http://cba.unomaha.edu/faculty/mohara/web/LEA-f11-SYSTEMS-handout.pdf

"*For every complex problem*
there is an answer that is clear, simple, and wrong."
H. L. Mencken

"*Any intelligent fool can make things bigger and more complex.*
*It takes a touch of genius - and a lot of courage to move in the opposite directio*n."
Albert Einstein

"*As far as the laws of mathematics refer to reality,*
they are not certain, and as far as they are certain, they do not refer to reality."
Albert Einstein

"*If people do not believe that mathematics is simple,*
it is only because they do not realize how complicated life is."
John von Neumann

"*Not everything that counts can be counted,*
and not everything that can be counted counts."
Albert Einstein

"*Technological progress is like an axe in the hands of a pathological criminal*."
Albert Einstein

"*"How did it get so late so soon?*"
Dr. Seuss

"*Imagination is more important than knowledg*e."
Albert Einstein

Many, but far from all, of the items outlined below (most especially outline levels IV. and V.) can be found discussed in:
Hayden, F. Gregory. *Policymaking for a Good Society: The Social Fabric Matrix Approach to Policy Analysis and Program Evaluation*. Springer: New York, 2006. ISBN-13: 978-0387-29369-1.

I. All excellent analysis focuses upon **SYSTEMS**.

A. Profit necessarily requires ***at least three systems*** (π = TR - TC).

B. Ethics always involves ***at least a multitude*** of systems.

C. Complex socio-ecological systems necessarily engage
complex socio-technological systems.

D. One tool for managing such analysis is the Social Fabric Matrix.[1]

II. Systems analysis requires a **paradigm shift**
away from **isolated transactions** and towards **interrelated processes**.

A. Point of view is dependent upon a system of beliefs;
and, the viewer's own system of beliefs
rarely either is inventoried or is acknowledged by the viewer.

1. Context.
An isolated zero sum transaction
versus a linear flow versus a system (e.g.,[2] with feedback loops).

2. Criteria.

a. What are the (e.g., your) metrics of "good" and of "bad"?

i. For example,
does "good" always increase when GDP increases?

ii. See also II.A.7.: [positivist versus normative].

b. Systems necessarily have
competing arrays of explicit goals as well as
competing arrays of implicit goals.

c. EXAMPLE: Sustainability.

i. **Strong sustainability**.
Infinitely repeatable
until an exogenous force alters the system.

[I.] Does not require the assertion,
but is totally consistent with the assertion, that
human technology *can not* be
a sufficiently close substitute
for natural processes.
(e.g., baby formula *can not*
equal mother's breast milk)

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[1] Hayden, F. Gregory. *Policymaking for a Good Society: The Social Fabric Matrix Approach to Policy Analysis and Program Evaluation*. Springer: New York, 2006. ISBN-13: 978-0387-29369-1.

[2] **NOTE: i.e. means that is whereas e.g. means for example.**

II. A. 2. c. ii. **Weak sustainability**.
Is repeatability over a short long term
(i.e.,[3] *not* as long as an economist's **long run**).

[I.] Weak sustainability does require the assertion
that human technology can be *at least* a
sufficiently close substitute
for natural processes
(e.g., baby formula *does* equal
mother's breast milk).

[II.] An economist's **long run** in theory,
is an indeterminate clock time:[4]
it is that period that starts when
fixed costs equal zero.

[A.] TC = FC + VC
(i.e., fixed cost plus variable cost)

[B.] Recall I.A.: [systems if excellent
analysis] and note II.A.4.b.: [when].

iii. **Profitable**.
A firm is profitable if, for the period of firm's planning
horizon TR received equals TC paid: π = TR - TC.

[I.] Recall that economists define profit in a variety
of ways. Recall specifically that economists
focus on the explicit and the implicit purchase
of four resources (i.e., land, labor, capital, and
entrepreneurial ability) and, respectively, the
four payments for those resources (i.e., rent,
wages, interest, and **normal profit**).

[II.] To discuss "profitable"
requires specific attention to the following.

[A.] Whether a mere accounting profit
(i.e., π_A) is obtained?

[B.] Whether the obtained accounting
bottom line (be that an accounting profit
or an accounting loss) satisfies the
requirements of normal profit (i.e., π_N)?

[C.] Whether an economic profit
(i.e., $\pi_A > \pi_N$) has been obtained?

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[3] **NOTE: i.e. means that is whereas e.g. means for example.**

[4] Adam Smith estimated the long run as starting at about 90 years. Joseph Schumpeter estimated the short run as lasting as long as 100 years. John Maynard Keynes observed that in the long run we all are dead. Generically, the law of contracts and the law of treaties views the maximum duration of a limited time contract or treaty as 99 years; and contracts in excess of 99 years as equivalent to in perpetuity.

II. A. 2. c. iii. [II.] [D.] Whether an economic loss (i.e., $\pi_A < \pi_N$) has been obtained?

[i.] Note II.A.5.d.i.[I.][A.].: [shut down rule].

II. A. 2. c. iii. [III.] Note particularly II.A.4.: [where] and note II.A.6.: [ecological] and note II.B.2.: [time influences perception].

II. A. 2. d. Power, law, and ethics serve different functions as criteria.

i. In this document, the words "can" and "might" will be used to identify the criteria power to act.

ii. In this document, the words "may" and "may" will be used to identify the criteria law (i.e., authorized behavior).

[I.] A legal duty may exist when you can not act (i.e., you lack the power to act).

[II.] For a ***mere* legal person** (e.g., corporation) it is correct to write that the power to act requires legal authorization (e.g., *Ultra Vires* doctrine). Accordingly, resist the temptation to write "the corporation can" rather than write "the corporation may" except in those circumstances when it is critical to distinguish an unlawful exercise of physical power to act from a lawful authority to act.

II. A. 2. d. ii. [III.] But, for a **natural person** (i.e., human) given the importance of II.A.2.d.iv.: [law ≠ ethics] below it is very helpful to write "can" and "may" as appropriate for the context.

iii. In this document, the words "should" and "ought" will be used to identify the criteria ethics.

[I.] An ethical duty can not exist if you can not act (i.e., power to act is a prerequisite of an ethical duty).

iv. While creation of law routinely is guided by ethics, what is legal is not necessarily ethical; nor *visa versa*.

II. A. 2. d. iv. [I.] Creation of law routinely is both temporally remote and culturally remote from the application of law (i.e., what was ethical for "them" then is not necessarily ethical for "us" today).

[II.] Law is a tool designed to be applied to groups (e.g., legal duty is reasonable relative to the Reasonable Person) but law is applied to individuals (e.g., natural person within a corporation).

II. A. 2. d. iv. [II.] [A.] When all persons are acting lawfully when a corporation acts, then, legally, typically, only the corporation "acts" even though acts of multiple natural persons are necessary for that corporate action.

II. A. 2. d. iv. [II.] [B.] Recall the difference between II.A.2.d.ii.[I.]: [legal duty without power to act] versus II.A.2.d.iii.[I.].: [ethical duty only with power to act].

[III.] Law usually focuses upon objective knowledge (i.e., either receipt of notice or reason to know) while ethics solely focuses upon subjective knowledge (i.e., actual knowledge [a.k.a., *scienter*]).

3. Consequences.

a. Feasible.

i. Reality.

ii. Reasonable expectations.

iii. Actually expected.

iv. Known knowns versus known unknowns versus unknown knowns versus **unknown unknowns**.

II. A. 3. a. v. [I.] If the set of unknown unknowns is not a null set, then is the set of known knowns a null set?

II. A. 3. b. Countable.

i. Ought we count 0, 1, 2, 3, 4;
or,
ought we count 0, 1.62, 2.72, 3.14, 4.67?

c. Counts.

II. A. 4. Social: is it "us" versus "them"; or is it "us" and "them"?

a. *Who* are "us" and who are "them"?

i. Are "them" necessary for "us"?

ii. If the immediately preceding item II.A.4.a.i.: [them are us] is true, then is the distinction between "us" and "them" specious?

b. *When* are "us" and when are "them"?

II. A. 4. b. i. Int**RA**-generational transfers (e.g., unemployment insurance).

ii. Int**ER**-generational transfers (e.g., infrastructure).

iii. Rule of 72: see, II.B.2.: [time preference].

c. *What* are "us" and what are "them"?

i. Prioritization of life forms: but, recall II.A.4.a.ii.: [them are us].

II. A. 4. d. *Where* are "us" and where are "them"?

i. To what extent, if any, are "us" three dimensional beings in a four dimensional time/space; and are "them" identical in that regard?

e. Be here now. ≈ 11! * 20! * 13! ≈ 6.0 x 10^36 meanings.

i. Note II.B.3.: [synchronicity].

5. Technological.

a. **Technology** is a combination of idea(s) and physical embodiment(s).

b. **Technology** is the feasible combination of inputs.

i. Knowledge.

[I.] Recall the sources of "labor specialization" from economics: ability, time on task, and learning.

ii. Skills.

iii. Tools.

II. A. 5. c. Implicit blinders (e.g., See {literally, see the film} *My Dinner with Andre*) and explicit blinders (e.g., law's rules of evidence) alter what is seen.

i. Can not see (e.g., II.A.3.a.iv.; especially [I.]: [unknown unknowns])

ii. Acutely see.

[I.] The professional's blinders
(e.g., thinking like a businessperson)
facilitates focus both by
minimizing distraction by low priority stimuli
and by
enhancing the visibility of high priority stimuli.

iii. Criteria of appraisal changed by change itself.

[I.] Unpredictable consequences.

[A.] Good idea
experienced as bad consequence.

II. A. 5. c. iii. [I.] [B.] Interplay of II.A.3.a.iv.[I.]: [unknown unknowns]
with II.A.5.e.i.: [law can not anticipate]
with II.A.5.f.i.[III.][A.][1.]: [feedback loop; see also V.I.: [feedback loops]]
with II.B.3.: [synchronicity]
with III.A.1.a.: [whole greater than sum of parts; see also V.F.: [nonisomorphic]].

[II.] *Contra*, Rawles' ***veil of ignorance*** supports creation of coherence across full range of known feasible changes.

iv. ***Coherent*** criteria (i.e., stable across contexts) are superior criteria for appraisal.

[I.] Money is objective rather than coherent.

II. A. 5. c. iv. [II.] As scope of consequence increases
both
the coherence of objective criteria decreases
and
social urge to use objective criteria increases.

[III.] Note II.A.5.f.i.[III]: [economies of scope] and note III.C.4.: [scope].

II. A. 5. d. Implicit value structure.

II. A. 5. d. i. When technological change is an "advance" depends upon the criteria;
recall I.A.7.: [positivist versus normative].

[I.] Schumpeter: **creative destruction**.

[A.] Economic obsolesce involves use of the ***Shut Down Rule***: TR < VC.

[1.] Old technology becomes economically obsolete when $AVC_{old} > ATC_{new}$.

[2.] Since economic obsolesce is, no less than partially, triggered by events external to the firm it can arrive instantaneously and/or unexpectedly.

[B] Technological obsolesce is a functional question rather than a question of cost.

[C.] Accounting obsolesce (e.g., terminal date of straight line depreciation) is an objective forecast of useful life that might or might not be linked in any way to either technological obsolesce or economic obsolescence.

II. A. 5. d. i. [II.] Schumacher: **contextual appraisal**.

II. A. 5. d. i. [II.] [A.] Far less than most often, bigger is cheaper (e.g., Schumacher's *Small is Beautiful*).

[III.] Veblen: **conspicuous consumption**.

[A.] Value is dependent both upon context and upon reflection within that context.

ii. Which tool attributes is/are necessary for the appraisal of change to be correct?

[I.] Static versus dynamic.

[II.] Mechanical versus biological.

[III.] Equilibrium versus chaotic.

II. A. 5. e. Law can not anticipate.

i. Reasonable expectations are by definition historical.

II. A. 5. f. Due to the relatively minimal constraints attributable to the physical embodiment component of technology, technology is an economically distinctive input.

i. *Within bounds that are far less bounded than is ordinary, technological change often* ***in****correctly is viewed as allowing economies of scale to be feasible.*

[I.] Economies of **scale** = proportional increase in <u>*all inputs*</u> generates an increase in total cost but less than a proportionate increase in average cost; so that the LRATC falls as output rises.

[A.] Recall economist's long run in II.A.2.c.ii.[II.].: [long run].

[II.] ***Economies of size*** = proportional increase in <u>*most inputs*</u> generates an increase in total cost but less than a proportionate increase in average cost; so that the LRATC falls as output rises.

[A.] ***MES***: minimum efficient size.

[III.] Economies of **scope** (a.k.a., ***network effect***) = proportional increase in the <u>*market(s) generating and/or market receiving the inputs and/or the outputs*</u> of a market participant generates a more than proportionate decrease in LRATC of that participant's output.

II. A. 5. f. i. [III.] [A.] Within a process and across processes are linkages for obtaining inputs and sending outputs

[1.] A ***feedback loop*** connects the past status of a system part both forward to one or more system parts as well as backward to that system part's future self.

[B.] Feedback loops tend to accentuate other processes: see, V.I.: [feedback loops].

[C.] Note, III.C.4.: [scope].

[IV.] But, recall II.A.2.c.: [sustainability]; especially recall II.A.2.c.i.: [strong sustainability] versus II.A.2.c.ii.: [weak sustainability].

II. A. 5. f. i. [V.] In these estimations of ATC (i.e., average total cost) how broadly (e.g., II.A.2.c.i.: [sustainability]) is "total" estimated? See also, III.D.5.b.: [labor productivity versus total productivity]

II. A. 6. **Ecological** (i.e., relations and interactions between organisms and their environment [e.g., habitat], including other organisms).

a. What is the priority ranking of every life form?

i. Which life forms on Earth are *sine qua non* for human life?

ii. Recall II.A.4.: [us versus them] and recall II.A.5.f.i.: [technology not yield scale].

II. A. 6. b. Can rape of the Earth be good stewardship?

i. ***Private goods***, generically, are notable for their characteristics of rivalry of consumption and exclusivity of possession.

ii. ***Public goods***, generically, are notable for their characteristics of externalities springing from muted characteristics of rivalry or of exclusivity.

I. A. 6. b. ii. [I.] An **externality** (a.k.a., spillover) does not register as "supply" and an externality does not register in the market as "demand". The market price is a **zero price** for some fraction (?whole?) of the externality. That zero price prevents the allocative effect of the market, thereby generating excessive consumption for spillover costs and insufficient consumption for spillover benefits.

iii. Waste (i.e., real property law) is a breach of a legal duty or of legal duties.

[I.] ***Waste*** is misappropriation of the ownership rights of either concurrent or subsequent owners.

II. A. 6. c. What is the minimum feasible number of generations for an evolutionary consequence in a life form (i.e., what is minimally necessary fraction of total population that must carry a gene; as well as what is the relevant average fecundity)?

II. A. 6. c. i. Is it the "seventh generation of the seventh generation"?

[I.] E.g., approximately 266 years if assuming Thomas Jefferson's generational estimate of 19 years times 14 generations; or, e.g., approximately 350 years if assuming a 2006 USA mother's age of 25 at birth of first child.

[A.] See, II.B.2.a.iv.[I.].: [penny = million $].

ii. How does the metric "generation" vary across life forms?

[I.] Which existing technologies have generated an evolutionary consequence in some life form (e.g., antibiotic resistance)?

[II.] Which technologies have done so in humans (e.g., speech has; but not [?yet?] graphs)?

II. A. 6. c. ii. [III.] Given how you answered II.A.6.c.: [minimum number of generations] and II.A.6.c.ii.: [metric of a generation], relative to which other life forms on Earth, moving into the future, do humans have and do humans not have an advantage over most other life forms for gaining beneficial evolutionary consequence?

II. A. 7. Positivist versus Normative.

a. Recall Einstein counting.

b. Science strives to be positivist and science strives to minimize being normative.

c. ***Positivism*** (a.k.a., *scientific method*) seeks to avoid values (e.g., observer bias) and instead seeks to solely focus on ***facts***.

i. ***Facts*** are asserted to be objective (i.e., perception of a Reasonable Person) rather than to be subjective (i.e., natural person's personal perception).

II. A. 7. c. ii. ***Facts*** exhibit consistency of perception across different observers.

[I.] Opinions are subjective; and the mean opinion has a relatively larger variance.

[II.] In a court of law the opinions of experts are accepted as if *fact* because the opinions of experts cluster sufficiently tightly to warrant judicial acceptance: recall, II.A.5.c.: [rules of evidence].

II. A. 7. d. ***Normative*** explicitly recognizes and seeks to inventory the values explicit and implicit in all *facts* (e.g., GDP, profit).

i. Normative asserts it is impossible to extinguish observer bias. That is, at best can expressly manage influence of the observer bias.

ii. Normative asserts that the <u>*choice*</u> of the *facts* is <u>*inherently normative*</u>.

[I.] But note, New York Senator Daniel Patrick Moynihan, former U.S.A. Ambassador to the U.N., was fond of observing that "*Everyone is entitled to his own opinion, but not his own facts*.".

e. See also II.A.2.a.: [criteria for "good" and for "bad"].

II. B. Each conception of time influences what is perceived.

1. Stream of time.

a. Unidirectional causation (i.e., past then present then future).

b. ***Clock time*** a.k.a., *classical time*, is an artificial human abstraction created to foster positivist objective perceptions. See below, V.K.: [real versus classical time].

i. An advantage of clock time is that its units are infinitely divisible and infinitely aggregatable; as well as ranges from infinite past to infinite future.

II. B. 1. b. ii. A disadvantage of clock time is that the unit of clock time selected for use during a study need not bear any relationship whatsoever to the process cycles being studied.

II. B. 1. b. ii. [I.] There is a clear risk of specifying a unit of clock time that quite likely precludes the ability to perceive a process cycle being studied because the unit of clock time is vastly different (either larger or smaller) than the process cycle (e.g. study days when process cycle takes place in seconds; or study days when process cycle takes place in decades).

2. Discounting of the dollar value of time.

a. Dollar value varies with magnitude of temporal separation.

i. E.g., a rough estimator of the compounding process is the ***Rule of 72***:
72 / i = periods to double or to halve a dollar value via compound interest earned or via compound interest owed.

[I.] That compound period interest rate, i, is written as an integer (e.g., 7.2 rather than 0.072).

[A.] A $1 loan for a period of ten years at 7.2% *simple interest* would require the debtor to pay the creditor the principal of $1 plus the interest of $1 * 0.072 * 10; that is, $1.72.

[B.] On a $1 loan for a period of ten years at 7.2% compound interest would require the debtor to pay the creditor the principal of $1 plus the interest which included interest earned on the interest (e.g., year two's interest is $1.072 * 0.072, or 0.77); for a total repayment of $2.00. The formula, stated in terms of the compound interest rate is:
i = ({FV /PV}^1/n) - 1.

ii. Helps answer II.A.4.b.: [when are us & them].

II. B. 2. a. iii. Typically
ignores II.B.3.: [synchronicity]
as well as typically
ignores III.A.: [π = TR - TC];
ignores III.B.: [ethics is multiple systems]; and
ignores III.C.: [complex systems interacting].

II. B. 2. a. iv. Discounted present value routinely requires a host of implicit assumptions that rarely individually or collectively are accurate: if ever accurate (recall, II.A.5.c.iv.[I.]: [money is objective rather than coherent]).

[I.] At 7.2% compound annual interest, a debt of $1 borrowed today and payable at the end of 10 years is doubled as a debt by the debt's interest payment of $1; similarly, in this way, at 7.2% simple annual interest a cost of $1.0 x 10^6 is imposed 276 years in the future but, today, is only "worth" $1.0 x. 10^-2.

II. B. 2. a. iv. [I.] [A.] When a future cost (e.g., externality) is currently estimated and discounted, *vary* *rarely* is a ***sinking fund*** currently created and that penny deposited so in that future 276 years hence so that the compounded interest earned on that today penny so that future million dollar harm is compensated (e.g., II.A.4.b.ii.: [intERgenerational transfers]).

II. B. 2. b. Time preference.

i. Discounting implicitly prefers the present over the future.

ii. Adequate deposits into a II.B.2.a.iv.[I.][A.] sinking fund *might* reflect a balanced time preference rather than a biased time preference.

II. B. 2. b. iii. Given II.A.3.a.iv.[I.]: [unknown unknowns], use of II.B.4.b.i.: [Precautionary Principle] might be required to demonstrate a balanced rather than a biased time preference.

II. B. 3. Synchronicity.

a. *Sequencing* of process inputs and outputs.

i. Time is certain to be:

[I.] Linear;

[II.] Cyclical
(e.g., feedback loop); **and/or**

[III.] Alternating
(e.g., contextually defined directionality
for a feedback loop).

b. *Punctuality* of process inputs and outputs.

II. B. 3. c. *Duration* of process inputs and outputs.

d. *Coordination* of process inputs and outputs.

4. Preferences related to risk: risk averse, risk neutral, and risk seeking.

a. Speaking technically,
"uncertainty" does not equal "probability";
nor does "uncertainty" equal "risk".

i. Rarely will you encounter a human who
consistently speaks technically about
hazard, reward, uncertainty, probability, and/or risk;
instead humans routinely and erroneously substitute
one for the other.

ii. ***Hazards*** and ***rewards*** are consequences.
Hazards are a negative consequence.
Rewards are a positive consequence.

II. B. 4. a. iii. ***Uncertainty*** (duh!) is a lack of certainty:
that is,
a context where
it is not possible either to identify
the different feasible consequences or
it is not possible to measure
the relative frequency of the different consequences.

[I.] Recall II.A.3.a.i.[I.].: [unknown unknowns].

[II.] Some assert that randomness is a prerequisite
for certainty and probability.

[A.] See, II.B.4.f.i.: [random]; and
see, II.B.4.f.i.[II.].[A.]: [random
distribution].

II. B. 4. a. iii. [III.] Given the implicit definition of certainty in II.B.4.a.iii. is there always uncertainty? Recall, II.A.3.a.i.[I.]: [unknown unknowns].

II. B. 4. a. iv. ***Probability*** exists when it is both possible to identify the different consequences *and* possible to measure the relative frequency of the different consequences (e.g., likelihood).

v. ***Risk*** is *deviation from expected* probabilities mathematically coupled with the rewards and the hazards.

[I.] Does the Bayesian decision tree display risk, uncertainty, or neither?

[II.] Recall II.B.4.a.ii.: [hazard and rewards] and recall that humans frequently substitute risk for hazard as well as substitute uncertainty for probability.

II. B. 4. b. ***Risk Averse*** = decision maker prioritizes avoidance of large hazards; thus, voluntary acceptance of large risks requires rewards to be disproportionately larger (since probabilities are assumed not alterable).

II. B. 4. b. i. ***Precautionary Principle*** = for major risks shared broadly (e.g., externalities) the decision maker ought prioritize avoidance of worst case outcomes even if probabilistic assessment reasonably forecasts significantly profitable risk taking for the individual decision maker and significantly profitable risk taking for the broader social context.

II. B. 4. b. i. [I.] Recall II.A.2.c.i.: [strong sustainability] versus recall II.A.2.c.ii.: [weak sustainability]; as well as recall II.A.4.: [us versus them; or, us = them].

II. B. 4. c. ***Risk Neutral*** = voluntary acceptance of all risks as long as hazards and rewards track proportionally with the risk.

i. Economics, seeking to be positivist, *assumes* a rational person and then *assumes* all rational persons are risk neutral and then *assumes* all natural persons are rational persons.

II. B. 4. c. i. [I.] Based upon the flip of fair coin, what reward do you require for you to voluntarily accept your slavery as a hazard?

[A.] Are you risk neutral?

II. B. 4. c. i. [I.] [B.] Are you rational?

II. B. 4. d. ***Risk Seeking*** =
decision maker prioritizes large rewards over smaller rewards, thus voluntary acceptance of larger hazards and/or large risks does not require rewards to be grow proportionately with risks.

i. Small rewards tend to be assimilated by the current context without fundamentally transforming the current context; whereas, large rewards tend to transform the current context, and that change in context is what is desired rather than the reward itself.

ii. PowerBall probabilities are 1 in 2.0 x 10^8 with gross rewards rarely as good as $1.0 x 10^8; and yet very many tickets are sold at $1.0 x 10^0: who buys PowerBall tickets and why?

[I.] Note how PowerBall as an example of risk seeking incorrectly uses the concept of "risk" in the routine manner of that common error.

II. B. 4. d. iii. Is the word "risk" used in the II.B.4.b.: [risk averse] item with its II.B.4.a.v.: [risk] technical definition or with its II.B.4.a.i. vernacular definition (e.g., hazard)? Which definition of "risk" is used in II.B.4.c.: [risk neutral] and in II.B.4.d.: [risk seeking]? Re-read each item very carefully. In any one of those locations has the meaning of hazard been erroneously substituted when the word "risk" is used? While all knowledgeable persons use the phrase "risk averse", the vast majority of those users really mean "hazard averse" because they are not focusing upon any deviation from the expected probabilities.

II. B. 4. e. A ***Black Swan*** is a low probability event with a large consequence. Accordingly, a Black Swan posses high risk. The deviation from the expected probability is more likely because accurate estimation of low probability decreases with II.A.3.a.iv.[I.]: [unknown unknowns].

II. B. 4. e. i. What are the differences in consequences between a *positive Black Swan* and a *negative Black Swan*?

II. B. 4. f. When is a characteristic:

i. ***random***?

[I.] Recall II.B.4.a.iii.[II.]: [randomness is a prerequisite for certainty and probability].

II. B. 4. f. i. [II.] The definition of *random* varies by the purpose of the definition. Generically, random means having no specific pattern, purpose, or objective. Statistically, random means of or relating to a type of circumstance or event that is described by a probability distribution. Here, *random* means a specific statistical pattern (i.e., normal curve).

II. B. 4. f. i. [II.] [A.] The probability distribution of the **normal curve** ranges from negative infinity to positive infinity; its mean, median, and mode are identical; is symmetrical; and the frequency of occurrence decreases at an increasing rate of decrease as move away from the mean/median/mode.

ii. *chaotic* (e.g., ***Butterfly Effect***)?

[I.] Some assert the *Butterfly Effect* necessarily violates Newton's Laws of Motion (i.e.,
1st inertia;
2nd f=ma; and
3rd equal and opposite reaction)
and/or
violates Newton's Laws of Thermodynamics (i.e.,
1st conservation of energy;
2nd entropy in a closed system; and
3rd absolute zero not reached).

II. B. 4. f. ii. [I.] [A.] Instead, the *Butterfly Effect* functions via processes that are context dependent (e.g., H_2O is solid below 0° C and is a gas above 100° C) due to catalytic agents and feedback loops in open systems.

II. B. 4. f. ii. [II.] ***Chaos theory*** posits that dynamic systems (simple or complex) exhibit a system characteristic of sensitivity to initial conditions; such sensitivity being very responsive to any uncertainty. That is, II.B.4.a.v.: ["risk"] rapidly escalates and compounds.

[A.] Some systems have predictable properties, others do not.
An example of a predictable property is the *Butterfly Effect*: a major variation in consequence due to a minute variation in inputs.

[B.] Note as somewhat opposite view in *Coase's Theorem* at III.D.4.

iii. unpredictable?

[I.] *Uncertainty* of II.B.4.a.iii. is only one form of unpredictable.

II. B. 4. f. ii. [II.] Recall II.A.5.c.iii.[I.]: [unpredictable consequences].

iv. Recall II.A.3.a.iv.[I.]: [unknown unknowns].

III. A network as a context for consequence alters the array of feasible consequences.

A. *Size*.

1. Maximum size of an individual part is exceeded by aggregation of individual parts.

a. Across multiple dimensions, ***the whole is greater than the mere sum of the parts***.

2. Recall relative consequences discussed in II.B.2.a.iv.[I.]: [penny = million $] as well as in II.B.4.b.i.: [Precautionary Principle].

B. *Scale*.

1. A proportional increase in <u>*all inputs*</u> results in a proportional increase in output.

III. B. 1. a. A scale result is both more feasible and more likely with an aggregations of units versus with individual units.

III. B. 1. b. The **law of diminishing marginal returns** counsels that increasing a *single input* initially might result in a more than proportional increase in total output; but beyond a certain point increases in that *single input* results in a less than proportional increase in output; and, ultimately a decrease in total output.

C. *Scope*.

1. Classic definition of *network effect* springs from scope.

2. ***Proximately caused*** (i.e., reasonably foreseeable) consequences both on distant processes and in distant systems via alteration of *synchronicity* across *feedback loops*.

III. C. 3. *Scope* consequences alter:
   a. parts,
   b. subunits,
   c. aggregations of parts and of subunits, and/or
   d. the whole.

III. C. 4. *Scope*, with no change in technology, can be similar in consequence to a change in II.A.5.b.: [technology is the *feasible* combination of inputs).

   a. *Feedback loops* can alter positively and can alter negatively what is feasible.

   b. Recall all of II.A.5.: [technological].

   c. Recall II.A.5.c.iii.[I.][B.]: [interplay]; recall II.A.5.f.i.[III]: [network effect]; recall II.B.3.: [synchronicity]; and note V.I.: [feedback loops].

D. Optimization.

1. Whose utils are to be maximized?

   a. Recall II.A.4.: [us v. them; or us & them].

2. Benefit / Cost Analysis.

   a. What are the implicit values expressed when the ratio is phrased as benefit/cost versus phrased as "cost/benefit"?

III. D. 2. b. Is the mathematical interpretation of the ratio benefit/cost substantially similar to the interpretation of the ratio cost/benefit?

3. *Pareto Optimality*: change only is "good" if improve one without harm any.

   a. Contrast with *Pareto Principle*: 20% of inputs yield 80% of outputs.

III. D. 4. *Coase Theorem*:
if few transactions
and if small transaction costs individually and in aggregate,
then *(but not so if either of the above ifs is not satisfied)*
initial allocation does not preclude efficient end allocation
via market transactions in the long run.

a. *Coase Theorem* helps define the efficient boundary between the firm and the market.

b. Coase Theorem is routinely ***mis***applied to fallaciously justify gross inequalities coupled with governmental non-response (e.g., externalities).

c. Recall II.A.2.c.ii.: [weak sustainability] and recall II.A.2.c.ii.[II.]: [economist's long run].

III. D. 5. Cobb-Douglas function:
$Y = A L^{\alpha} K^{\beta}$
where
Y = total production; A = *total factor productivity*;
L = labor; α = elasticity; K = capital; and β = elasticity.

a. These elasticities are used to define economies of scale.

b. What is the difference between *labor productivity* and total factor productivity?

III. D. 5. b. i. Recall II.A.2.c.i.: [strong sustainability] versus recall II.A.2.c.ii.: [weak sustainability]; as well as recall III.4.C.iii.: [multiple recall of feedback loops].

III. D. 6. Subunit optimization at the expense of the whole becomes a discrete source of subunit "profit".

a. Also known as the ***principle / agent problem***.

b. Can be explored from the perspective of ***rent seeking***.

c. Recall II.A.4.: [us v. them; or us & them] and recall II.B.4.b.i.: [Precautionary Principle].

E. *The **Tipping Point**: How Little Things Can Make a Big Difference* by Malcom Gladwell. ISBN: 0316346624. HM1033 .G53 2002.

1. **Law of the Few**.

a. ***Connectors*** to facilitate transmission.

i. In Milgram's Omaha-to-Boston ***six degrees of separation*** a few connectors were responsible for half of the deliveries.

III. E. 1. a. ii. The age of information, paradoxically, also is the *age of isolation*.

[I.] As information flow increases, especially when the flow exceeds the channel capacity *immunity* to communication via that channel sets in.

[A.] A decrease in the cost of a mode of communication tends to trigger both an increase in the quantity of communication via that mode as well as an increase in the *immunity* of recipients via that mode.

[1.] *Fax effect* as contrasted with email's *law of plenty*.

[II.] As immunity sets in the relative importance of *word of mouth* communication increases.

[III.] Immunity is stimulated when the recipient of a communication experiences conflict between the recipient's internal word view and the external world view being communicated.

b. ***Mavens*** collect and transmit a vastly disproportionate amount of information.

i. The relative importance of *mavens* increases as *immunity* increases along with *isolation*.

c. *Salesmen* perform the function of persuasion that is necessary for adoption.

2. **Sticky concept**.

a. Information washout via flooding unless information is memorable.

3. **Power of Context**.

a. Environmental conditions welcome or oppose transmission (e.g., seasonality in transmission of STDs).

b. Environmental conditions signal (e.g., *broken window effect*) receptivity to some transactions (e.g., crime).

c. Group awareness and involvement preserves, cultivates, and transmits stimuli.

i. Channel capacity constrains and focuses transmissions.

III. E. 4. The interplay of the law of few, stickiness, and the power of context control the process of ***diffusion***.

a. The sequence of adoption is:

[i] innovators;

[ii] early adopters;

[iii] early majority;

[iv] late majority; and finally

[v] laggards.

b. Early adopters perform the function of *translation* of the innovators' vision into a conceptualization concordant with the main stream so that the early majority feels comfortable making the adoption decision.

IV. General Systems Analysis (GSA) prioritizes a focus on relationships, structure, and interdependency rather than a focus on constant attributes of objects.

A. Openness, complexity, wholeness, hierarchy, and regulation set up those relationships, structure, and interdependence.

B. Within a dynamic whole a part functions differently than when the part is examined in isolation.

V. Twelve Principles of Systems.

A. A system is a set of objects together with relationships between objects and their attributes.

1. Objects are elements (e.g., parts, subparts).

2. Attributes are properties (e.g., trigger levels and tolerance levels).

3. Relationships connect with iterations (e.g., cycles of cycles).

a. Due to our **Bounded Rationality** we are prone to tell ourselves the lie of uni-dimensionality.

i. All rational decision makers suffer from Bounded Rationality due to the infirmities of limited intellect, limited knowledge, and limited time for analysis and decision. Accordingly, the quality of a decision is measured against the constraints of those infirmities.

V. B **All systems are open** (but, recall II.B.4.f.ii.[I.]: [Newton's Laws of Motion and Laws of Thermodynamics]).

1. **Openness is a flow** (i.e., typically both inputs and outputs) between the system being examined and its environment (i.e., multiple, other systems).
2. The state of a system is influenced by its flows.
3. **Environment routinely viewed as a *black box*** that is source of:
   a. Recall II.A.2.c.: [sustainability]; and recall II.A.6.b.i: [private goods] versus recall II.A.6.b.ii.: [public goods].
   b. Natural good production (e.g., forest);

V. B. 3. c. Natural resources (e.g., oil);

   d. Living Systems (a.k.a., Life Support Services [e.g., atmosphere]);
   e. *Sink Function* (e.g., absorb and process human pollution).

C. Systems are ***nonisomorphic*** (i.e., whole is greater than sum of parts).

1. a.k.a., holistic.
2. Rejects reductionist thinking of objects viewed in isolation.

V. D. Systems stress ***equifinality***.

1. Posits multiple feasible paths rather than focus on equilibrium.
   a. Forecasting the future
      (e.g., start with an ice cube and end with ?)
      is far easier than
      forecasting the past
      (e.g., now a puddle of water having started with ?).
   b. Managers generally focus on the task of *backcasting*. That is, identify a future date and future status, and then actively constrain present and intermediate events so as maximize the likelihood of that identified future status being achieved by the identified future date.
2. Recall *can* versus *may* versus *should* (i.e., power v. law v. ethics) at II.A.2.d.

E. System components interact.

1. Cultural values (e.g., Golden Rule versus invisible hand versus golden rule [there are two rules known as the "golden rule"]).
2. Social beliefs (e.g., free will versus fate).
3. Personal attitudes (e.g., risk preference a.k.a., hazard preference).

V. E. 4. Technology: recall II.A.5. through II.A.5.f.i.[V.].

5. Natural Environment (e.g., wild versus depleted).

F. Systems operate within constraints imposed by the system's controls and the system's regulations.

1. Magnitude of constraints vary.

a. ***Necessary***.

i. If system part #A is <u>*necessary*</u> for system part #B, and if part #A is present, then part #B might or might not be present; but, if part #A is absent, then part #B is absent.

ii. Recall II.A.2.b.: [necessarily competing explicit and implicit system goals] and recall II.A.3.a.iv.[I.]: [unknown unknowns].

b. ***Sufficient***.

i. If system part #A is <u>*sufficient*</u> for system part #B, and if part #A is present, then part #B must be present; and if, if part #A is absent, then part #B is absent.

c. Adequate.

d. Viable.

V. F. 2. Subsystem linkages provide additional venues for control and regulation.

3. Rules of control and rules of regulation are both alterable and interactive.

V. F. 4. ***Technology*** interacts with control and regulation in a multitude of ways (e.g., *mechanism* for control versus *alters* controls).

i. Recall II.A.2. through II.A.2.d.iv.[III.]: [criteria] and recall II.A.5. through II.A.5.f.[V.]: [technological] and recall II.B.3. through II.B.3.d.: [synchronicity] and recall III.C. through III.C.4.b.: [scope].

V. F. 5. Social beliefs interact with control and regulation in a multitude of ways (e.g., view of what is feasible [e.g., USA racism prior to Martin Luther King]).

a. Law assumes a Reasonable Person. Recall II.A.5.e.: [law can not anticipate; reasonable expectations necessarily are historical]

V. F. 5. b. Economics assumes a Rational Person.
Recall II.B.4.c.i.: [economics seeks to be positivist via risk neutrality].

c. Who is more likely to succumb to ***group think***:
a natural person, a legal person,
a Reasonable Person, or a Rational Person?

V. G. Systems contain hierarchies.

1. Outputs of subsystems
provide inputs to other subsystems and/or systems.

2. Hierarchies increase scope of reasonably foreseeable
(i.e., proximate cause) consequences.

H. A system can be viewed via its ***flows***, its ***deliveries***, and its ***sequences***.

1. Threshold levels trigger reaction
within or outside of the system.

2. Tolerance levels when exceeded trigger transformation
within or outside of the system.

3. Recall II.B.3.: [synchronicity] and
recall II.B.4.f.ii.: [chaos theory] and
recall V.F.1.: [magnitude of constraints vary].

I. ***Feedback loops*** can be positive or can be negative.

1. ***Positive feedback*** is self reinforcing.

a. If the flow is both above the threshold and below the tolerance levels, then the feedback loop fosters growth.

i. But, tendency towards instability and/or decay.

V. I. 1. a. ii. A positive feedback loop can aggregate flow until the flow exceeds the tolerance level; potentially triggering unrestrained growth that collapses the system if that flow either consumes to exhaustion a source of inputs or produces outputs that swamp the system.

b. Positive feedback often serves as
both intra-system and inter-system communication.

2. ***Negative feedback*** is self-regulating and fosters goal direction.

a. The dampening consequences of a negative feedback reduce the likelihood of a run-away process.

i. Easily confused with Newton's 2nd law of thermodynamics at II.B.4.f.ii.[I.].

V. I. 3. Stimulation of a system's feedback loops (either positive or negative) by a force external to the system which can magnify the scope of consequences; feasibly triggering multiple system collapse if necessary subsystems or if sufficient subsystems either are starved of inputs or are swamped by inputs.

a. Recall II.B.4.f.ii.[I.]: [chaos theory] and recall II.A.5.c.iv.[II.]: [as scope increases coherence of objective criteria decreases] and recall II.A.5.f.i.[III]: [network effect] and recall III.C. through III.C.4.b.: [scope].

V. J. **Systems** foster differentiation and elaboration.

1. **Evolution towards complexity** (i.e., not entropy).

a. Note, Newton's 2nd law of thermodynamics at II.B.4.f.ii.[I.] uses the assumption of a closed system which is contrary to open systems principle at V.B.

V. K. Systems use ***real time*** rather than *classical time*.

1. Newtonian time relies upon strict deterministic causality.

a. Contrast with *equifinality* principle at V.D.

2. Time is a social construct rather than a natural phenomena.

a. Focus on process *synchronicity*; not clock time.

i. Recall II.B.3. through II.B.3.d.: [synchronicity].

L. **Evaluation** of a system's objects, attributes, and relationships **requires prior specification of values**.

1. Recall II.A.2. through II.A.2.d.iv.[III.]: [criteria] and recall II.A.7. through II.A.7.e.: [positivist versus normative].

2. System viability typically requires both *sufficiency* and redundancy.