the assembly ratings (complexity and sustainability) over the total number of steps:

Formula:

$$A = \frac{\sum_{i=1}^{N} (C_i \cdot S_i)}{T}$$

- Where,
  - A = calculated-complexity [index] of assembly (a.k.a., asssembly index, AI).
  - C_i = complexity rating of the i^{th} assembly step, based on predetermined criteria (e.g., technical difficulty, skill-level required).
  - S_i = sustainability rating of the i^{th} assembly step, reflecting environmental impact and resource efficiency.
    - This could be any variable; it could be time (T_i) required for the i^{th} step.
  - T = total number of steps in the assembly process.
  - N = final/last assembly step.

The complexity rating could be a function of various factors, such as the skill level required, the number of parts, or the precision needed. The time could be actual hours or a relative measure compared to other steps.

> **NOTE:** *The 'complexity of disassembly' and 'ease of complete recycling' variables can also be assessed using similar principles, adapting the formula to reflect disassembly and recycling processes, thus contributing to a full lifecycle analysis of products.*

Here, an electric vehicle may be used as an example assembly. Suppose the assembly of an electric vehicle is broken down into 4 major steps:

1. **Chassis assembly** (including the frame, wheels, and suspension)
   A. Complexity rating (C_1): 3 (on a scale of 1 to 5, where 5 is most complex).
   B. Sustainability rating (S_1): 4 (on a scale of 1 to 5, where 5 is most sustainable).
2. **Battery pack installation.**
   A. Complexity rating (C_2): 5.
   B. Sustainability rating (S_2): 3.
3. **Interior and electronics fitting.**
   A. Complexity rating (C_3): 4
   B. Sustainability rating (S_3): 3.
4. **Powertrain and final inspection.**
   A. Complexity rating (C_4): 4
   B. Sustainability rating (S_4): 4.

Total number of steps in the assembly process (T) = 4.

Applying the assembly index (A) formula:

Applied Formula:

$$A = \frac{(3 \cdot 4) + (5 \cdot 3) + (4 \cdot 3) + (4 \cdot 4)}{4} = 55/4 \quad = 13.74$$

- Where,
  - The assembly index of 13.75 reflects the weighted average of complexity and sustainability ratings across the four major steps of the EV assembly process.
  - A higher complexity rating (C_i) indicates more technical difficulty or higher skill levels required for the assembly step.
  - A higher sustainability rating (S_i) suggests that the step has a lower environmental impact and higher resource efficiency.

5.1.4 Global habitat production assembly complexity index[ing]

A global habitat production can be assembled with a determined complexity using the assembly formula:

1. Inputs:
   A. Habitats ($x_1 \rightarrow x_n$).
      1. Weights (each habitat) ($w_1 \rightarrow w_n$).
2. Summation and bias:

$$A \text{ (weights and habitats)} = \sum_{i=1}^{N} (W_i \cdot X_i) + \text{bias}$$

3. Activation:

$$F(x) = \begin{cases} 1 \text{ if } \sum wx + b \geq 0 \\ 0 \text{ if } \sum wx + b < 0 \end{cases}$$

4. Output result:

$\hat{y}$

5.1.5 Societal processes assembly complexity index[ing]

The assembly complexity index aims to quantify the overall efficiency, sustainability, and complexity of production across various stages and resources within society.

Here, the primary groups related to the production process are:

1. Labor-time index (LTi).
2. Labor-complexity index (LCi).
3. Assembly-step index (ASi).
4. Power-usage index (PUi).
5. Resource indices (mineral, cultivated, production

units, operational units).
   A. Recycled resources (RR).
6. Complexity and sustainability ratings for each process.

A simplified assembly complexity formula:

Formula:

$$A = \frac{\sum (\text{Complexity} \times \text{Sustainability} \times \text{Efficiency})}{\text{Total Processes}}$$

- Where,
  - **Complexity** is derived from the labor complexity (LCi), labor time (LTi), assembly complexity (a^i), and disassembly complexity (d^i).
  - **Sustainability** factors in the use of recycled resources (RR), labor availability, and energy efficiency.
  - **Efficiency** could encompass labor efficiency in hours (LHrs), resource utilization efficiency (MR, nMR), and power efficiency.

Imagine a scenario where a dwelling construction is under inquiry, incorporating components like sensors (technology), metal frames (mineral resources), and bioplastic casings (non-mineral resources).

1. Calculate individual components:
   A. For labor assume an average complexity of 3 and sustainability of 4 across 1000 LHrs.
   B. For assembly steps, including mineral and technology, assume a complexity of 4, sustainability of 3, and efficiency of 2 across all 10 steps.
   C. Power usage reflects the efficiency of energy consumption, with an assumed efficiency rating of 3 across all processes.

Hence, a simple view of the formula is:

Formula:

$$A = \frac{(3x4x2)_{LTI}+(4x3x2)_{ASI}x10_{steps}+(3)_{PUI}}{\text{Total Processes}}$$

Assuming "Total Processes" includes all steps in labor, assembly, and power usage, 12 total processes (2 labor processes, 10 assembly steps).

Formula:

$$A = \frac{(24)_{LTI}+(240)_{ASI}+(3)_{PUI}}{12} = \frac{267}{12} = 22.25$$

5.1.6 Product complexity assembly index[ing]

The assembly index is a quantitative measure used to assess the ease or complexity of assembling a given product. As the quantitative assessment of the complexity of any product the assembly index (A or AI) accounts for:

1. The number of components.
2. The necessity for specialized tools, techniques or skills.
3. The sequence of assembly steps.
4. The integration of parts into sub-assemblies.
5. The labor time (and compute time) it takes to create the assembly.

A higher Assembly Index typically indicates a more complex assembly process, requiring more time, specialized resources, or both. The assembly index analytical calculations informs efficient product design by quantifying the complexity of its assembly process.

While there is no standard formula for the assembly index (A) due to the variability in products and assembly processes, a hypothetical formula might be:

Formula:

$$A = \frac{n_c + n_t + n_s + n_i + k + n_{steps}}{n_p}$$

- wherein,
  - A = calculated-complexity [index] of assembly (a.k.a., asssembly index, AI).
  - n_c = number-count of components.
  - n_t = number-count of specialized tools required.
  - n_s = number-count of specialized skills required.
  - n_i = number of integration steps into sub-assemblies.
  - n_{steps} = number-count of number of discrete steps necessary to produce an assembly.
  - n_p = number-count of final product units assembled in a standard time period.
  - k = a weighting factor that adjusts the influence of the number of steps on the overall Assembly Index, reflecting the relative complexity added by each additional step in the assembly process. This factor can be calibrated based on empirical data or industry standards to accurately represent the impact of the assembly steps on the complexity of the product.

This formula can be complexified to account for all required variables:

Formula:

Formula:

$$A=\frac{n_c+k1\cdot n_t+K2\cdot n_s+k_3\cdot n_i+k_4\cdot N_{steps}+k_5\cdot n_v+k_6\cdot T_c+k_7\cdot C_{var}+k_8\cdot D_{com}}{n_p}$$

- Where,
  - A = calculated-complexity [index] of assembly (a.k.a., asssembly index, AI).
  - n_c = number-count of components.
  - n_t = number-count of specialized tools required.
  - n_s = number-count of specialized skills required
  - n_i = number of integration steps into sub-assemblies.
  - n_{steps} = number-count of number of discrete steps necessary to produce an assembly
  - n_v = number-count of variants of the product. Different versions of a product can increase assembly complexity due to the need for additional parts and assembly paths.
  - n_p = number-count of final product units assembled in a standard time period.
  - T_c = complexity of technology used in product.
  - C_{var} = variability in component quality or supply. Fluctuations in the quality or supply of components can increase complexity by necessitating additional quality checks or adjustments during assembly.
  - D_{com} = degree of communication required between team members. The need for coordination and communication among team members, especially in large or distributed teams, can add to the complexity of the assembly process. (or this variable could be straight labor hrs).
  - k1,k2,...,k8 = weighting factors for each variable (step).

5.1.7 Concentration assembly index[ing]

The assembly formula can measure the concentration of copies (species) of an assembled unit in a system/ environmental (ecological) context. This formula calculates the assembly index by summing the squares of the proportions of each unit (i.e., species) within the whole:

Formula:

$$A = \sum_{i=1}^{N} p_i^2$$

- Where,
  - A is the assembly index.
  - p_i is the proportion of individual units in the belonging to type/category (service, species, need, demand, count, etc.), *i*.
  - N = final/last iteration of the sum.

The following are the primary ways of embodying intentional functional extensions of objects into increasingly useful technology:

1. In chemical systems, molecular assembly treats bonds as the elementary operations from which molecules (micro-physical things) are constructed. Here, atomic bonding is the elementary unit-operation.
2. In electromagnetic systems, electromagnetic assembly treats rotating threads of atoms (separating threads of a rope), (magnetic lines of force), in place, are the elementary unit-operations from which electricity is created.
3. In electromagnetic systems, pumping atoms (torquing a rope) are the elementary unit-operations from light is created.
4. In mechanical (friction) systems, mechanical assembly treats joints and motors as the elementary units/operations from which complex macro-physical things are constructed.
5. In software (computation) systems, computer assembly language treats machine language instruction as the elementary unit-operations from which micro-software things are constructed. Here, computation is the elementary unit-operation.

Scholarly references (cited in document)

- Albino, V., Izzo, C., Kühtz, S. (2002). *Input-Output Models for the Analysis of a Local/Global Supply Chain*. International Journal of Production Economics, 78, pp119-131.
- Albino, V., Nicolo, M.D., Petruzzelli, A.M., Yazan, D. (2007). *Integrating Enterprise Input-Output Modelling with GIS Technology for Supply Chain Analysis*. 16th International Input-output Conference in Istanbul, Turkey, 2-6 July.
- Aulin-Ahmavaara, P. (2000). *Dynamic input-output and capital*. In Presentado en: 13th International Conference on Input-Output Techniques. University of Macerata, Italia. Agosto 2000. http://www.iioa.org/conferences/13th/files/AulinAhmavaara_DynamicIO%26Capital.pdf
- Chevaleyre, Y., Dunne, P.E., Endriss, U., et al. (2006). *Issues in multiagent resource allocation*. INFORMATICA, 30 , 2006.
- Cockshott, P. (2008) *Calculation in-Natura, from Neurath to Kantorovich*. University of Glasgow. http://www.dcs.gla.ac.uk/~wpc/reports/standalonearticle.pdf
- Cockshott, P. (2014). *Mises, Kantorovich and economic computation*. University Library of Munich, Germany, MPRA Paper. https://www.researchgate.net/publication/24114759_Mises_Kantorovich_and_Economic_Computation

- Cockshott, P. (2018). *Returning to Kantorovich*. https://www.academia.edu/35712859/Returning_to_Kantorovich
- Cottrell, A., Cockshot, P. (2008). *Computers and economic democracy*. Revista de Economia Institucional. (1). http://socialsciences.scielo.org/scielo.php?script=sci_arttext&pid=S0124-59962008000100001
- Cole, D.H., Grossman, P.Z. (2008). *Institutions Matter! Why the Herder Problem is Not a Prisoner's Dilemma*. SSRN. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1114541
- de Filippi, P., Mccarthy, S. (2012). *Cloud Computing : Centralization and Data Sovereignty*. European Journal of Law and Technology. University of Warwick. 3 (2). ffhal-00746065. http://hal.archives-ouvertes.fr/docs/00/74/60/65/PDF/07_-_2012_EJLT_-Cloud_Computing_and_Data_Sovereignty.pdf
- Fath, B.D., Patten, B.C. (1999). *Review of the Foundations of Network Environ Analysis*. Ecosystems 2(2):167-179. https://www.researchgate.net/publication/201997490_Review_of_the_Foundations_of_Network_Environ_Analysis
- Goldberg, E., Podell, K. (1999). *Adaptive versus Veridical Decision Making and the Frontal Lobes*. Consciousness and Cognition, 8(3), 364-377
- Haber, J. (2015). *Modeling Distributed Cybernetic Management for Resource Based Economies: A simulation approach to Stafford Beer's 1971 CyberSyn Project*. University of Amsterdam, Intelligent Systems Lab. Bachelor thesis. https://esc.fnwi.uva.nl/thesis/centraal/files/f1930828629.pdf
- Hayek, F. A. (1945). *The Use of Knowledge in Society*. The American Economic Review. American Economic Association. Vol. 35, No. 4. https://www.jstor.org/stable/1809376
- Hayek, F. A. (1955). "*Degrees of Explanation*". In Hayek, Friedrich A. (1967). Studies in Philosophy, Politics and Economics. Chicago: University of Chicago Press.
- Heinz, D.K., Salvadori, N. *'Classical' Roots of Input-Output Analysis: A Short Account of its Long Prehistory*. Accessed: April 2020. https://www.iioa.org/conferences/13th/files/Kurz&Salvarodi_IOsClassicalRoots.pdf
- Lahiri, S. (1976). *Input-output analysis with scale-dependent coefficients*. Econometrica: Journal of the Econometric Society, pp.947–961.
- Malczewski, J. (2004). *GIS-based land-use suitability analysis: a critical overview*. Progress in Planning, 62, pp3-65.
- Polenske, K.R. (2001). *Competitive advantage of regional internal and external supply chain*. Lahr, M., Miller, R. (Eds.), Perspective in regional science: a Festschrift in Memory of Benjamin Stevens. Elsevier, Amsterdam. Production Economics, Vol. 55, pp281-294.
- Rodrigues, J., Marques, A., Wood, R., Tukker, A. (2016). *A network approach for assembling and linking input–output models*. Economic Systems Research. Volume 28, 2016, Issue 4. https://doi.org/10.1080/09535314.2016.1238817
- Samothrakis, S. (2020). *Open Loop In Natura Economic Planning*. https://doi.org/10.48550/arXiv.2005.01539
- Soule, M.E. (1985) *What is conservation biology?* BioScience, Vol. 35, No. 11. [uvm.edu]
- Tan, R.R., Aviso, K.B., Promentilla, M.A.B., Yu, K.D.S., antos, J.R. (2018). *Input-Output Models for Sustainable Industrial Systems: Implementation Using LINGO. Springer*. Lecture Notes in Management and Engineering. https://doi.org/10.1007/978-981-13-1873-3_1
- Wooldridge, M., Jennings, N.R. (1995). *Intelligent agents: theory and practice*. The Knowledge Engineering Review, 10 , 152. https://www.cambridge.org/core/journals/knowledge-engineering-review/article/intelligent-agents-theory-and-practice/CF2A6AAEEA1DBD486EF019F6217F1597

Scholarly references (non-cited)

- Albino, V., Petruzzelli, A.M., Okogbaa, O.G. (2009). *Managing Logistics Flows Through Enterprise Input-Output Models*. 2008 IEEE International Conference on Industrial Engineering and Engineering Management, IEEM 2008. 852 - 856. https://doi.org/10.1109/IEEM.2008.4737990 | https://www.researchgate.net/publication/224366921_Managing_Logistics_Flows_Through_Enterprise_Input-Output_Models
- Bazhanov, A. (2008). *Maximin-optimal sustainable growth in a resource-based imperfect economy.* Far Eastern National University. https://mpra.ub.uni-muenchen.de/19258/2/MPRA_paper_19258.pdf
- Cockshot, P., Cottrell, A., et al. (2009). *Classical Econophysics*. Routledge, 2009. Chapter 5 & 15. Cockshot, P., Zachariah, D. (2017). *Leontief Meets Shannon - Measuring the Complexity of the Economic System*. ResearchGate. https://www.researchgate.net/publication/316736719_Leontief_Meets_Shannon_-_Measuring_the_Complexity_of_the_Economic_System | https://arxiv.org/abs/1705.02154
- Cole., D.H., Grossman, P.Z. (2010). *Institutions Matter! Why the herder problem is not a prisoner's Dilemma*. Theory and Decision. 69(2). pp 219-231. doi.org/10.1007/s11238-008-9121-3
- Epstein, J. M. (2008). *Why model? Journal of Artificial Societies and Social Simulation*, 11 (4), 12. http://jasss.soc.surrey.ac.uk/11/4/12.html
- Goldspink, C. (2002). *Methodological implications of complex systems approaches to sociality: Simulation as a foundation for knowledge*. Journal of Artificial Societies and Social Simulation, 5 (1), 1:19.
- Guevara, Z., Rodrigues, J.F.D., Domingos, T. (2015). *The Ultimate Energy Input-Output Model*. https://pdfs.semanticscholar.org/c713/1330d24002b91b6f12de658f8bcfe62b105c.pdf
- Schaffer, W.A. (1976). *On the use of input-output models for regional planning*. Studies in Applied Regional Science, Vol 1. H.E. Stenfert Kroese B.V., Leiden. https://doi.org/10.1007/978-1-4613-4358-5
- Siebers, P., Aickelin, U. (2008). *Introduction to multi-agent simulation*. CoRR. http://arxiv.org/abs/0803.3905
- Vershik, A.M., (2007). L. V. *Kantorovich and linear programming*. St. Petersburg Department of Steklov Institute of Mathematics. https://arxiv.org/pdf/0707.0491.pdf

Book references (cited in document)

- Dobb, M., Pollitt, B. (2008). *Development of Socialist Economic Thought*. Lawrence & Wishart.
- Hardin, G. (1986). *Running on "empty"*. BioScience, 36(1), p2. https://doi.org/10.2307/1309787 https://academic.oup.com/bioscience/article-abstract/36/1/2/336174
- Leontief, W.W. (1941). T*he Structure of the American Economy*. Oxford University Press, New York.
- Leontief, W.W. (1986). *Input-output economics*. Oxford University Press.
- Kantorovich, L. V. (1960). *Mathematical methods of organizing and planning production*. Management Science, 6(4), 363–422. Originally published as Matematicheskie metody organizatsii i planirovaniia proizvodsiva. Leningrad: State Publishing House, 1939.
- Kantorovich, L. V. (1965). *The Best Use of Economic Resources*. Oxford: Pergamon. Originally published as Ekonomicheskii raschet nailchshego isplo 'zovaniia reurov. Moscow: State Publishing House, 1959.
- Puterman, M.L. (2014). *Markov decision processes: discrete stochastic dynamic programming*. John Wiley & Sons.
- Rifkin, J. (2015). *The Zero Marginal Cost Society*. Griffin.
- Shannon, C. E., Weaver, W. (1949). *The Mathematical Theory of Communication.* Urbana, Ill.: University of Illinois.

Book references (non-cited)

- Cockshot, P., Mackenzie, L., Michaelson, M., et al. (2011). *Computation and its limits*. Oxford University Press.
- Cockshott, P., & Cottrell, A. (1993). *Towards a new socialism.* Nottingham: Spokesman.
- Cockshot, P., Cottrell, G., et al. (2009). *Classical Econophysics*. Routledge.
- Joseph, P. (2017). *The New Human Rights Movement: Reinventing the Economy to End Oppression*. BenBella Books.
- Russel, S. Norvig, P. (2015). *Artificial Intelligence: A modern approach.* Pearson Education India. http://aima.cs.berkeley.edu/

Online references (cited in document)

- Cockshott, W.P. & Cottrell, A.F. (1996). *Information and Economics: A Critique of Hayek*. https://users.wfu.edu/cottrell/socialism_book/hayek_critique.pdf
- Cockshott, P. (2019). *Input-output or Harmony planning*. Paul Cockshott's Blog. https://paulcockshott.wordpress.com/2019/05/14/input-output-or-harmony-planning/
- Cockshot, P. (2019). *5yearplan*. GitHub Repository. https://github.com/wc22m/5yearplan
- Cockshott, P. (2018). *5 year planing software performance*. Paul Cockshott Channel. https://youtu.be/rtZQtEnGtLc
- Cockshott, P. (2018). *Using linear programming for 5 year plans*. Paul Cockshott Channel. https://youtu.be/PqzJ5hrnDCk
- Cockshott, P. (2018). *Harmonious plans*. Paul Cockshott Channel. https://youtu.be/czcnmQ3ua0Y
- Epstein, J.E. (1982). *Have You Ever Tried to Sell a Diamond?* The Atlantic. February. http://www.theatlantic.com/magazine/archive/1982/02/have-you-ever-tried-to-sell-a-diamond/304575/
- *External Research*. The Equality Trust. Accessed: January 7, 2020. https://www.equalitytrust.org.uk/taxonomy/term/94
- Joseph, P. (2013). *Economic Calculation in a Natural Law / RBE, Peter Joseph, The Zeitgeist Movement, Berlin.* Accessed: January 7, 2020. https://youtu.be/K9FDIne7M9o | http://theeconomicrealms.blogspot.com/2014/06/peter-joseph-on-economic-calculation-in.html
- Mazhar, F. (2007). *Any discourse of "rights" presupposes an autonomous and egocentric subject.* GRAIN. https://www.grain.org/article/entries/635-farhad-mazhar

Online references (not cited)

- *Check your understanding: Input-output models*. (2018). The University of Vermont. https://www.uvm.edu/~wgibson/CYU/CYU_InputOutput.pdf
- *Conferences of the International Input-Output Association*. IIOA. Accessed: January 24, 2020. https://www.iioa.org/
- *Economic calculation in a resource based economy – a defence*. (2015). The Resource-Based Economy Blog. http://web.archive.org/web/20180324213816/http://www.theresourcebasedeconomy.com/2015/01/economic-calculation-in-a-resource-based-economy-a-defence/
- Holman, Z. (2012). *How GitHub Uses GitHub to Build GitHub by Zach Holman.* Accessed: January 7, 2020. https://youtu.be/qyz3jkOBbQY
- Holman, Z. *How Github works.* Accessed: January 7, 2020. https://zachholman.com/posts/how-github-works/
- *In Soviet Union, Optimization Problem Solves You*. (2012). Three-Toed Sloth Blog. http://bactra.org/weblog/918.html
- *lpsolve: Mixed Integer Linear Programming (MILP) Solver*. (2016). https://sourceforge.net/projects/lpsolve/
- Joseph, P. *Works/Projects by Peter Joseph*. Accessed: January 7, 2020. http://peterjoseph.info/projects/
- *Kantorovich*. Accessed: January 25, 2020. https://drive.google.com/drive/folders/1CBkWwqdO1OT0y2kcZ04JI45oulgt-Pn6 | https://paulcockshott.wordpress.com/returning-to-kantorovich/ (description of program]
- Kiernan, N. (2011). *A realistic look at the economic calculation problem*. V-Radio Blog. http://v-radioblog.blogspot.com/2011/04/realistic-look-at-economic-calculation.html
- Kiernan, N. (2011). *Misean "Calcuation Problem" debunked*. V-Radio Blog. http://v-radioblog.blogspot.com/2011/04/misean-calcuation-problem-debunked.html
- Morozov, E. (2019). *Digital Socialism: The calculation debate in the age of big data*. New Left Review. https://newleftreview.org/issues/II116/articles/evgeny-morozov-digital-socialism
- TZM Lecture Team. (2014). *The Zeitgeist Movement*

Defined: Realizing a New Train of Thought. https://wiki.p2pfoundation.net/Zeitgeist_Movement_Defined:_Realizing_a_New_Train_of_Thought

- Von Mises, L.V. (1902). *Economic Calculation Problem*. https://wiki.mises.org/wiki/Economic_calculation_problem

TABLES

Table 17. **Decisioning > Decision Table Parts:** *The parts of a decision table.*

	Stub (programming)	Entry
Condition / Inquiry	Condition / Inquiry Stub	Condition Entry
Action	Action Stub	Action Entry

Table 18. **Decisioning > Decision Table Parts:** *The parts of a decision table.*

Decision Table		Requirements (Rules) *Part*		
		Rule 1	**Rule 2**	**Rule 3**
Stub *Part*	**Condition 1**	Condition Entry *Part*		
	Condition 2			
	Action 1	Action Entry *Part*		
	Action 2			

Table 19. **Decisioning > Decision Table Parts:** *The parts of a decision table.*

Decision table		Requirements *(Rules Part)*		
		Requirement 1	**Requirement 2**	**Requirement 3**
If, Then *(Stub Part)*	**Condition 1** *or* **Inquiry 1**	Entry *Part*		
	Condition 2 *or* **Inquiry 2**			
	Action 1 *or* **Solution 1**			
	Action 2 *or* **Solution 2**			

Table 20. **Decisioning > Decision Table Parts:** *The parts of a decision table showing the if, then, else statement. The "IF" part are the conditions 1 ... n. The "THEN" part is the actions 1 ... n. Sometimes a decision table will contain an ELSE column at the far right. This is a single decision rule that essentially says that if any of the previous rules in table (to the left of the ELSE column) were not triggered, than take the action(s) specified in the ELSE column. This is a way of simplifying a decision table where only certain condition sets require specialized responses and all other conditions can be responded to with the same action.*

	Rules			
IF	**Decision Rule 1**	**Decision Rule 2**	**Decision Rule 3**	ELSE
Condition 1		*Entries*		
Condition 2				
Condition 3				
THEN				
Action 1		*Entries*		
Action 2				
Action 3				

TABLES

Table 21. *This table presents a highly simplified economy in terms of inputs and outputs. In this table, it says that 280,000 kilograms of corn seed plus 1,800,000 liters of fuel were used in the cultivation sector to produce an output of 14,000,000 kilograms. Here, there is a feed-forward relationship. Corn is used to make flour, flour is used to make final food-like substances, which is then consumed. Fuel is used everywhere. Production products are used everywhere. Labor is used everywhere. The final two columns (on the right) show final consumption by users. Labor is not applicable in the final physical consumption. Final physical consumption of fuel is 38,430,000. 638,666 flour for home baking. The value of flour is computed as 0.1.0 = (D3*C10+D6*F10+D7*G10+D8)/D9. This means (corn used * value corn + fuel used * value fuel + produces * value produces + labor)/output of flour. Iterative solving must be used on a spreadsheet to do this since values are recursively defined.*

	Units (measured)	Corn Seed	Flour	Final Food (loaves of corn bread)	Fuel	Produces	Final Physical Consumption	Total Productive Consumption in Physical Terms
Corn Seed	Kilograms	280,000	13,034,000	84,851	0	0	601,149	13,398,851
Flour	Kilograms	0	0	8,485,134	0	50,000	638,666	8,535,134
Final Food (loaves of corn bread)	Loaves	0	0	0	0	0	10,283,982,408	0
Fuel	Kilograms	1,800,000	100,000	800,000	10,600,000	1,270,000	38,430,000	14,570
Produces	Kilograms	204,000	20,000	90,000	200,000	254,000	702,009	768,000
Labor	Person years	467,421	50,000	1,637	544,000	2,570,000	N/A	5,278,421
Output		14,000,000	9,123,800	10,283,982,408	53,000,000	1,470,009		
Value Per Unit	Person years per unit (kg)	0.069	0.109	0.00027	0.023	2.138		

TABLES

Table 22. Decisioning > Simple Decision Table: *The left column is the stub portion. The c letter represents conditions (c1,c2,...) and the a letter represents actions (a1,a2,...). The top row is the condition portion; it is the requirements or rules. Each column in the entry portion is a rule (i.e., rule 1, 2, ...). Rules indicate which actions, if any, are taken for the circumstances indicated in the condition portion of the rule. In this example, when conditions c1,c2,c3 are all true, then actions a1 and a2 occur. When conditions c1 and c2 are true, then action a3 occurs. The pattern continues forward in this manner.*

	Entry Portion				
Stub Portion	**Rule 1**	**Rule 2**	**Rule 3**	**Rule 4**	**Rule 5**
Condition 1	T	T	T	F	F
Condition 2	T	T	F	T	F
Condition 3	T	F	T	T	F
Action 1	x	...	x	x	...
Action 2	x	...	...	x	...
Action 3	...	x	...	...	...

Table 23. Decisioning > Simple Decision Table: *The parts of a decision table. This is illustrative of the decision system in this standard.*

	Entry Portion				**Total**
Stub Portion	**Objective 1**	**Objective 2**	**Objective 3**	**Objective 4**	
Inquiry 1	T	T	T	F	3
Inquiry 2	T	T	F	F	2
Inquiry 3	T	F	T	F	2
Solution 1	x	...	...	...	1
Solution 2	...	...	...	...	0
Solution 3	...	...	...	...	0

Table 24. Decisioning > Decision Table Parts: *The parts of a decision table.*

Decision Table	*Entry Portion (Condition Entries; Habitat Service Case Rules)*				
Stub Portion	Rule 1	Rule 2	Rule 3	Rule 4	Rule 5
Conditions					
Condition 1	choice 1a	choice 1b	choice 1a	choice 1b	choice 1b
Condition 2	choice 2a	choice 2b	choice 2a	choice 2a	choice 2b
Outcomes					
Outcome 1	x	...	...	x	...
Outcome 2	...	x	...	...	...

Table 25. Decisioning > Decision Table Parts: *The parts of a decision table.*

Objects	Conditions			Decision
	Distance	Capacity	Requirements	Acceptance
S1	short	yes	low	yes
S2	shortest	yes	high	yes
S3	long	no	high	yes
S4	shortest	no	low	no
S5	longest	yes	low	no
S6	short	no	high	no

TABLES

Table 26. Decisioning > Decision Table: *A decision table showing the conditions (value alignment objectives), service systems, and service system solutions. The entries are fictitious.*

Conditions ⇩	**Solutions ⇨**	Habitat Service Solutions									
		Life Support Service				Technology Support Service				Exploratory Service	
		Solution 1	Solution 2	...	Solution n	Solution 1	Solution 2	...	Solution n	Solution 1	Solution n
Value Alignment Planning	Justice Inquiry	T	T	...	F	F	F	...	F	T	F
	Social Inquiry	F	T	...	T	T	F	...	F	T	T
	...	...	...	...	...	...	...	...	...	...	...
	Inquiry n	F	F	...	T	T	T	...	F	T	F
Economic Sector Calculation Planning Matrix	Life Support Resources	3	4	...	3	1	1	...	1	5	9
	Technology Support Resources	1	2	...	4	1	1	...	1	2	8
	Exploratory Resources	5	5	...	9	5	7	...	4	8	8
Contribution		3	5	...	5	4	3	...	1	1	5
Priority (Urgency Spectrum) Determination		1	1	...	1	5	5	...	5	8	8
Total Solution Inputs		∑	∑	...	∑	∑	∑	...	∑	∑	∑
Actions											
Action 1 (Accept)		x	-	...	x	-	x	...	x	-	x
Action 2 (Reject)		-	x	...	-	x	-	...	-	x	-

Table 27. Decisioning > Decision Table: *A decision table showing the conditions (design acceptability protocol), the acceptable actions (reject or accept), and a series of solution options from solution Case 1A to 3A. In this example, only 1 solution is acceptable, 2A. Only one solution passes all the inquiries:*

DECISION TABLE **Design Acceptability Protocol ⇩**	**Solution Options ⇨**	Technical Solution Inquiry					
		Solution Case 1A	Solution Case 1B	Solution Case 2A	Solution Case 2B	Solution Case 2C	Solution Case 3A
Parallel Value Alignment Inquiry	Justice Inquiry	T	T	T	T	F	T
	Resource Inquiry	F	T	T	T	T	T
	Environmental Inquiry	F	T	T	T	F	T
	Efficiency Inquiry	T	F	T	T	T	F
	Preference Inquiry	F	F	T	T	T	T
	Effectiveness Inquiry	T	T	T	F	T	T
Actions							
Action 1 (Accept Solution)		-	-	X	-	-	-
Action 2 (Reject Solution)		X	X	-	X	X	X

TABLES

Table 29. Decisioning > Decision Table: *An example decision table with the conditions (inquiries) as rows and the potential solutions as columns. The inquires are conducted on each solution, and the solution is scored.*

DECISION TABLE		Design Options (Solutions)						
		Design Option 1		Design Option 2		...	Design Option *n*	
Priority		Weight	Score	Weight	Score	...	Weight	Score
Decision Inquiry Processes	Inquiry 1	#	#	#	#	...	#	#
	Inquiry 2	#	#	#	#	...	#	#
	...	...	...	..	...	...	...	...
	Inquiry *n*	#	#	#	#	...	#	#
Total		#	#	#	#	...	#	#

Table 28. Decisioning > Decision Table: *An example decision table with the value alignment objective criteria to the left and the solution scores on the right.*

Criterion type *(eliminatory or ranking only)*	Criterion *(objective)*	Criterion Weight	Threshold *(accept, go OR not accept, no go)*	Solution Scores		
				Score for solution 1	Score for solution 2	Score for solution 3
Eliminatory	Effectiveness	2	3	2	4	2
Ranking only	Justice	2	5	6	2	1
...	...	...	...	...	...	...
Ranking only	Social	4	2	3	5	7
Ranking only	Power usage	2	*Does not apply*	1	3	6
Ranking only	Availability	3	7	3	9	2
Ranking only	Manufacturability	3	5	2	4	1

Table 30. Decision System > Resource-Based > MacroCalculation*: The resource-based logical design calculation table.*

Logical Symbol	Description
E_{design}	Design efficiency
E_p	Production efficiency (Optimized production efficiency)
E_{dist}	Distribution efficiency (Optimized distribution efficiency; $\mathbf{d}_p$)
E_r	REcycling efficiency (Optimized recycling efficiency; P_{reg})
E	Efficiency
$\mathbf{f}_p$	Production functional
$\mathbf{E}^i_{design}$	[Current] Design efficiency standards
$\mathbf{t}_d$	Durability
A_{design}	Adaptability (design of)
$\mathbf{c}_r$	Recycling conduciveness of components
$\mathbf{g}^1_c, \mathbf{g}^2_c, \ldots, \mathbf{g}^i_c, \ldots, \mathbf{g}^{Nc}_c$	Genre components (total number)
Nc	Minimum number of genre components
$\mathbf{H}_L$	Human Labor
$\mathbf{A}_L$	Automated Labor
$\mathbf{f}_{design}$	Functional design efficiency
D	Demand class determination process
$\mathbf{D}_s$	Demand splitting value
$\mathbf{D}_c$	Consumer demand (or, $\mathbf{D}_u$ for user demand)
$\tilde{\mathbf{A}}_p$	Flexible automation process
$\bar{\mathbf{A}}_p$	Fixed automation process
$\mathbf{C}_i$	User with index i (or, $\mathbf{U}_i$ for user with index i)
$\mathbf{D}_i$	Distributor with index i
$\mathbf{d}_p$	Distance to production facilities (proximity protocol/strategy)
$\mathbf{d}_{dist}$	Distance to re-distribution facilities
$\mathbf{P}_{reg}$	Regenerative protocol
$\mathbf{DIST}_d$	Direct to user distribution
$\mathbf{DIST}_m$	Mass user distribution

TABLES

Table 32. Decision System > Resource-Based > MacroCalculation*: The calculation table for optimal labor-automation.*

Logical Symbol	Description
$\mathbf{H_L / (H_L + A_L) \rightarrow min}$	Human effort (labor) is reduced to its desired design minimum
$\mathbf{H_L (I_1 ,..., I_i) / A_L (I_1 ,..., I_i) \rightarrow min}$	This is the expression in its expanded form.
$\mathbf{I_i}$	Individual with index i

Table 31. Decision System > Resource-Based > MacroCalculation*: The calculation table for optimal durability.*

Logical Symbol	Description
$\mathbf{t_d}$	Durability maximization
$\mathbf{t_d (d_1 , d_2 ,..., d_i)}$	Durability maximization expanded
$\mathbf{d_i}$	Durability factors
$\mathbf{d^0_1 , d^0_2 ,..., d^0_i}$	Optimal and coordinated values of the factors
$\mathbf{t_d (d_1 , d_2 ,..., d_i) \rightarrow max, t_d = t_{max} (d^0_1 , d^0_2 ,..., d^0_i)}$	Optimized durability

TABLES

Table 33. Decision System > Economic Calculation Planning > Quadrant View: *A complex input-output flow table showing its basic four quadrant view (square n*n) of inputs and outputs for high-level visual comprehension of statistical operations to be completed on accountable quantities in order to produce economic calculation results useful for decisioning purposes.*

Sectors		**Inputs**		**Total Outputs**
Sectors				=
Outputs		**Quadrant 1** *Elements of intermediate demand* n•n matrix (a.k.a., nxn matrix)	**Quadrant 2** *Elements of final demand* n•m matrix (a.k.a., nxm matrix)	Quantity
		Quadrant 1 *Primary inputs to the production sector* p•n matrix (a.k.a., pxn matrix)	**Quadrant 4** *Primary inputs to the final demand* p•m matrix (a.k.a., pxm matrix)	Quantity
Total inputs	=	Quantity	Quantity	Result

Table 35. Decision System > Economic Calculation Planning > Simple Input-Output Table: *A simple economic input-output table example.*

	Purchasing Industry	Goes into				*Human Demand*
Selling Industry	*Sectors of simple economy*	Coal	Electricity	Water	Product *n*	**Total Output**
Comes out of	Coal	...	...	...	...	...
	Electricity	...	...	...	...	...
	Water	...	...	...	...	...
	Product *n*	...	...	...	...	...
Natural Resources	**Total Used/ Produced**	...	...	...	...	...

Table 36. Decision System > Economic Calculation Planning > Resource and Sector View: *The generalized case of an input-output matrix; wherein, x_i are resources or products, y_i is a sector of the economy (e.g., habitat service system), $\sum_i x_i$ is the total output produced in sector i, $\sum_i y_i$ are the total amount of resource x_i used in production across sectors.*

Resource flow to services inward ⇨ Resource flow to services outward ⇩		Resources *(and their resource compositions into 'products')*			
		x_1	...	x_n	$\sum_i x_i$
Sectors of the economy (and their aggregation into 'services systems')	y_1	...	...	...	...
	...	...	...	...	...
	y_n	...	...	...	...
	$\sum_i y_i$	...	...	...	...

Table 34. Decision System > Economic calculation Planning > Balancing: *Input-output table planning necessarily involves material balance planning of rows as well as column balance planning.*

Vector	Input-Output Table Planning *(balance rows and columns together)*	
Output (out from)	⇨	Row Balancing (*is* "material balance planning")
Input (in to)	⇩	Column Balancing

TABLES

Table 37. Decision System > Economic Calculation Planning > Service System Input-Output View: *Basic structure of an economic input-output table for [habitat] service systems.*

Inputs (Requirements) ⇨ / Outputs (Productions) ⇩		Habitat Service System Use				Final Human Use	
		Service System 1	Service System 2	...	Service System n	Total (Net) Economic Outputs *(demand)*	User Access *(type of, time of)*
Intermediate Habitat Service Systems	Service System 1	$Z^L_{1,1}$	$Z^L_{1,2}$	...	$Z^L_{1,n}$	d^L_1	a^{TYPE}_{TIME}
	Service System 2	$Z^L_{2,1}$	$Z^L_{2,2}$	...	$Z^L_{2,n}$	d^L_2	a^{TYPE}_{TIME}
	...	...	...	...	...	..	..
	Service System n	$Z^L_{n,1}$	$Z^L_{n,2}$	...	$Z^L_{n,n}$	d^L_n	a^{TYPE}_{TIME}
Total (Net) Economic Input	All Service Systems	w_1	w_2	...	w_n		

Table 38. Decision System > Economic Calculation Planning > Technical Interdependence: *Input-output table shows the technical interdependence between service systems in a given environment.*

Demand side (Inputs) ⇨ / Production side (Outputs) ⇩		index j (inputs; intermediary demand)				Final Use (Final Demand)	
		Service System 1	Service System 2	...	Service System n	+ User Final Demand (d, or sometimes, D or Y)	= Total Output (x)
index i (outputs)	Service System 1	$Z^L_{1,1}$	$Z^L_{1,2}$	...	$Z^L_{1,n}$	d^L_1	L_1
	Service System 2	$Z^L_{2,1}$	$Z^L_{2,2}$	...	$Z^L_{2,n}$	d^L_2	L_2
	...	...	...	...	...	...	...
	Service System n	$Z^L_{n,1}$	$Z^L_{n,2}$	...	$Z^L_{n,n}$	d^L_n	L_n
+ Priority Spectrum (priority added, or "value" added)		u_1	u_2	...	u_n	u_d	u
= Total Output Schedule		L_1	L_2	...	L_n	d	L
Key: Z = Intermediate Demand							

Table 39. Decision System > Economic Calculation Planning > Service System Input-Output View: *Basic structure of an economic input-output table for access by users to the service and object (goods) outputs of habitat service system sectors immediate and intermediate services and technologies (productions).*

Inputs (Requirements) ⇨ / Outputs (Supplies) ⇩		Habitat Service Sectors				Final Use (Final Demand Complete)	
		Service System 1	Service System 2	...	Service System n	Total (Net) Access quantity	User Access (type of, time of)
Habitat Service Sectors	Service System 1	$Z^L_{1,1}$	$Z^L_{1,2}$	...	$Z^L_{1,n}$	a^L_1	a^{TYPE}_{TIME}
	Service System 2	$Z^L_{2,1}$	$Z^L_{2,2}$	...	$Z^L_{2,n}$	a^L_2	a^{TYPE}_{TIME}
	...	...	...	...	...	..	..
	Service System n	$Z^L_{n,1}$	$Z^L_{n,2}$	...	$Z^L_{n,n}$	a^L_n	a^{TYPE}_{TIME}
Total Requirements		R_1	R_2	...	R_n	R_n	

TABLES

Table 40. Decision System > Economic Calculation Planning > Material Cycling: *Material cycling input-output economic table.*

Sectors of [Resource] Materialization		Inputs				
		Extraction Service	Cultivation Service	Production Service	Library Access Service	Recycling Service
Outputs	Extraction Service	X11	X12	X13	X14	X15
		X1	X2	X3	X4	X5
	Cultivation Service	X21	X22	X23	X24	X25
		X1	X2	X3	X4	X5
	Production Service	X31	X32	X33	X34	X35
		X1	X2	X3	X4	X5
	Library Access Service	X41	X42	X43	X44	X45
		X1	X2	X3	X4	X5
	Recycling Service	X51	X52	X53	X54	X55
		X1	X2	X3	X4	X5
Life Cycle Stages		Raw Materials >>	Raw Materials >>	Production & Transportation >>	Use >>	Disposal/Recycle >>

Table 41. Decision System > Economic Calculation Planning > Environmental Economics: *Environmental economics (a.k.a., eco-habitat economics). Material resources flow are measured along the rows. Activities are measured in the columns.*

Sectors of BioSphere		Activities (Task-Deliverables)	
		Habitat Service Systems *(Human)*	**Ecological Processes** *(Non-Human)*
Materials (Resources)	**Habitat Service Systems** *(Human)*	Flows between Habitat Service Systems (material flows, A_{xx})	Flows from the Habitat Service System to the Ecosystem (material flows, A_{xe})
	Ecological Processes *(Non-Human)*	Flows from the Ecosystem to the Habitat Service System (material flows, A_{ex})	Flows within the Ecosystem (material flows, A_{ee})

Table 42. Decision System > Economic Calculation Planning > Input-output: *Input-output economics base square table.*

		Demands *(users have requirements)*
		Input Product *(resource composition)*
Services *(have requirements to produce products)*	**Output Product** *(resource composition)*	*Accounting and Calculation occurs here*

Table 43. Decision System > Economic Calculation Planning > Decisioning > Simplified Input-Output Economic Table: *A simplified input-output table for a habitat-based economic system where habitat sectors are prioritized and patterns of demands are processed as intermediary requirements for resources to produce (as sectors) services and objects for the optimal and mutual fulfillment of all users by means of computation therein.*

Sectors of Habitat Economy	Processing	Final Demand	Total Outputs
Processing	**InterHabitat / InterSystem Structure**	**Usage Patterns**	
Total Inputs		**Optimal Path Calculation**	

TABLES

Table 46. Decision System > Economic Calculation Planning > Leontief Open and Closed: *This is an example of a Leontief closed table and open table.*

The Open and Closed Leontief models		OPEN MODEL: CLOSED MODEL				OPEN MODEL			
		Sector 1	Sector 2	...	Sector n	User Access (User Demand)	Taxes (Government Demand)	...	Demand n
CLOSED MODEL	Sector 1								
	Sector 2	**CLOSED MODEL** - When all outputs go to all inputs				**OPEN MODEL** - When some outputs go to "external" demands (e.g., user access, taxes, etc.)			
	...								
	Sector n								

Table 44. Decision System > Economic Calculation Planning > Accounting: *Simplified resource and process accounting table.*

To (Output) ⇨ From (Input) ⇩		Processes	User demand	Current Production
		1 ... *n*	**Final demand**	**Total Production**
Projects	**Process 1** ... **Process *n***	Endogenous transaction matrix $Z(n \times n)$	f (n x 1)	x (n x 1)
	Resource 1 ... **Resource *m***	Exogenous transaction matrix $R(m \times n)$		

Table 47. Decision System > Economic Calculation Planning > Simplified Matrix Model: *The following is a highly simplified example of a economic matrix (input-output) model.*

	Types of (sectors) of production	End product	Sum of output
Types of (sectors) of production	**Quadrant 1** $x_{11}x_{12}...x_{1n}$ $x_{21}x_{22}...x_{2n}$ ... $x_{n1}x_{n2}...x_{nn}$	**Quadrant 2** d_1 d_2 ... d_3	x_1 x_2 ... x_3
Input of primary resources	**Quadrant 3** $z_1z_2...z_n$	**Quadrant 4**	
Sum of inputs	$x'_1x'_2...x'_n$		

Table 45. Decision System > Economic Calculation Planning > Simplified Economic Plan: *The following is a highly simplified example of a simplified closed and planned economy, where distribution occurs from coal, electric, and steel, and is entirely used by coal, electric, and steel.*

Production of Coal	*Production of* Electric	*Production of* Steel	Used completely by:
0	**.4**	**.6**	**Coal**
.6	**.1**	**.2**	**Electric**
.4	**.5**	**.2**	**Steel**

TABLES

Table 48. Decision System > Economic Calculation Planning > Data Flow: *An economic system can be viewed as a table of data about access to need fulfillment based upon units of some operation.*

Gather all available data	Divide into categories	Divide categories into sub-categories	For selected areas supplement with data in physical units	Count quantity of resources	Calculate based on IO analysis and hybrid processes	Service Platform Resource Compositions and Allocations
DATA	NEEDS	DEMANDS	UNITS	RESOURCES	OPERATIONS	Access
Unified Societal Information System	**Life Support Service** System	Architectural service	metric	#	...	...
	Life Support Service System	Water service	metric	#	...	...
	Life Support Service System	Cultivation Service	metric	#	...	...
	Life Support Service System	Power Service	metric	#	...	...
	Life Support Service System	Medical Service	metric	#	...	...
	Technology Support Service System	Information Service *(Storage and Processing)*	metric	#	...	...
	Technology Support Service System	Communications Service *(Devices and Protocols)*	metric	#	...	...
	Technology Support Service System	Transportation Service *(Machines and Protocols)*	metric	#	...	...
	Technology Support Service System	Materialization Service *(Machines and Protocols)*	metric	#	...	...
	Exploratory Support Service System	Scientific Discovery Service	metric	#	...	...
	Exploratory Support Service System	Technology Development Service	metric	#	...	...
	Exploratory Support Service System	Learning Service	metric	#	...	...
	Exploratory Support Service System	Recreation Service	metric	#	...	...
	Exploratory Support Service System	Art & Music Service	metric	#	...	...
	Exploratory Support Service System	Consciousness Service	metric	#	...	...

Table 49. Decision System > Economic Calculation Planning > Natural User Economics: *An input-output table showing natural resources and demand within a community-type society where access is split three-ways: between intersystem teams (contributors who sustain and adapt the society); common [city] access (the city/habitat service commons); and, personal access.*

Resource Access Sectors		Contributor Activity Demands	Final User Activity Demands	
		InterSystem Team Access	**Common [City] Access**	**Personal Access**
Natural Resources	**Pre-existing motion (energy)**	Intermediary products (in order to do work, energy is needed)	Habitat service subsystem material interfaces	Habitat service subsystem objects
	Materials (organic and inorganic resources)	Intermediary products (in order for teams to do work, resources are needed)	Habitat service subsystem material interfaces	Habitat service subsystem objects
	Human contribution (capable and accountable individuals)	Intermediary products (in order to contribute, teams need intermediate products to do their work)	**Collaborative design system interface**	**Personal data and information processing interface**

TABLES

Table 50. Decision System > Economic Calculation Planning > Simple Input-Output Habitat Access and Allocation Table: *This is a simplified input-output table example of access and allocation within a habitat service system with priority designation and final community demand. The sectors of the economy are those fundamental to a habitat service system. The economy can be summarized by taking the last column: $X = x_1 + x_2 + x_3 + L_1 + L_2 + L_3$; or, taking the last row: $X = x_1 + x_2 + x_3 + dc + dp$*

Wherein,

- z_{ij} is the input of sector i to j
- d_i is the user component of final demand for output of sector i
- L_{ij} is the prioritization component of final demand for output of sector i
- x_i is the total output of sector i
- Lj is the priority input for sector j
- X is the total output for the entire economy

Combining the equations:

$$x_1 + x_2 + x_3 + L_i = x_1 + x_2 + x_3 + d_i$$
$$X_i + L_i = X_i + d_i$$
$$L_i = d_i$$

The left-hand side of the equation represents the [gross economic] priority row for all sectors, while the right-hand side represents demand for object/service production. Through a unified information system, it is possible to equate the total production, with the total demand, with total resources, with a human habitat prioritized operating structure, without price. Input-output analysis is the basis for this type of economic calculation (which generally uses linear algebra, but may in the future use neural networks).

		Intermediary Processes and Objects Input (j)				**Output of services and service objects to community**		
	Goes to ⇨	**Consuming Sectors** *(InterSystem Team Access; Habitat Service)*				**Final Demand; User Access (Community + Personal = Total Demand; d_i)**		**Total production output for demand (x_i)**
Comes from ⇩	[Processing] Sectors of Economy	**Life (S_1)**	**Tech (S_2)**	**Exp (S_3)**	**... S_n**	**Community (dc_i)**	**Personal (dp_i)**	
Producing Sectors (i) *(Intersystem Team Access; Habitat Service)*	**Life (S_1)**	Z_{11}	Z_{12}	Z_{13}	...	dc_1	dp_1	x_1
	Tech (S_2)	Z_{21}	Z_{22}	Z_{23}	...	dc_2	dp_2	x_2
	Exp (S_3)	Z_{31}	Z_{32}	Z_{33}	...	dc_3	dp_3	x_3
	... S_n	...	...	...	...	...	...	...
Priority Added (L_i)	**Incident (L_1)**	L_{11}	L_{12}	L_{13}	...	L_{1dc}	L_{1dp}	L_1
	Operations (L_2)	L_{21}	L_{22}	L_{23}	...	L_{2dc}	L_{2dp}	L_2
	Planning (L_3)	L_{31}	L_{32}	L_{33}	...	L_{3dc}	L_{3dp}	L_3
Total inputs (x_i)		x_1	x_2	x_3	...	**dc**	**dp**	X

Table 51. Decision System > Economic Calculation Planning > Simplified Matrix Model: *The following is a highly simplified example of a economic matrix (input-output) model.*

From / To	**Solution 1 ... n**	**Final Demand**	**Total Production**
Process 1 ... Process n	**Endogenous transaction matrix Z(n x n)**	**d(n x 1)**	x(n x 1)
Resource (R) 1 ... m	**Exogenous flow matrix R(m x n)**		
Contribution (C) 1 ... c	**Exogenous flow matrix C(m x c)**		
Objectives (O) 1 ... o	**Exogenous flow matrix O(m x o)**		
Sum of inputs	$x'_1 x'_2 ... x'_n$		

TABLES

Table 54. Decision System > Economic Calculation Planning > Simplified Matrix Model: *The following is a highly simplified example of a economic matrix (input-output) model.*

Habitat Process	Input	Operational Control Parameters	Output
User Demand	Survey	Arrival time, production process capability, product list	Compiled demand list
Logistics & Planning	Compiled demand list, technology matrix, priority matrix, resource list	List of materials, operational parameters	Schedule

Table 52. Decision System > Inquiry > Economic Calculation Planning > Decisioning > Impact-Probability: *Example of a qualitative matrix, a risk matrix. All qualitative matrices also have quantitative components (see: 1, 2, 3, 4), which are necessary for performing statistical/mathematical operations on the matrix in order to derive more useful data. Qualitative matrices exist in contrast to quantitative matrices, such as Leontif input-output matrices.*

Probability (consequence category)	Very Likely	**Acceptable Risk (2; Medium)**	**Unacceptable Risk (3; High)**	**Unacceptable Risk (4; Critical)**
	Likely	**Acceptable Risk (1; Low)**	**Acceptable Risk (2; Medium)**	**Unacceptable Risk (3; High)**
	Unlikely	**Acceptable Risk (1; Low)**	**Acceptable Risk (1; Low)**	**Acceptable Risk (2; Medium)**
	Occurrence/ Impact	Low	Moderate	High
Probability x Impact = Risk	**Impact** (How serious is the risk?)			

Table 53. Decision System > Economic Calculation Planning > Decisioning > Human-Habitat Priority: *The following is a highly simplified example of service sector priority in an real-world habitat economy where humans. Here, a lower priority value is of a higher importance to human need fulfillment.*

Prioritizable Sectors of Habitat Economy	Life	Technology	Exploratory	Total natural units
Life	**1**	**1**	**1**	**3**
Technology	**1**	**2**	**2**	**5**
Exploratory	**1**	**2**	**3**	**6**
Final Priority	**3**	**5**	**6**	**14**

Table 55. Decision System > Economic Calculation Planning > Material Cycling: *Material cycling input-output economic table. All inputs are consumed by all outputs. It is possible to think of individuals (subjects, agents, users, etc.).*

Sectors of Habitat		Inputs (j)			Total Output
		Habitat Service 1	**Habitat Service 2**	**Habitat Service 3**	
Outputs (i)	**Habitat Service 1**	X11	X12	X13	X1 j
	Habitat Service 2	X21	X22	X23	X2 j
	Habitat Service 3	X31	X32	X33	X3 j
Total Used *(of primary inputs; total primary inputs)*		∑ i	∑ i	∑ i	X X ∑ ∑ i j

TABLES

Table 56. Decision System > Economic Calculation Planning > Service System Input-Output Access Planning Matrix: *This is an access matrix for a unified habitat service system where there are three primary (economic) habitat service systems (sectors) and three forms of access to the inputs and outputs of those service systems. Basic summations for an input-output table for [habitat] service economic systems. $Z_{i,j}$ represents the quantity of some unit or value in each sector. The first three rows represent sectors dedicated to production of habitat services. The fourth row is a sum total of the rows above. The columns indicate the requirement for (i.e., value of/ demand for) the service sectors. The final right column is the total outputs of all sectors, and its total sum. Wherein, pers. (is personal access), com. (is common access), and tea. (is team access).*

Access Matrix: Access to the Inputs and Outputs of Sectors of a Habitat Service System			Inputs (j)									Total Output
			Habitat Service 1 (Life; Z1)			**Habitat Service 2 (Technology; Z2)**			**Habitat Service 3 (Exploratory; Z3)**			
			pers.	com.	tea.	pers.	com.	tea.	pers.	com.	tea.	
Outputs (i)	**Habitat Service 1 (Life; Z1)**	pers.										Z_1
		com.		Z_{11}			Z_{12}			Z_{13}		j
		tea.										
	Habitat Service 2 (Technology; Z2)	pers.										Z_2
		com.		Z_{21}			Z_{22}			Z_{23}		j
		tea.										
	Habitat Service 3 (Exploratory; Z3)	pers.										Z_3
		com.		Z_{31}			Z_{32}			Z_{33}		j
		tea.										
Total Used *(of primary inputs; total primary inputs)*												Z Z
				∑			∑			∑		∑ ∑
				i			i			i		i j

Table 57. Decision System > Economic Calculation Planning > Simple Input-Output Table: *Another simple economic input-output table example.*

		Inputs of Sectors				**Outputs to Final Using Humans**			
		Processing (InterSystem Team Access)				**Final Access (Community + Personal = Total Demand; d_i)**		**Total supply (s_i)**	**Total production for demand (x_i)**
	Sectors of economy	**A**	**B**	**C**	**…** *n*	**Community (dc_i)**	**Personal (dp_i)**		
Outputs of Sectors	**A**	…	…	…	…	…	…	…	…
	B	…	…	…	…	…	…	…	…
	C	…	…	…	…	…	…	…	…
	… *n*	…	…	…	…	…	…	…	…
Total Priority / Value Added		…	…	…	…	…	…	…	…
Total Used (x_i)		…	…	…	…	…	…	…	…

TABLES

Table 58. Decision System > Economic Calculation Planning > input-output table: *Simplified version of an economic input-output table showing resources moving into and out of sectors for a value oriented final demand.*

		Using Sectors						**Total Outputs (x_i)**
	Goes to ⇨	**Consuming Sectors** *(InterSystem Team Access; Habitat Service)*				**User Access**		
Comes from ⇩	[Processing] Sectors of Economy	**A**	**B**	**C**	**…** *n*	**Community (dc_i)**	**Personal (dp_i)**	
Producing Sectors (i) *(Intersystem Team Access; Habitat Service)*	**A**	z_{11}	z_{12}	z_{13}	…	dc_1	dp_1	x_1
	B	z_{21}	z_{22}	z_{23}	…	dc_2	dp_2	x_2
	C	z_{31}	z_{32}	z_{33}	…	dc_3	dp_3	x_3
	… *n*	…	…	…	…	…	…	…
	Contribution	C_{11}	C_{11}	C_{11}	…	C_{1dc}	C_{1dp}	
Value/s Added (L_i)	**Priority Added**	L_{11}	L_{12}	L_{13}	…	L_{1dc}	L_{1dp}	L_1
	Other Values Added (Objectives, Urgency)	L_{21}	L_{22}	L_{23}	…	L_{2dc}	L_{2dp}	L_2
Total inputs (x_i)		x_1	x_2	x_3	…	**dc**	**dp**	X

Table 59. Decision System > Economic Calculation Planning > Service System Input-Output View: *Basic summations for an input-output table for [habitat] service economic systems. $z_{i,j}$ represents the quantity of some unit or value in each sector. The first three rows represent sectors dedicated to production of habitat services. The fourth row is a sum total of the rows above. The columns indicate the requirement for (i.e., value of/demand for) the service sectors. The final right column is the total outputs of all sectors, and its total sum.*

Intermediary and Complete Matrix Z (Z or) *Inputs (Requirements) ⇨* *Outputs (Productions) ⇩*		Habitat Service System Use (j)							
		Service System 1	Service System 2	…	j	…	Service System n	Total Output to all Service Systems (-1)	Demand
Intermediate Habitat Service Systems (i)	Service System 1	$Z^{L}_{1,1}$	$Z^{L}_{1,2}$	…	$Z^{L}_{1,j}$	…	$Z^{L}_{1,n}$	$\sum_{j-1} z_{1,j}$	d_1
	Service System 2	$Z^{L}_{2,1}$	$Z^{L}_{2,2}$	…	$Z^{L}_{2,j}$	…	$Z^{L}_{2,n}$	$\sum_{j-1} z_{2,j}$	d_2
	…	…	…	…	…	…	…	…	
	i	$Z^{L}_{i,1}$	$Z^{L}_{i,2}$	…	$Z^{L}_{i,j}$	…	$Z^{L}_{i,n}$	$\sum_{j-1} z_{i,j}$	d_i
	…	…	…	…	…	…	…	…	
	Service System n	$Z^{L}_{n,1}$	$Z^{L}_{n,2}$	…	$Z^{L}_{n,j}$	…	$Z^{L}_{n,n}$	$\sum_{j-1} z_{n,j}$	d_n
Total (Net) Economic Input	Total used for all Service Systems (-1)	$\sum_{i-1}^{n} z_{i,1}$	$\sum_{i-1}^{n} z_{i,2}$	…	$\sum_{i-1}^{n} z_{i,j}$	…	$\sum_{i-1}^{n} z_{i,n}$	$\sum_{i-1}^{n} \sum_{j-1}^{n} z_{i,j}$	$\sum_{i-1}^{n} y_j$
Objectives	Variable Value Added (decisioning result)	V_1	V_2		V_j		V_n	$\sum_{j-1}^{n} V_j$	

TABLES

Table 60. Decision System > Economic Calculation Planning > Products and Sectors Matrix: *This is an example of a product and sector matrix.*

Products and Sectors (Objects and Services)		Inputs								Final Access Demand (Final Demands)	
Uses (To) ⇨		Products				Sectors				Final Use	
Resources (From) ⇩	HABITAT SERVICES & OBJECTS	Product 1	Product 2	...	Product n	Sector 1	Sector 2	...	Sector n	Common Access	Personal Access
Product Outputs	Product 1										
	Product 2	Output of products as input of products (output of objects as input of other objects)				Output of products as input of sectors (output of objects as input of services)				Objects used by the population	
	...										
	Product n										
Sector Outputs	Sector 1										
	Sector 2	Output of sectors as input of products (output of services as input of objects)				Output of sectors as input of other sectors (output of services as input of other services)				Services used by the population	
	...										
	Sector n										
Priority (Urgency Spectrum) Determination											
Total Inputs											

Table 61. Decision System > Economic Calculation Planning > Service Object Sector Access: *Table showing two sectors (Life and Tech) and final user demand for service-objects.*

Service and Object Access		(InterSystem) Team Access								Final Access (Final Demands)	
Inputs (To) ⇨		Habitat Service Sector 1 (Life)				Habitat Service Sector 2 (Tech)				Final Use	
Outputs (From) ⇩	HABITAT SERVICES & OBJECTS	Service 1	Service 2	...	Service n	Service 1	Service 2	...	Service n	Common Access	Personal Access
Sector 1 (Life)	Service 1	Service	Service	...	Service	Service	Service	...	Service	Service	Service
		Object	Object	...	Object	Object	Object	...	Object	Object	Object
	...	...	...	...	...	...	...	...	...	...	...
	Service n	Service	Service	..	Service	Service	Service	...	Service	Service	Service
		Object	Object	...	Object	Object	Object	...	Object	Object	Object
Sector 2 (Tech)	Service 1	Service	Service	...	Service	Service	Service	...	Service	Service	Service
		Object	Object	...	Object	Object	Object	...	Object	Object	Object
	...	...	...	...	...	...	...	...	...	...	...
	Service n	Service	Service	...	Service	Service	Service	...	Service	Service	Service
		Object	Object	...	Object	Object	Object	...	Object	Object	Object
Priority (Urgency Spectrum) Determination											
Total Inputs											

TABLES

Table 63. Decision System > Economic Calculation Planning > Decisioning > Matrix Operations: *Simplified view of the operation, input, and outcome of the three functions of addition (and subtraction), scalar multiplication, and matrix product.*

Operation		Input		Outcome	
Function	**Expression**	**Input 1**	**Input 2**	**Size**	**c_{ij} from**
Add / Subtraction	**C = A ± B**	$(a_{ij})_{m \times n}$	$(b_{ij})_{m \times n}$	$(c_{ij})_{m \times n}$	a_{ij}, b_{ij}
Scalar Multiplication	**C = kA**	**k**	$(a_{ij})_{m \times n}$	$(c_{ij})_{m \times n}$	k, a_{ij},
Matrix Product	**C = AB**	$(a_{ij})_{m \times p}$	$(b_{ij})_{p \times n}$	$(c_{ij})_{m \times n}$	i^{th} row of A j^{th} column of B

Table 62. Decision System > Economic Calculation Planning > Decisioning > Matrix Operations: *Two matrices are shown, W and W' (a.k.a., W prime). W' is the inverse of W. The identity matrix is shown in quadrant 2 of matrix W and Quadrant 3 of matrix W'.*

		Service 1	Service 2	...	Service n	Object 1	Object 2	...	Object n	
Matrix W =	Service 1	0	0	0	0	1	0	0	0	Identity matrix (I)
	Service 2	0	0	0	0	0	1	0	0	
	...	0	0	0	0	0	0	1	0	
	Service n	0	0	0	0	0	0	0	1	
	Object 1	0	1	1	0	0	0	0	0	
	Object 2	1	1	1	1	0	0	0	0	
	...	1	0	0	1	0	0	0	0	
	Object n	0	0	0	1	0	0	0	0	
		Production (p)								

		Service 1	Service 2	...	Service n	Object 1	Object 2	...	Object n	
Matrix W' =	Service 1	0	0	0	0	0	1	1	0	Production prime (p')
	Service 2	0	0	0	0	1	1	1	1	
	...	0	0	0	0	1	0	0	1	
	Service n	0	0	0	0	0	0	0	1	
	Object 1	1	0	0	0	0	0	0	0	
	Object 2	0	1	0	0	0	0	0	0	
	...	0	0	1	0	0	0	0	0	
	Object n	0	0	0	1	0	0	0	0	
		Identity matrix (I)								

TABLES

Table 64. Decision System > Economic Calculation Planning > Habitat Service Flows: *Simplified input-output table of a community-type habitat service system for human life, technical, and exploratory fulfillment. The economic sectors are: Life, Technology, and Exploratory. The primary sub-system services are shown for each of the top-level economic sectors for a community-type society.*

	Total top-level sectors and services for a habitat service system	Ecological Processes	Inputs															
			Life Support Service System	*Life Support Service System*	*Life Support Service System*	*Life Support Service System*	*Life Support Service System*	*Life Support Service System*	*Technology Support Service System*	*Technology Support Service System*	*Technology Support Service System*	*Technology Support Service System*	*Exploratory Support Service System*	*Exploratory Support Service System*	*Exploratory Support Service System*	*Exploratory Support Service System*	*Exploratory Support Service System*	*Exploratory Support Service System*
			Architectural service	Water service	Cultivation Service	Cultivation Service	Power Service	Medical Service	Information Service	Communications Service	Transportation Service	Materialization Service	Scientific Discovery Service	Technology Development Service	Learning Service	Recreation Service	Art & Music Service	Consciousness Service
Outputs	**Life Support Service** System	Architectural service																
	Life Support Service System	Water service																
	Life Support Service System	Cultivation Service																
	Life Support Service System	Power Service																
	Life Support Service System	Medical Service																
	Technology Support Service System	Information Service (Storage and Processing)																
	Technology Support Service System	Communications Service (Devices and Protocols)																
	Technology Support Service System	Transportation Service (Machines and Protocols)																
	Technology Support Service System	Materialization Service (Machines and Protocols)																
	Exploratory Support Service System	Scientific Discovery Service																
	Exploratory Support Service System	Technology Development Service																
	Exploratory Support Service System	Learning Service																
	Exploratory Support Service System	Recreation Service																
	Exploratory Support Service System	Art & Music Service																
	Exploratory Support Service System	Consciousness Service																

TABLES

Table 65. Decision System > Economic Calculation Planning > Habitat Sector Components: *Table show the primary service sector components of the three primary habitat services.*

Matrix of Habitat Sector Components			Habitat Service Sector 1 (Life)							Habitat Service Sector 2 (Technology)							Habitat Service Sector 2 (Exploratory)						
			Resources			Products	Access		Contribution	Resources			Products	Access		Contribution	Resources			Products	Access		Contribution
			Distance	Quantity	Quality	Life	Personal	Common	Team	Distance	Quantity	Quality	Technology	Personal	Common	Team	Distance	Quantity	Quality	Exploratory	Personal	Common	Team
Habitat Service Sector 1 (Life)	Resources	Distance																					
		Quantity																					
		Quality																					
	Products	Life																					
	User Access	Personal																					
		Common																					
	Contribution Access	Team																					
Habitat Service Sector 2 (Technology)	Resources	Distance																					
		Quantity																					
		Quality																					
	Products	Technology																					
	User Access	Personal																					
		Common																					
	Contribution Access	Team																					
Habitat Service Sector 3 (Technology)	Resources	Distance																					
		Quantity																					
		Quality																					
	Products	Exploratory																					
	User Access	Personal																					
		Common																					
	Contribution Access	Team																					

TABLES

Table 66. Decision System > Economic Calculation Planning > Global Habitat Cities and Services

Cities as Global Habitat Sectors		Intermediate Habitat Requirements (Intermediate Demands)								Final Habitat Demand (Local Demands)				Final Global Demand	
Uses (To) ⇨		City 1 Input (1 … n)				City 2 Input (1 … n)				City 1 Demand		City 2 Demand			
Resources (From) ⇩	HABITAT SERVICES	Service 1	Service 2	…	Service n	Service 1	Service 2	…	Service n	Common Access	Personal Access	Common Access	Personal Access	Total Production	User Access *(type of, time of)*
City 1 Outputs (1 … n)	Service 1														
	Service 2	Intermediate use of local outputs				Intermediate use by City 2 of City 1 outputs				Final use of local outputs					
	…														
	Service n														
City 2 Outputs (1 … n)	Service 1														
	Service 2	Intermediate use of network outputs				Intermediate use of local outputs									
	…														
	Service n														
Priority (Urgency Spectrum) Determination															
Total Inputs															

Services as Local Habitat Sectors		Global Demand								Final Access Demand (Local Demands)				Final Global Demand	
Uses (To) ⇨		Intermediate City 1 Requirements				Final Demand for City 1 Service				City 1 Demand		City 2 Demand			
Resources (From) ⇩	HABITAT SERVICES	Service 1	Service 2	…	Service n	Service 1	Service 2	…	Service n	Common Access	Personal Access	Common Access	Personal Access	Total Production	User Access *(type of, time of)*
City 1 Processing Sector Outputs	Service 1														
	Service 2	Intermediate use of local outputs									Access type of outputs			Gross Demands	
	…														
	Service n														
City 2 Processing Sector Outputs	Service 1														
	Service 2														
	…														
	Service n														
Priority (Urgency Spectrum) Determination															
Total Inputs															

TABLES

Table 67. Decision System > Economic Calculation Planning > Global Habitat System

Economic Calculation and Decision Tables		MATRIX Z												MATRIX D		MATRIX P
Habitat Sectoring Unit Matrix Z		Habitat Sector Inputs				Habitat Sector (Inputs)				Habitat Sector (Inputs)						
		Habitat Sector Inputs (Life)				Habitat Sector Inputs (Technology)				Habitat Sector Inputs (Exploratory)				Final Use		Total Produced
Uses (To) ⇨ Produced (From) ⇩		Service-Object 1	Service-Object 2	...	Service-Object n	Service-Object 1	Service-Object 2	...	Service-Object n	Service-Object 1	Service-Object 2	...	Service-Object n	Common Access	Personal Access	Total
Habitat Sector Outputs (Life)	Service-Object 1															
	Service-Object 2															
	...															
	Service-Object n															
Habitat Sector Outputs (Technology)	Service-Object 1															
	Service-Object 2						Matrix Z							Matrix D		Matrix P
	...															
	Service-Object n															
Habitat Sector Outputs (Exploratory)	Service-Object 1															
	Service-Object 2															
	...															
	Service-Object n															
Priority and Urgency Determination																
Total Inputs Required																
Rules	Cases of a Solution	Solution Option 1...n	Solution Option 1...n	...	Solution Option 1...n	Solution Option 1...n	Solution Option 1...n	...	Solution Option 1...n	Solution Option 1...n	Solution Option 1...n	...	Solution Option 1...n	Common Decision Option 1...n	Personal Decision Option 1...n	
Conditions																
Conditions 1	Objectives Ability Design Optimization Protocol	T	T		F	T	F		F	T	T		F			
Conditions 2	Parallel Value Alignment Protocol	F	T		T	T	T		F	T	T		F			
Actions																
Action 1	Reject Solution	x	-		x	x	x		x	-	x		x			
Action 2	Accept Solution	-	x		-	x	-		-	x	x		-			

TABLES

Table 68. Decision System > Economic Calculation Planning > Global Habitat System: *Table showing habitat service system outputs to the three types of access: 1) team access to the habitat service contribution system; 2) User demanded access to common and personal objects and services (or, products).*

Services as Local Habitat Sectors			City 1 Processing Sector Human Access Types									Final Global Demand
			Life			Technology			Exploratory			
		Uses In (To) ⇨	Contribute	User Demand		Contribute	User Demand		Contribute	User Demand		
Products Out (From) ⇩		HABITAT ACCESS	Team	Common	Personal	Team	Common	Personal	Team	Common	Personal	Total Production
City 1 Processing Sector Outputs	Life	Fixed										
		Flexible										
		Cyclical										
	Technology	Fixed										
		Flexible										
		Cyclical										
	Exploratory	Fixed										
		Flexible										
		Cyclical										
Value(s) Added												
Total Inputs												

TABLES

Table 69. **Contribution***: Tasking contribution status.*

Contribution Coordination Data For Determining Task Priority	
Urgency/Criticality Weighting	Contribution/Participation Criticality Weighting
4	Insufficient contribution to sustain service; all scheduled 'operations' periods are currently empty, and there is insufficient backup/redundancy or insufficient training for project needs.
3	Insufficient contribution to sustain service; all scheduled 'operations' periods are currently empty, but there is sufficient backup/redundancy or sufficient training for project needs.
2	Insufficient contribution to sustain service, all scheduled periods have contributors, and there is insufficient backup/redundancy or insufficient training for projected needs.
1	Insufficient contribution to sustain service; some scheduled 'operations' periods are currently empty, but there is sufficient backup/redundancy or sufficient training for project needs.
0	Sufficient contribution with adequate backup/redundancy and adequate levels of education/training to ensure future sustainability of the service.

Table 70. **Contribution***: Tasking contribution status.*

Contribution Coordination Data For Determining Task Priority	
Urgency/Criticality Weighting	Contribution/Participation Criticality Weighting
1	No contribution at this time.
2	Insufficient contribution to maintain service; some scheduled 'operative maintenance' periods are currently empty.
3	Insufficient, all scheduled periods have contributors, but there is; insufficient backup/redundancy or insufficient training for projected needs.
4	Sufficient contributors with adequate backup/redundancy and adequate levels of education/training to ensure future sustainability of the service.

Environmental Inquiry Accounting

Travis A. Grant,

Affiliation contacts: *trvsgrant@gmail.com*

Version Accepted: 1 April 2024

Acceptance Event: *Project coordinator acceptance*

Last Working Integration Point: *Project coordinator integration*

Keywords: Environmental assessment inquiry (ESI), environmental inquiry assessment (EIA), environmental impact assessment (EIA), environmental impact inquiry (EII), environmental impact evaluation (EIE), environmental impact statement (EIS), environmental review (ER), strategic environmental assessment (SEA), sustainability assessment (EA), sustainability accounting and inquiry (SA&I), economic [environmental] decision planning, needed ecology, environmental thresholds inquiry,

Abstract

Assess the real world impacts, costs and benefits of an issues resolution, to identify those solution designs that meet (or do not meet) a strategic economic feasibility threshold of ecological sustainability, which involves at least the variables of: ecological carrying capacity; habitat damage; regeneration and consumption rates; and behavioral changes due to the modification of [structural] systems dynamics. Environmental inquiry acquires data and does analysis to determine thresholds for a sustainable and minimal (or, least harm) impact approach to environmental interactions. An environmental assessment inquiry emphasizes the need for environmental accounting, impact assessments, sustainable materialization practices, and the integration of life-cycle analyses to mitigate environmental impacts and promote sustainable development.

Graphical Abstract

Image Not Yet Associated

1 Environmental accounting and inquiry

If humanity desires its needs fulfilled, then it must fulfill (or at least not inhibit the fulfillment of) the needs of its ecological environment, which is humanity's lifeground. Humanity is 'viable' [in part] when its outputs do not significantly hinder the needed fulfillment of a greater ecology in the continued recycling of its many natural services. Humanity must account for the environment in the designed re-planning of its services. The process of Environmental Inquiry is the process of identifying the knowable impacts that a particular solution configuration will have on our social community and our environmental habitat. It is a form of environmental analysis where environmental economic effects are processed in the form of an evaluation (as a form[ed tool] of 'differentiation'). It is an inquiry into the environmental viability of a solution. The process of Environmental Inquiry is the process of assessing the potential damage to ourselves, our environment, and the continuation of our common resources for the particular configuration of resources that form a designed solution to an issue, and it is based upon resource trending data and evidence from the environment, which the decision system directly and explicitly accounts for. Environmental inquires (e.g., surveys) give the decision system more data to more greatly consider optimal potential selectable decisions.

The term "placemaking" refers to the shaping (re-configuring) of a[n physical] environment. The shaping of an environments has tremendous social and psychological implications for how people in the world think. Part of the idea of 'justice' is the underlying application of a spatial strategy involving 'access' (and not "property ownership"). By developing material space in particular kinds of ways it is possible to counter those impulsive, compulsive, and less serving forces that may exist within and around us, structurally. We can design structural environmental systems that facilitate our experience of certain states of existence, and not others.

The design of a living space influences the individual and social behaviors of those people interacting within the space. Nowhere is this subject apparently more researched then in the scientifically studied arrangement of classrooms and office spaces. To some degree there is a relationship between the qualities of the structure in an environment [of structure] and the emergent behaviours of the individuated sentience in that structure [who conform to some degree to the qualities of the structure]. Here, we ask, what qualities does our designed structure have that cause it to deviate from what we know is our optimized fulfillment?

The big social question about producing spaces, places, and environments is not the question, "what do we want them to look like?" It is instead a question of "what kind of future do we want to create for ourselves?" What kind of values do we want to maintain in our social interactions with one another. What types of social relationships do our structural designs, for our environment, reinforce in us? What kind of people do we want to be, and what kind of social relations do we want to maintain? The social/political/economic question of space and place and environment is partly about being able to integrate these concepts in such a way that it allows for the continuous fulfillment of our purpose, a movement toward a higher potential [environment of thought responsive creation].

A truly sustainable economy maintains an economic model that accounts for the environmental impact of its actions (i.e., negative externalities and environmental decision constraints). A society's economic impact on the environment cannot be neglected if the community seeks its own preservation, its survival. To neglect the impact one's actions have on the environment is to act without an orientation toward fulfillment, to act with negligence. The costs of an economic action on the environment are scientifically discoverable and critically knowable. For a sustainable community to exist there is an absolute requirement to make all environmental impacts (a.k.a., "costs", true costs, real-world costs, etc.) are known. If the true and real-world impacts ("costs") of an economic action are known and accounted for, then economic practices become transparently classifiable as sustainable or unsustainable [given capacity and resource availability]. Under such a system many early 21st century economic practices would be seen for what they are, negligent, due to their high environmental impact costs. The factual concept of a "true cost", if applied holistically, would make some economic practices perceptible for what they really are -- a socio-economic dis-alignment with the fulfillment of human need.

Real world impacts/costs represent external constraints on the resolution of issues. Real constraints include but are not limited to: the carrying capacity of the environment (or a particular system); environmental pollution (cumulative & synergistic); and the rates of consumption and resource regeneration. Any modern, technological economic system that does not account for real world costs is highly likely to cause severe damage to its habitat because modern technologies require the handling and use of organotoxic compounds, which are unlikely to be effectively accounted for in the market [as they are considered "externalities"]. Externalities - some exchanges have a spillover effect where they damage the environment and relationships there. Market-based systems primary treat reality (i.e., the air, water, soil and other life upon which humans depend), not as primary, as it needs to be for survival and thriving, but instead, it is treated as an externalized resources for individual [consumer] benefit and a place for waste. Which is a view that is unsustainable by its very definition. Early 21st century society's technologies produce pollution - environmentally damaging substances and by-products. If environmental costs are not accounted for by an economic system, then those who participate in such a system should expect their actions to cause persistent and sustained damage to their environment.

In society, there is a need to think through externalities in the design process. What are the externalities of the design; what may be affected by this design that the design isn't intentionally designed to account for and effect. There are two generalized categories of organismal need, and hence, two categories of possible externality:

1. Physical externality - mediated by technology that causes physical effects. Physical causation can create physical externalities, which are effectively harmful physical unintended consequences. For example, the creation of a pesticide to support crop growth, and it ends up getting into the water supply, killing pollinators, and harms ecosystem.
2. Psychosocial externalities - mediated by technology that incentivizes humans to behave differently. The effect is psychological and when it starts to happen to many people, then there is a social effect. The more likes some post gets the higher it is ranked and the more people see it, because of the algorithm, and the more people believe it, because other people like it. If one military develops a technology, it often obligates the other rival militaries to develop the same technology (or even more advanced technologies) in response.

Necessary questions about the "externalization" of harm include, but are not limited to:

1. Whose needs are being factored?
2. Identify all stakeholders, including human and non-human life, that will be affected by second and third order physical and psycho-social harms (externalities)
3. Are there any needs not being factored (accounted for) that ought to be?
4. How do we do our best not to create "losers" and externalize harm?
5. What are the standards for harm; how are the standards set for harm (e.g., for pollution):
   A. Harm can be done.
   B. How much harm is acceptable for what level of strategic fulfillment.
6. How are consequential harms being balanced with the human requirements to provide sufficient and optimized fulfillment of human needs.

2 Environmental impact assessment deliverable

All human activities involving construction (e.g. roads, habitats, ports, etc.) or natural resource extraction (e.g. mining, logging, etc.) typically generate multiple interacting and usually "negative" impacts on the environment in concern to its biota and ecological processes. In most States, these environmentally impactful activities are regulated (by the State) and cannot commence without formal environmental approval (by the State). A significant deliverable as part of this approval process is the environmental impact assessment (EIA) (Drayson et al., 2015; Glasson and Therivel, 2019). An environmental impact assessment (EIA) relies on rigorous scientific assessment of all potential causal pathways by which large-scale developments may impact on valued assets in a region. The purpose of an environmental assessment is to inform decisioning by producing a complete analysis of causal pathways, a complete spatial assessment, with complete transparency. An environmental assessment assesses the environmental impacts associated with some solution, project or plan. To resolve the inquiry it is necessary to acquire site-specific (context-relevant) data on most/all of the relevant environmental parameters and valued assets, and then, integrate that data with the current solution to determine alignment with community objectives.

The process of Environmental Inquiry involves environmental impact assessments. An environmental impact assessment (EIA) is an assessment of the possible positive or negative impacts that a proposed project may have on the environment, including the biophysical environment and social environment. Socio-physical feedback data is necessarily involved in this inquiry process to identify the impact a service solutions is having, or has had, on our total environment. Also, an ‘environmental [feasibility/viability] study’ might identify additional information needs and deficiencies, and clarify or modify the rationale for why a particular solution is more efficient, safe, value-oriented, and strategically meets our needs.

A comprehensive habitat viability study is continuously ongoing within the decisioning system. In other words, it is an ongoing task of an interdisciplinary team to study and otherwise evaluate the viable capacity of the system as it is deigned utilizing all available information in the context of an issue. Viability studies provide evidence and may resolve individual and scientific concern that were previously lacking in information. An environmental impact study may be necessary before the transported application of a resource is “made into service” in order to maintain the safe operation of the habitat service system.

It is essential for the process of adaptation for a Habitat system to have multiple forms of feedback. Don’t we all want to know how our designs are affecting us so that we can more intentionally (and safely) design. The habitat service system maintains interdisciplinary environmental assessment teams.

In a sense, the process of Environmental Inquiry represents a continual scientific investigation into the results of our tasked behaviors on a responsive environment that to some measurable degree determines our continued viability (and feeds our Real World model with data).

Environmental assessments often include an assessment on the expected pollution of a design. Pollution is an undesirable form of emanation. It either damages the environment or prevents the environment from restoring itself. It should be noted here that those living in early 21st century society, particularly those living in cities, have become desensitized to some forms of pollution (particularly those of light and sound). In a sense, pollution is a dis-alignment of our patterns with evolutionary patterns. For example, the usage of lighting which emits blue and green photons of light at night disrupts our melatonin production, which has a host of health ramifications including the onset of sleep pressure and sleep quality.

2.1 Assessment documentation

An environmental impact assessment may be produced based on a network analysis of potential causal pathways in a given region and/or for a habitat construction.

2.1.1 Environmental inquiry (causal-chain) assessment flow map/model

A.k.a., The scope of the environmental assessment, the environmental assessment procedure, pathway environmental assessment.

The causal map includes a spatially explicit analysis of the region (habitat) that allows residual risk (i.e. risk remaining after all feasible mitigations) to be mapped for all valued assets. This identifies which activities could lead to potential impacts of varying concern (rated from 'very low' to 'very high'), their likely pathways, which valued assets are at risk and where these residual risks are greatest. The output maps reveal where there are concentrations of risk ("risk hotspots") which require more detailed local-scale assessments and monitoring.

The visualization of a systematic mapping of the cause-and-effect chain of relationships makes it possible to identify:

1. All possible pathways (relationships) between a starting node and end node.
2. Where mitigation methods can be applied.
3. Which mitigation methods may be effective.
4. Mitigation methods that affect multiple pathways.
5. Level of redundancy in mitigation methods along pathways.

NOTE: *It is important to combine "life-cycle assessments" with "environmental assessments" to provide a complete production life-cycle solution.*

A simplistic box-and-arrow diagram of a environmental inquiry situation may be developed to visualize the information within the assessment space. Wherein, boxes represent stressors and ecosystem components (including valued assets) and arrows represent the pathways and processes (mechanisms) by which stressors cause impacts on valued assets. Here, it is important to illustrate likely relationships between activities and environmental impacts. A formal analysis will verify whether the factors are internally consistent, and explore all the mapped pathways between activities and impacts. A causal network is a graphical representation of relationships (pathways represented by links) and conditions (nodes, represent by activities, stressors, processes and valued assets) in the system being assessed. The links represent the cause-and-effect relationships between nodes. The nodes can be considered the conditional effects, and the pathways describe impacts. (Peeters, et al., 2022)

For each causal pathway where there is a concern (risk), the network (flow) approach provides a systematic evaluation of the:

1. Likelihood (of incident occurring).
2. Consequence (of occurred incident under conditions).
3. Mitigation options (control) of the concerns/risks.

Causal pathways extend from conditions (drivers, context/situation) to issues to resources to solutions to tasks, and then to, results. This environmental impact method includes analysis of the confidence of these evaluations, recognizing where knowledge gaps constrain assessments of risks.

The causal-chain map from the source-point of a contextual driver (on the left of the flow-graph) to the contextually desirable end-point (on the right of the flow-graph):

1. **Drivers** *(on "left" of chain-of-flow)* - what is the broader activity set's function, and what are it's key features. The core driver in community is global human need fulfillment, human flourishing and ecological regeneration. In order to meet material human needs, habitats (habitat productions) must be constructed and there services must be operated in order to produce access to life, technology, and exploratory goods and services. In order to produce habitat services there must be:
   A. Resource development, for example:
      1. Drilling Wells, having pipelines, etc.

      2. Intermediary production.
   B. Habitat production operations, for example:
      1. Contribution services.
      2. Life support services.
      3. Technology support services.
2. **Activities** - describe individual activities necessary to develop something (e.g., a gas resource or a whole habitat). Some activities would be unique to certain drivers, whereas other would be common to nearly all drivers, such as clearing and transport of material. For example,
   A. Drilling, hydraulic fracturing, civil works for clearing, access to water, disposal of waste, transport material in and out, constructing of architectural-infrastructure.
   B. After construction there are ongoing and cyclically required activities to operate and maintain the system.
3. **Stressor nodes** (e.g., blue linked nodes) are stressors - what do these activities do to the surroundings, how do they impact the environment and environmental processes, and what is the stress they put on the environment. Some stressors are separate and others are common (i.e., common to all habitat productions, such as clearcutting, etc,). For example,
   A. Land clearing.
   B. Removal of flora.
   C. Removal of fauna.
   D. Bringing in non-local species of flora or fauna.
   E. Extraction of water from the environment.
   F. Release of water (possibly contaminated) into the environment.
   G. Etc.
4. **Process nodes** (e.g., red linked nodes) are natural and human activity processes. Processes are the processes in the environment, which don't really change. For example,
   A. Light pollution.
   B. Soil contamination.
   C. Aquifer recharge.
   D. BioSpheric cycles:
      1. Climate cycle.
      2. Soil cycle (pedogenesis).
      3. Photosynthetic cycle (photosynthesis).
      4. Etc.
   E. **Emissions** (e.g., waste streams) are natural and all activity produces (i.e., all life processes produce) them.
5. **Endpoints** *(on "right" of chain-of-flow)*- are objectives (agreements about the real-world that have been identified as being something to be cared about). The endpoints that are have the impacts assessed on. There will (or, will not) be impacts on assessed endpoints. Some of these impacts can, and others cannot, be mitigated by existing or new controls. The resulting risk for that which there is no possible control, is called, residual risk.

Mitigation is an inherent part of risk control and represents the potential for diminishing and/or eliminating a concern, and its impact if realized. The mitigation process involves the following steps:

1. Identify causal mapping of drivers, activities, stressors, processes, and endpoints.
2. Identify relationships (pathways) of concern.
3. Developing a mitigation solution or, master-plan modifying solution).
4. Constructing mitigation solution.
5. Compliance (to mitigation solution standard).
6. Enforcement (of existing controls).
7. Monitoring (of the effectiveness of controls).
8. Standards create code, and then, regulators enforce compliance with that code.

2.1.1.1 The causal flow-chain assessment procedure

This procedure results in a model that visualizes drivers connected to endpoints, and an intermediary "space" that reveals new information on the impact of the solution to the environment, including potential mitigation controls, residual risks, and confidence levels.

The following is one method for evaluating a solution in the context of an environmental inquiry protocol (Peeters, et al., 2022):

1. Identify solution to be analyzed in the context of a potentially impacted environment and set of community strategic preservation objectives.
   A. Identify the drivers of the issues that make-up the solution.
   B. Specify activity (activities) and development scenario(s).
   C. Define potential impact area (PIA) and/or population (PIP) = maximum spatial/population extent of potential impacts [space].
      1. PIA (potential impact area) = the maximum spatial extent over which potential impacts of the proposed project are considered.
      2. PIP (potential impact population) = the maximum population extent over which potential impacts of the proposed project are considered.
   D. Define potential impact duration (PID) = likely duration of direct, indirect, and cumulative [time].
   E. Compile and map all valued assets; to complete the context-setting step, it is necessary to:
      1. Compile and map all valued ecosystem

service-assets (e.g. protected species, significant wetlands, etc.) that do or may occur in the PIA.

2. Compile and map all the valued habitat service-assets (e.g., medical services, water services, etc.) that do or may occur in the PIA.

F. Identify valued habitat infrastructural assets and map their distribution to PIA (geographically) and PIP (among a population).

G. Identify value eco-system assets and map their distribution to PIA (geographically) and PIP (among a population).

2. Establish conceptual model and identify development activities. All -logical systems, can be understood through concept models. An ecological concept model, for example, is necessary for visualizing the multiple interacting pathways by which human behaviors (anthropogenic drivers) impact those things humans say they care about.

A. Construct conceptual model of key eco-system processes.

B. Construct conceptual model of key habitat-system processes.

C. Systematically identify development activities that may affect processes.

D. Most activities generate stressors (e.g., vegetation removal, drilling, groundwater extraction, etc.). These activities that result in links ("ropes") of stress have impacts on assessed endpoints. Activities change the environment -- changing characteristics (e.g. rate, magnitude, frequency, direction) of naturally occurring processes. A good conceptual model identifies with confidence the pathways by which these impacts may occur, revealing interactions with each other as well as from other drivers.

3. Create a causal network flow model. After concept construction, it is possible to represent the information as a directed acyclic graph (DAG) in which the nodes represent the drivers, activities, stressors, processes and endpoints (assessed), and the links are the inferred causal relationships between those nodes. To clearly define each node, the following must be available: current knowledge base, relevant knowledge gaps and key assumptions, which provide transparency about the assessment and ensure internal consistency throughout the network.

A. Encode conceptual model and activity list as directed non-cycling (acyclic) graph.

B. For each link assess on regular grid of PIA and PIP for PID. For all types, state:

1. Direction of relationship (direct or inverse). Specify whether each relationship is either direct or inverse.

2. Evaluate risk:

i. Likelihood - How likely within some contextually relevant amount of time is it likely to become an incident (a realized risk, an event)? Refers to whether a link is possible; if so, can it lead to a material change (consequence), and if so, can this risk be avoided or mitigated? Any link represents a causal relationship. A link can be evaluated as "not possible" if it is:

1. Extremely unlikely.
2. Illegal (i.e., standards violation).
3. Was inferred from observations outside the potential impact area (PIA) yet is not physically possible within the PIA. Nonetheless, the link is preserved in the network to indicate that it can contribute to a potential pathway of impact in the future.

ii. Consequence - Flow links (arrows) can be of five types. Impact evaluation questions (yes or no answers) on the links. Use the following decision-tree to decide consequential impact assessment level:

1. Link is possible or not?
   a. Could a change in A cause a change in B.
2. Link is possible, but not material?
   a. Could a material change in A cause a change in B.
3. Link is possible, and material [change], but can be avoided?
   a. Could a material change in B due to a change in A be avoided in the spatial area.
   b. What is the material change?
   c. What is the threshold of effect of the material change?
4. Link is possible, material and unavoidable, but can be mitigated?
   a. Could a material change in B due to a change in A be minimized or mitigated in the spatial area.
5. Link is possible, material, unavoidable, and cannot be mitigated?

iii. Impacting link assessment level (i.e., the links has a value from 0-4 assigned, usually represented with unique colors):

1. 0 = Link is not possible.
2. 1 = Link is possible, but no [material] change occurs.
3. 2 = Link is possible and [material]

change, but can be avoided.
4. 3 = Link is possible, [material] change occurs, but can be mitigated.
5. 4 = Link is not possible, [material] change occurs, is unavoidable and cannot be changed.
iv. Mitigation controls.
1. Identify control measure.
2. Identify residual risk.
a. Residual risk likelihood.
b. Residual risk consequence.
v. Confidence in evaluation. A rating of confidence ('high' or 'low') for:
1. Likelihood.
2. Consequence.
3. Mitigation.
4. Create a spatial causal map. Plot on a geographical map a spatial analysis of stressors, processes and assessment endpoints. The inquiry/study area will cover some geographic area of land and/or water body (Read: map). Use at least a topographic-hydrological map. Show the area and intensity where the stress is occurring. If the driver involves extraction activities, then the map will also show prospectivity.
5. Create a table of the level of concern for activity, stressor and process for each endpoint. Each cell in the cross-tabular area is colored. The amount of area covered in color in each cell illustrates the level of concern. The colored area is proportional (on a scale from 0% to 100%) to the percentage of each assessed endpoints distribution mapped with that level of concern.
6. Evaluate causal network flow map/model.
A. Evaluate causal pathways to create list of hazards. Hazards interact. Hazards have a likelihood, consequence, and mitigation options.
B. Combine link assessments to assess residual risk.
C. Develop a monitoring plan.
D. Integrate the results into the information system.

Each link in the resulting causal network has three attributes by which risk is evaluated:

1. Relationship direction (i.e., direct or inverse).
2. A grid with ordered categorical assessment scores (i.e., link is not possible, possible, material change, etc.).
3. A rating of confidence ('high' or 'low') for likelihood, consequence, and mitigation.

Analysis (assessment

1. Looking at all the different pathways what would be the impacts?
2. The squares represent the level of concern of pathways and the percentage of the endpoint area that may be impacted.
3. Size of the square relates to amount of impact.

2.1.2 Stressors

Some common stressors where there are material changes include, but may not be limited to:

1. Compromised aquitard integrity.
2. Atmospheric emissions.
3. Groundwater extraction.
4. Compromised well integrity.
5. Operation of industrial machinery.
6. Accidental release.
7. Controlled release of wastewater.
8. Dust generation.
9. Vehicle movement.
10. Surface water extraction.
11. Storage ponds.
12. "Invasive" plants.
13. "Invasive" insects
14. Vegetation removal.
15. Soil compaction.
16. Waste disposal.
17. "Invasive" herbivores.
18. "Invasive" predators.
19. Overland flow obstruction.
20. Artificial water sources.

2.1.3 Processes

Some common processes include, but are not limited to:

1. Human cause:
A. Light pollution.
B. Air pollution.
C. Noise pollution.
D. Soil contamination (soil pollution).
E. Ecosystem burning.
F. Competition and predation.
G. Soil erosion.
H. Channel flow
I. Bank instability and erosion.
J. Aquifer contamination.
K. Surface water contamination.
L. Mortality of native species.
M. Habitat degradation, fragmentation and loss.
N. Floodplain inundation.
O. Souring.
P. Sedimentation.
2. Ecosystem services (a.k.a., bio-spheric cycles):
A. Climate cycle.

B. Aquifer recharge.
C. Soil building cycle (pedogenesis).
D. Photosynthetic cycle (photosynthesis).
E. Micro-organism life-cycles.
F. Macro-organism life-cycles.

2.1.4 Factors of reality-as-environment analysis

A.k.a., Systematizing and environmental factors of analysis.

During analysis of environmental factors, it is important to look at collective impacts of the range of activities associated with the master-plan (solution): development, construction, and operation of the specified solution. The purpose of a causal-spatial environmental network map and assessment is to provide a systematic, consistent and transparent analysis/assessment of potential impacts (to the whole environmental context by the solution), in order to improving the quality of decisioning about planned developments and their environmental risks. (Peeters, et al., 2022)

An environmental evaluation using these factors should be:

1. Investigatory, intelligent.
2. Systematic, transparent, robust.
3. Statistical (identifying likelihoods), consequential (evidence-based), and apply appropriate mitigation actions (task control).
4. Know, and seek to know, knowledge gaps.

All environmental inquires include an assessment of the concern/risk of harm/damage to an environment by human behavior. All factors in the model have some consequence with a level of concern, or no pathway for concern. All relationships/links take one of the following forms [of concern/risk] (Peeters, et al., 2022):

1. **Potentially high concern** - for "possible, material, unavoidable and cannot be mitigated" (4) because impacts cannot be avoided or mitigated at the scale of the potential impact area.
2. **Potential concern** - for "possible, material and unavoidable but can be mitigated" (3) because impacts can be minimised or mitigated by existing management controls.
3. **Low concern** - for "possible and material but can be avoided' (2) or 'possible but not material" (1) because impacts are avoided due to current legislation or because the impact does not represent a material change
4. **Very low concern** - for "not possible" (0) because impacts are not physically possible or are extremely unlikely.
5. **No pathway** (no concern).

Environmental impacts are the manifestation of risks to the environment. An environmental impact statement (EIS) document typically includes the following categorical sub-sections (criteria categories):

1. Introduction.
2. Project approvals.
3. Sustainability.
4. Risk assessment.
5. Stakeholder engagement
6. Project definition.
7. Climate and climate change adaptation.
8. Land, geology, geomorphology & land contamination.
9. Land use planning.
10. Landscape and visual amenity.
11. Terrestrial ecology.
12. Water and aquatic ecology.
13. Ground water.
14. Surface water and water course.
15. Air quality.
16. Greenhouse gasses.
17. Noise and vibration.
18. Waste.
19. Traffic and transport.
20. Indigenous and non-indigenous cultural heritage.
21. Social impact assessment.
22. Economic assessment.
23. Hazard and risk.
24. Matters of national environmental significance (protected matters)
25. Fauna (species of fauna).
26. Flora (species of flora).
27. Reserve ecosystem(s).
28. Other matters.
29. Environment impact coordination ("management") plan.
30. Cumulative impact assessment (cumulative impacts).

Note that sometimes these environmental "factors" are referred to as environmental "assets", each of the following representing categories of asset class.

The primary environmental assets are:

1. Land - terrestrial environmental quality; land-form; terrestrial ecosystem.
2. Water - water environmental quality; aquatic ecosystem; hydrological processes.
3. Sea - coastal processes; marine environmental quality.
4. Air - air quality; atmospheric processes.

5. People - team processes; user processes.
6. Other animals - organismal environmental quality; bio-region processes.

Environmental assets (objects) include, but are not limited to:

1. Aquifers.
2. Ecosystems.
3. Significant species.
4. Etc.

Environmental conditions (object interactions) include, but are not limited to:

1. Sightline conditions.
2. Atmospheric conditions.
3. Soil conditions.
4. Sound conditions.
5. Light conditions.
6. Waste conditions (Read: material cycling conditions).
7. Hazard conditions.
8. Etc.

2.1.4.1 Risk factor

> **NOTE:** *Always make sure links in the assessment are actually possible. There may be things that just can't happen because the legal and or physical law doesn't let "you".*

Environmental inquiries include an inquiry into the risks of the solution to the environment. Herein, the following questions are significant in determining the level of risk:

1. It is possible for the risk/concern to become an incident; is the risk likely?.
2. Can the risk be avoided; can something be done to completely (99%) avoid the risk?
3. If it cannot be avoided, can it be mitigated; can the impact/consequence of the risk be reduced somehow when it is realized?

Terms associated with the level-of-risk (level-of-concern) include:

1. **Precaution (data collection tasks):** Refers to an action taken in advance to prevent potential harm or minimize risk.
2. **Mitigation (control tasks):** Involves actions or measures taken to reduce or minimize the negative impact or risk associated with a particular situation or event.
3. **Caution (monitoring tasks):** Implies care, attentiveness, and awareness of potential dangers or risks, when deciding, thinking and acting.

The primary eco-system service inquiry looks for overshoot (including, potential overshoot) of capacity. Overshoot means to have exceeded carrying capacity of some ecosystem-/production-service.

It is possible to overshoot capacity in two ways:

1. **By taking too much:** Will the operational system (plan, human being) use the products of ecosystems faster than they can regenerate?
2. **By polluting too much:** Will the operational system (plan, human beings) dumping waste into the ecosystem at a rate faster than the assimilative capacity of an ecosystem?

2.1.4.2 Emission factor

A.k.a., Pollution factor.

Anything emitted is referred to as an emission. Something which is pollution is something that is emitted in too large a quantity or in the wrongly location. Emissions are typically waste streams, some of which may be pollution streams (as in, emissions that harm people and ecologies).

There are multiple forms of emission, and hence, pollution, that must be accounted for through an environmental assessment to insure decisioning is informed of assessed consequences of the master plan, developed within the decision system of society:

1. Atmospheric.
2. Electromagnetic radiation (i.e., EMF/EMR).
3. Light (i.e., photon and wavelength; light is a form of electromagnetic pollution).
4. Sound (i.e., noise) - mechanical wave that passes through a physical medium.
5. Material as chemical and biological (e.g., garbage & pharmaceutical hazards/metabolite hazards).
6. Cognitive & visual (e.g., the very notion of ‘advertising’ could be considered a form a form of visual and cognitive pollution).
7. Time (as general relativity and technical inefficiency).

2.1.4.3 Recyclation factor

A.k.a., Recyclability factor, recycling factor.

Most environmental assessments also include an assessment on the recyclability of the resource, service, or system. To remain environmentally sustainable, resources must either be safely and timely recycled or they must be safely and timely decomposed, otherwise they risk becoming pollution that accumulates damage in the system. The accumulation of damage increases uncertainty [of the systems stability] and it signals the decay of the system. In community, we creatively construct our mapped systems through feed-back from an environmental terrain.

> **INSIGHT:** *It is a weird thing to do to take sensory input coming in from your environment and try to tune it out. A lack of situational awareness would have essentially resulted in the death of indigenous people. In other words, what would have essentially resulted in death in an indigenous person is locking out sound signals from the environment. If they weren't attuned signals from their environment they would be dead quickly. Early 21st century society creates so much "racket" that people are forced to tune out the signals. It is essential for us to observe changes in the signature of life around us.*

2.1.4.4 Strength, weakness, opportunity, threat factor

Harm to a present ecology may be capable of having its ecology restored and/or fit back-into the larger ecology, most notably, after mining (or another extraction operation). It is essential to balance human needs for material fulfillment with ecological consequences and future potential restoration activities. Environmental assessments must account for the benefit to human need fulfillment in the context of temporary harm to an ecology, to later plan and following through with restoring the ecology once the extraction is complete. Develop a strength, weakness, opportunity, threat (SWOT) matrix showing the standards for human fulfillment against the pollution-/harm-based consequences of production. Identify the standards [continuum] of pollution and the level of acceptability in each individual case.

2.2 Sustainable materialization

A.k.a., Sustainable master-plans.

A sustainable solution is within the thresholds of the capacity of a biospheric ecological service system today, and into the future.

In technology production, sustainability involves developing and manufacturing products and services, together as habitat, using:

1. Processes that minimize environmental impact, and where there is impact, it is appropriate for fulfillment (more appropriately viewed as care-taking).
    A. Ensure the earth is caretaken. Monitor that the earth is caretaken (as a national contribution service).
2. Decision processes that produce durable and appropriately lasting materializations.
    A. Ensure the appropriate longevity and responsible disposal of all produced objects (i.e., cycle all materials associated with trashed technologies). Monitor decisioning about society and the habitat (as a national contribution service).
3. Socio-technical systems that minimize energy consumption, as appropriate.
    A. Ensure all electrical technologies are energy efficient given what is known and available. Monitor service usage (as a national contribution service).
4. Habitat service operations that respect human time.
    A. By rewarding labor hours and pricing habitat goods and services through some token[ization] system.
        1. Labor tokens with priced market (more-or-less) services and goods.
        2. Beneficial-to-self (e.g., biking).
        3. Beneficia-to-others (e.g., volunteering).
        4. Generational wealth transferred to community commons (i.e., the transfer of information, resources and people into a community-type conficuation).
    B. By rewarding intrinsically through participation in a global contribution service system during some duration of one's life, in a way one prefers, given availability and qualification. Here, there are no tokens traded for contribution or for access.
5. Habitat systems that cycle material resources without eco-system harm, as appropriate.
    A. Ensure materials are cycled through the global habitat and the larger biosphere in a way that does not cause chronic ecosystem harm, that does not harm healthy organisms, and has low-relative pollutive potential. Monitor the flow of material through the global habitat and the larger biosphere.

It aims to create technology that is environmentally friendly, energy-efficient, and has minimal adverse effects on ecosystems and natural resources.

2.2.1 Pollutionless materialization

I.e., Less pollution, less waste, accountability for pollution and restoration over time.

In the pursuit of sustainable and environmentally responsible production and manufacturing solutions, it is paramount to prioritize the concept of pollution prevention at every stage of the product life-cycle. To achieve this goal, it is essential to adopt a holistic approach that envisions a complete flow of resources that assemble into, and dis-assemble from, any given product; visualizing the complete flow of resources from inception to ultimate disposal and cycling. By visualizing the entire life-cycle of production, master plan decisioning can identify potential environmental impacts and inefficiencies at each step, allowing for proactive mitigation measures. This approach not only facilitates the reduction of pollutants, but also promotes resource efficiency and the care-taking of nature. Ultimately, embracing production practices that seek the least pollution not only benefits the environment and human health, but also enhances product quality, reduces operational costs, and aligns with sustainability objectives.

> **CLARIFICATION:** *"Pollutionless" does not mean that there is never pollution; it simply means that there is the least (less) amount of pollution possible, given requirements and materials, and the life-cycle accounting over time of ecological and habitational resources.*

Life-cycle analyses need to occur to account for material transfers into and out of functional [product-habitat] assemblies. These life-cycles need to account for losses of material as "waste" plumes (a.k.a., pollution) into the environment. Pollution is generally considered a waste plume into the environment that damages (has significant negative impacts) entities and/or relations. Life-cycle assessments, analyses, and models need to go to sufficient depth to appropriately visualize all material transfers. For example, when synthetic plastic microfibers from clothing are washed, the microfiber plastics end up in the output water. Where do those plastics go? How long do they last? What is their influence on the environment (with the following potential influencing parameters):

1. Unkown influences.
2. Neutral influences.
3. Influences negative to ...
4. Influences positive to ...

It is important to visually trace the flow and composition (assembly type, structure type, status type, and quality type) as they flow through the ecosystem, and therein, the human habitat network (i.e., the network of community cities, or 'community-city' network.

2.2.2 Contamination materialization

Contamination is a failure mode of production. After contamination, a clean-up process must be engaged to remove any contaminants that occurred during the process of a chemical compound and or a physical assembly's formation.

Scholarly references (cited in document)

- Drayson, K., Wood, G., Thompson, S. (2015). *Assessing the quality of the ecological component of English environmental statements*. J. Environ. Manag., 160 (2015), pp. 241-253. https://doi.org/0.1016/j.jenvman.2015.06.022
- Peeters, J.M., Holland, K.L., et al. (2022). *A spatial causal network approach for multi-stressor risk analysis and mapping for environmental impact assessments*. Science of The Total Environment. Vol. 802. https://doi.org/10.1016/j.scitotenv.2021.149845 | video overview of the research: Huddlestone-Homes, C. (2023). *Dealing with complexity in environmental impact assessment | Dr Cameron Hiddlestone-Holmes*. Sustainable Minerals Institute UQ Channel. YouTube. https://youtu.be/TB3pWqkosiE

Book references (cited in document)

- Glasson,J., Therivel, R. (2019). I*ntroduction to Environmental Impact Assessment.* (5th edition), Routledge, New York

TABLES

Table 71. *Simplified strengths, weaknesses, opportunities, threats (SWOT) matrix.*

4 LISTS	Positives	Negatives
Capabilities	Strengths (Abilities)	Weaknesses (Inadequacies)
Results	Opportunities (Goods)	Threats (Bads)

Table 72. *Strengths and weaknesses, threats and opportunities (SWOT) matrix for analysis of events, scenarios, and strategies in concern to their impact certainty and impact scale.*

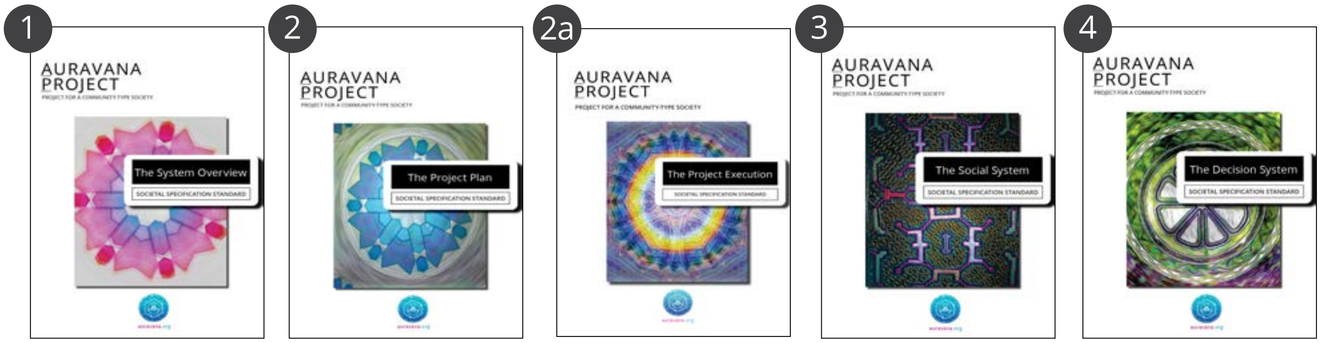
Benefits / Opportunities / Advantages / Strengths						Impact Scales	Risks / Liabilities / Threats / Weaknesses					
8	9	10	11	12	13	Global [7]	8	9	10	11	12	13
7	8	9	10	11	12	Societal [6]	7	8	9	10	11	12
6	7	8	9	10	11	City/ Habitat [5]	6	7	8	9	10	11
5	6	7	8	9	10	Institution [4]	5	6	7	8	9	10
4	5	6	7	8	9	Project [3]	4	5	6	7	8	9
3	4	5	6	7	8	Group [2]	3	4	5	6	7	8
2	3	4	5	6	7	Personal [1]	2	3	4	5	6	7
Preventable 0% *(not likely)* 1	Conceivable 20% *(low likelihood)* 2	Possible 40% *(moderately low likelihood)* 3	Plausible 60% *(moderately high likelihood)* 4	Probable 80% *(high likelihood)* 5	Provable 100% *(likely)* 6	**Local**	Preventable 0% *(not likely)* [1]	Conceivable 20% *(low likelihood)* [2]	Possible 40% *(moderately low likelihood)* [3]	Plausible 60% *(moderately high likelihood)* [4]	Probable 80% *(high likelihood)* [5]	Provable 100% *(likely)* [6]
Certainty/Prescience												

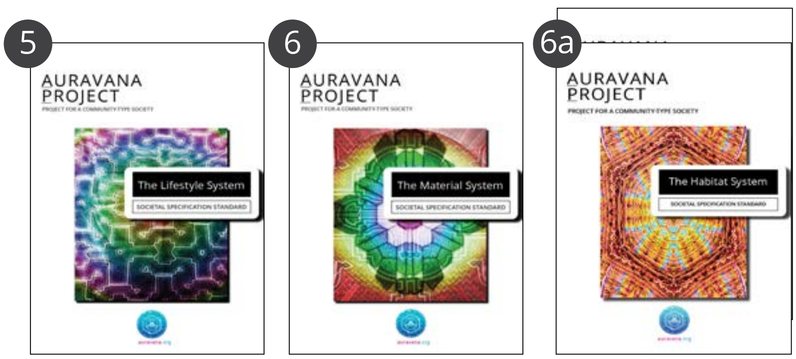
The Auravana Project exists to co-create the emergence of a community-type society through the openly shared development and operation of a information standard, from which is expressed a network of integrated city systems, within which purposefully driven individuals are fulfilled in their development toward a higher potential life experience for themselves and all others. Significant project deliverables include: a societal specification standard and a highly automated, tradeless habitat service operation, which together orient humanity toward fulfillment, wellbeing, and sustainability. The Auravana Project societal standard provides the full specification and explanation for a community-type of society.

This publication is the Decision System for a community-type society. A decision system describes the formal structuring of decisions involving a comprehensive information system that resolves into a modification to the state-dynamic of the material environment. A decision system is a collection of information-processing components -- often involving humans and automation (e.g., computing) -- that interact toward a common set of objectives. This decision system is designed to coordinate and control the flow of resources for global accessibility to all goods and services. To navigate in common, humanity must also decide in common. Herein, individuals maintain a relationship to resources that focuses on access rather than possession, maximizing the advantages of sharing, and incentivizing cooperative, rather than competitive, interest. All requirements relevant to human fulfillment and ecological well-being are factored in to the allocation of resources, optimizing quality-of-life for all, while ensuring the persistence of the commons. The standard's decision processes produce tasks that are acted upon by an intersystem (a.k.a., "interdisciplinary") team involving the coordinated planning and operation of projects. Through this comprehensive and transparent decisioning process individuals know precisely what needs to be accomplished to sustain and evolve their fulfillment. Herein, through formalized decisioning and cooperation humanity may continuously restructure society toward a higher potential dynamic of life experience for all. The use of a common social approach and data set allows for the resolution of societal level decisions through common protocols and procedural algorithms, openly optimized by contributing users for aligning humanity with its stated values and requirements.

Fundamentally, this standard facilitates individual humans in becoming more aware of who they really are.

All volumes in the societal standard:





auravana.org

$7.00
ISBN 979-8-9861436-4-4
50700>