Dynamics (Week 7)

Systems Dynamics

[Summarize some of the key principles of systems dynamics and apply some of these principles to the system of interest.]

Recommendations

[Recommend how this system could improve with a better understanding of systems dynamics.]

Sustainability and Resilience in Socio-Ecological Systems (Week 8)

Resilience Matrix

[Use the World Economic Forum matrix to explore resilience in the selected system. This matrix contains 25 cells made up of the intersections of the X axis and the Y axis. The X axis elements are: *economic*, *environmental*, *governance*, *infrastructure*, and *social*. The Y axis elements are: *robustness*, *redundancy*, *resourcefulness*, *response*, and *recovery*. Describe any ten of these cells in narrative format. For example, describe how robust your organizational economics are in the economic/robustness cell. Continue to describe these

ten cells in this manner. Finally provide an overall assessment or evaluation of how resilient the system is based on your analysis.]

Recommendations

[Recommend how this system could improve with a better understanding of resilience.]

Evolutionary Systems (Week 9)

Systems Model

[Use AI, such as Gemini, Copilot …, to generate a causal loop diagram of an abstract evolutionary system, create a story about it, and turn the story into a podcast. Then explain how the model helps understand how abstract systems evolve over time.

]**Recommendations**

[Recommend how this system could improve with a better understanding of evolution.]

Supporting Research

[Compare and constrast information gained from the generated causal loop diagram with the information in the article by Fichter, Pyle, & Whitmeyer.]

Recommendations (Week 10)

Recommendations Summary

[Summarize an understanding of the system studied (“as-is”) and provide recommendations for an innovative future (“to-be”).]

References

[*Note:* These references are some examples. Most are available in Kindle format from Amazon.com. Replace this note and the references cited in this project with those used in this paper.]

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