system > society), 'data' science is a set of understandings concerning the intentional/usable nature of data that conceptually unify studies of statistics, data analysis, machine learning and their related methods in order to understand (why) and analyze (how) actual phenomena occur with data. Data science could be said to employ techniques and knowledge of patterns:

1. **Human patterns, life patterns** - meaningful patterns; the experience of interfacing with patterns that mutually benefit all.
2. **Mathematics, conceptual-visual patterns** - computational patterns; the visual language of pattern recognition.
3. **Linguistics, language patterns, language science** - unified communications patterns; the unification of linguistic communication, in order to facilitate precision of communication.
4. **Informatics, informational patterns, information science, data patterns** - modeling patterns; the logical way of building and visualizing observable patterns.
5. **Analytics, pattern recognition, pattern comparative de-composition, analytic sciences** - the collection and de-composed recognition of patterns; a way to observe and de-compose patterns from data based on an existing model.
   A. Social system > Discovery.
   B. Decision system > Data acquisition and recognition.
6. **Statistics, pattern prediction, computational understanding sciences, mathematical sciences, inquiry threshold resolution patterns** - predictable patterns; a way to infer patterns from data based on an existing model.
   A. Social system > Knowledge development, memory, and search.
   B. Decision system > Parallel inquiries resolution thresholds.
7. **Computer science, computronics, pattern computation, computer language(s)** - soft patterns, a way to build algorithmic patterns. These are conceptually/mentally/consciously interface-able patterns) based on data of an existing model (i.e., software).
   A. Social system > Application to computation, conceptual automation [inquiry].
   B. Decision system > Solution Inquiry (in part), computational decision algorithm, which can be visualized and understood by the humans using it).
8. **Material science, pattern spatialization, spatial patterns, object patterns** - hard patterns, a way to build material/physically interfaceable patterns based on data of an existing model (i.e., hardware/ hardware modules).
   A. Social system > Application to spatial, physical conscious experience [inquiry].
   B. Decision system > Solution Inquiry (in part), material objectives' encoding algorithm, which can be visualized and understood by the humans using it.

The following is sometimes said of the following processes:

1. Scientists care about understanding why something works the way it does.
2. Engineers care about how something works; and thus, whether something works or does not work.
3. Developers care about when and where something is to work (note engineers are also developers).
4. Coordinators care about access to working information.
5. Users care about how much something works as required or expected.

2.2 What is a systems-based form of organization?

CLARIFICATION: *While many definitions of the word "system" exist, nowadays, the concept, 'system', is more and more frequently used, in different domains, to refer to a real world set of bounded dynamics, as in: a software system, a hardware/physical system, a social system, an economic system, a service system, etc. In each domain the meaning of the word "system" may have nuances.*

There are a large range of accurate definitions in the literature for the term, 'system'. In its most broad definition, a 'system' is an integrated set of interacted and organized elements and related processes. The following is a common, comprehensive, list of definitions of the concept, 'system':

1. Autonomous entity with regard to its environment, organised in a stable structure (identifiable in the course of time), constituted by interdependent elements, whose interactions contribute in maintaining the system structure and making it evolve.
2. A system processes inputs into outputs that achieve and satisfy a purpose or purposes through the use of resources in an environment.
3. Aggregation of end products and enabling products to achieve a given purpose (ANSI/EIA 632, the earliest definition of a system to identify the components and the purpose of a system in its definition).
4. Combination of interacting elements organized

to achieve one or more stated purposes (ISO/IEC 15288).
5. Set of elements and a set of inter-relationships between the elements such that they form a bounded whole relative to the elements around them.
6. Set or arrangement of elements [people, products (hardware and software) and processes (facilities, equipment, material, and procedures)] that are related, and whose behavior satisfies operational needs and provides for the life cycle sustainment of the products (IEEE 1220).
7. Integrated set of elements, subsystems, or assemblies that accomplish a defined objective. These elements include products (hardware, software, and firmware), processes, people, information, techniques, facilities, services, and other support elements (INCOSE 2010).

> **NOTE:** *Many standardized definitions of what a system "is" are available, including but not limited to: [ANSI/EIA 632, IEEE 1220, ISO/IEC 15288, INCOSE SEBOK, TAP CDS-SS-01.*

A system, itself, is completely defined by specifying (or otherwise, describing):

1. What the system does.
2. How the system does it.
3. What the system uses to do it.
4. Where the system lives ("is" in relation to a larger unified information system)

A system can be comprehended in its entirety through integration of various seemingly separate views, which unify the systems view:

1. **System context (system environment)** - context exist as the circumstances, factors, conditions, or patterns that enable or constrain system solutions.
2. **System bounding (system interface)** - the bounding of systems along different dimensions (geographical, physical, time, conceptual).
3. **System concept (system definition)** - the characteristics, properties, and classification of a system as a system of systems.
4. **System analysis (system de-composition)** - the development of approaches to engage in "holistic" analysis for systems.
5. **System transformation (system process)** - the nature, framing, and approach to transforming systems of systems from a "holistic" perspective.
6. **System representation and modeling (system intelligence)** - the distinction in modeling approach, and the role of representation, for systems.
7. **System intervention (system change)** - the design and deployment of initiatives to purposefully modify a system.
8. **System development (system prototype)** - the execution of methodologies an environments necessary to engage in systems engineering.
9. **System serving (system operation)** - the development of guiding frameworks and platforms to support [human needs through] system engineering execution.

Wherever there is technology and population that values efficient and effective alignment, then automation and measurement will likely play an important role in service operations. At the societal level, systems science necessitates measurement, and systems engineering necessitates automation.

2.2.1 Systems-based work organizational concepts

The basic systems concepts of 'organization' as applied to 'work' (useful effort) are:

1. **Order** - An order is a permutation of a list of items, where you are trying to find the best way to arrange a set of given values.
   A. A societal service system.
2. **Grouping** - The Grouping method assigns variables into sets.
   A. An InterSystem Team of individuals.
3. **Budget/Threshold** - The Budget/Threshold method is similar to Recipe except that all of the variables' values must total a number. This method is designed to run budget calculations or assign resource allocations with a Recipe solution in which the total is kept constant.
   A. Socio-technical resource accountability - decisioning that concerns material composition and position).
4. **Schedule** - The Schedule method is similar to Grouping except that it assigns elements to blocks of times while meeting certain constraints. This can be used to assign workers or courses to time periods or schedule meetings.
   A. Socio-technical event accountability - decisioning that concerns material positioning and timing).

2.3 What is the systems approach?

> *A.k.a., What is a 'working'-type systems organization?*

The systems approach is an approach that produces a working systems organization. Systems are processes organized in structural and functional hierarchies. Since all components, and their interactions, exist only as processes unfolding in time, the word system and the word process are essentially synonyms. Systems are structured hierarchically (logically). As processes, functional hierarchies correspond with the structural hierarchical architecture if systems. Systems naturally organize the work they do by functional hierarchy. A system may consist of several levels where each element at each lower level may by this definition itself be considered a system (i.e., a subsystem of a large system may itself possess all of the attributes of a system).

In a general sense, the concept of a 'system' is applicable to all things, contexts and situations. In other words, the use of the word 'system' can be applied to everything: all situations and contexts, all behaviors and environments, all organizations and experiences, all definitions and explanations, and all visualizations.
Visually, a system is a mapping (visualization) between a set of inputs and a set of outputs. Wherein, there is a relationship between the inputs [entities] and outputs [entities] by means of process [entities]. Here, shape, position, and motion form visualization.

Hierarchies are recognized as the means by which systems naturally organize the work they do. Analytical tools decompose a system. Because systems function through operational hierarchies, it is best to design systems as a hierarchy of components (concept through to material) integrated into working modules, which, in turn, are integrated into meta-modules, the top level of which, at least for society, is the unified societal system. Systems are networks of components tied together via links representing different kinds of relations and flows. Dynamics refers to how the processes operate or change inputs into outputs over time. Systemness is a recursive property in which, starting at some level, one can go up or down. A sub-system cannot extend beyond the capacity of the total system of which it is a part, nor can a sub-system be understood except through the larger system of which it is a part.

> **CLARIFICATION:** *A tool is some "thing" (physical or informational) used to carry out a specific function (task, or job).*

In order to understand a real world system, it must be studied and engineered as a process, not just structure. As processes, functional hierarchies correspond with the structural hierarchy of systems.

> **INSIGHT:** *In a system it is most effective to distribute tasks and processing, but it most efficient to centralize the information system; both can occur in parallel.*

The system's approach describes a system (i.e., a system has the following properties):

1. Holistic refers to a continuous region of space/time, that is viewed as a single entity identifiable by properties manifest at its boundary, and is identified generically as the system-of-interest or specifically by a meaningful descriptor.
2. Closed boundary refers to the terminating surface that limits the region of consideration from the space/time continuum that it exists without, i.e. its environment, and across which flow interactions between the system and its environment.
3. Elements refer to the complete set of discrete subordinate entities that comprise the whole, each having a different homogeneous nature and identity relative to all other members of the set;
4. Order refers to the arrangements of elements, their functioning and their relationships and their precedence in a hierarchy of consideration;
5. Interaction refers to all the mutual influences that each element has with all other elements;
6. Properties refer to all qualities that emerge at the level of the whole in all degrees of freedom as a result of the combinatorial effect of each individual entity, one on another.
7. A system is a state of energy and matter with distinguishable arrangement. The reasoning mind is tuned to define regions and to degrees of ordering within them.
8. A system is most effectively defined by boundaries that encapsulate meaningful need and practical solution.

> **NOTE:** *A complex system has both structure and process.*

The more common, though broad characterizations of a system include:

1. A system is a whole composed of parts, and there is a similarity (resonant quality) between the whole and the parts.
2. A system is, in part, defined as a set of system elements that interact to achieve, output a defined mission, input.
3. A system is a hierarchical composition of [system] elements. Each [system] elements will need to perform functions that have been allocated to it so that it can contribute to the system's existence, objective, or purpose (as in, imperative or mission).
4. A system's objective is broken down into a hierarchical structure of its functions. The logical description of a system's mission is broken down into a hierarchical structure of its major functions to form a functional hierarchy, or a functional architecture.
5. The physical hierarchy [of a system] consists of, for example: system, sub-system, assemblies, components.

All complex system design and development occurs through a project-based structure (coordinating the designed resolution to commonly indicated problems):

1. A project coordination (management) process (e.g., one that can easily be applied to all societal systems).
2. Common indicators
   A. Indicators that allow someone to check how the users handle any mismatch between expectations and results. These expectations may concern:
      1. The system to be built (as viewed from the angle of the product or service), or
      2. The system for creating (as seen from the viewpoint of performance, stability, and integrity of the organization supporting the project).
   B. Construct aggregate indicators and dashboards providing an overall process transparency capability.
3. Designing a system for an integrated coordination:
   A. Define mechanisms that provide an objective tool ("aid") for taking into account the needs of stakeholders and following-up, verifying, and validating these needs according to the indicators selected.
   B. Anticipate and plan the efforts needed (as in, activities and tasks), to check and validate both systems (i.e., the system to be built and the system for creating).
   C. Mechanisms for tracking any malfunctions by using trend analysis.

2.3.1 Visualization

A.k.a., Modeling.

The second form of visualization, after shape, is structure. A structure is an ordering of objects. Objects and structures can and cannot have motion. Objects and structures without motion are static. A combination of moving objects is a dynamic.

Herein, experience arises through the conscious ordering of structurally static and dynamic shapes, which can occur both at an information (conceptual-interface) level, and at a material (physical-interface) level:

1. **Experience** - An orderi[ng memory] of consciousness is an experience.
   A. **Shape** - An order of identifiable [geometric] patterns is a shape.
      1. **Structure** (order or parts) - An order of parts is a structure. Structures can be characterised as having or not having motion (internal and/or external)
         i. **Motion** - An order of operations is a motion..
            1. **Static** - no motion (internal / external). No motion to the visualization experience.
            2. **Dynamic** - motion (internal / external). Simulation of the visual experience.

2.3.1.1 Feedback loop models

Feedback loops are the building blocks of systems' dynamics (i.e., systems' control of behavior). A feedback loop is a structure within which a decision variable (flow) controls an action that is integrated into the system to generate a system state. Information pertaining to the state is then fed back to the decision variable, which in turn is used to control the flows. Two kinds of feedback loops comprise all complex behaviors of a system:

1. **Positive feedback loop -** Positive loops are self-reinforcing and tend to amplify whatever is happening in the system. In this case, bad situations/behaviors are likely to be amplified; or, good situations/behaviors are likely to be amplified.
2. **Negative feedback loop** - Negative loops are self-correcting and tend to counteract and oppose changes. An increase in one parameter causes the other parameter to increase, which then decreases the first parameter.

A feedback loop is composed of two kinds of variables:

1. **State** - State is an accumulation characteristic of the state of the system that generates the information upon which decisions and actions are based. A state variable is altered by inflows and outflows and is represented by a rectangle in a model.
2. **Flow** - Flow is a variable that changes a state over a period of time. Flow variables are of two types: An inflow increases a state and an outflow depletes a state. In short, a flow is a statement of system policies that determines how information about the system is translated into action(s).

2.3.1.2 Causal loop diagramming

Causal loop diagrams (CLD) is a systems visualization language composed of a framework of rules for seeing interrelationships rather than just things. For seeing patterns of change rather than static snapshots. A causal loop diagram has two entities:

1. **Variable** - state, condition, action, or decision, which can influence or be influenced by other variables. A variable can be quantitative (number or value of some thing), or it can be qualitative (objectives, values, feelings, non-functional requirements).
2. **Arrow** - indicates a causal relationship or change of

the state of new variables.

A causal loop diagram shows the visual dynamics of inter-relationships. Those salient variable points are identified (or, scheduled) in time as events (or, milestones and tasks). A causal loop diagram is a systems-type modeling tool and can be analyzed by identifying feedback loops formed in the model. A real world causal loop diagram would normally have feedback loops. A feedback loop arises when a sequence of interactions between variables through arrows form a closed loop. The feedback loops can be reinforcing, or balancing, which are visualized, which then become visible as task-activities. For example a recent analysis of the biosphere on Cat Ba Island in Vietnam identified ten reinforcing (R) and five balancing (B) loops. (Tri et al., 2018)

There are two types of feedback loops:

1. **Reinforcing loops** - positive feedback systems that represent growing or declining actions, or information cohesion.
2. **Balancing loops** (negative feedback loops) - negative feedback loops seek stability or return to control; for example, those designed to control automated vehicles and service bots.

2.4 Modeling system dynamics

A system dynamics (objects-process) model can be used as a virtual world to simulate real-life material situations. A virtual world is a formal model, simulation, or "microworld" in which decisions can be taken (i.e., there is choice), experiments can be conducted, and situations can be acted out (i.e., simulated), in order to more greatly understand.

Everything in physics, in engineering, is a model. A model is a set if "ideas" about the ways some thing works. A model explains the facts (the meaning, explains the experience).

2.4.1 Modeling system objects

All objects have the property of shape, and all shape is geometry. Therein, objects perform motions. The objects themselves, their relationships and motions may be modeled (as in, identified by rules and explained by visualization of the objects and their relationships).

2.5 Why is the systems approach used?

The systems approach may be used by all conscious individuals to ensure the freedom, efficiency, and effectiveness of all cooperation. The systems approach greatly facilitates certainty of directionality in an uncertain environment.

2.5.1 Evidence of claim to existence

In its real-world application by embodied consciousness, systems science encodes three primary types of evidence for individually, conscientiously considering (and socially "taking") a claim to existence:

1. Physical observation (sensation, perception).
2. Physical explanation (physics modeling).
3. Statistical evidence is demonstrated by data analysis on a study:
   A. Clear evidence.
   B. Some evidence.
   C. Equivocal evidence.
   D. No evidence.

2.5.2 Data validity

'Validity' is traditionally understood to refer to the correctness or precision of a data reading. Validity concerns measurements 'truly' recording what they intend to measure. In qualitative research it concerns the extent to which the phenomena under study is being accurately reflected, as perceived by the study population. Validity has two dimensions, internal concerned with the success of the research to investigate what it claims and external concerned with applicability of the abstract constructs to other populations.

> **NOTE:** *If it is 'valid' science, then it is 'valid' science, and it doesn't matter who is doing the science.*

2.5.3 Data reproducibility

Reproducibility is the systematic reproduction of a system, or set of data. Reproducibility is the foundation of modern systems science. If there is not reproducibility, then possibly it could be a mistake, error, fraud, corruption, or just a conflict of interest. It's not science as a body of knowledge until it has been tested, checked and replicated. Science is based on being able to understand and to reproduce a result. In order for data to be use useful, engineering knowledge, it must be reproducible. When science is going to be used for engineering into human lives, it is tested first.

> **NOTE:** *Modeling (analytical-synthesis, computation) is not the same as scientific inquiry.*

Science is used to discover data from an uncertain environment. Sensors are used to discover data from a certain environment, because the sensors are designed based upon an engineering pre-designed and pre-selected model.

2.5.4 Real [world] information system processes

Everything is a system, and every system in an information process. A real system's core information processes can be described in two broad descriptive ways (logical and physical):

1. **Logical (or functional) requirements description (a.k.a., functional hierarchy)** - what the system will do, how well it will do it, how it will be tested, under what conditions it will perform, what other systems will be involved with its operation.
   A. **System logical architecture (functional architecture; system development)** - outlined in *requirements breakdown structure*.
2. **Physical/material requirements description** - what the system elements are, how they look, and how they are to manufactured, integrated, and tested.
   A. **System physical architecture (system development)** - mapped onto the logical architecture as represented by [the configuration items contained in] the *work breakdown structure*.

   ***NOTE:** *In general, the logical description of a functional system tends to change slowly; whereas the physical description tends to change much faster as knowledge and technology advances.*

2.5.5 System information flow modeling

Systems can be described in various ways by their expressed type of interactions (information flow relative to the system boundary):

System types (per type of environmental interaction):

1. **Open system** - interacts with the surrounding environment through a boundary.
2. **Closed system** - does not interact/exchange with the surrounding environment.

System types (by internal interaction):

1. **Transformational** - a process that receives one or more system inputs I from an external environment, transforms them with process T, and then releases them as system outputs O to an external environment. A transformational system generates an output and them terminates.
   A. Single input/single output.
   B. Multiple input/multiple output.
2. **Reactive** -a system that,when turned on, is able to create desired effects in its environment by enabling, enforcing, or preventing events in the environment. Reactive systems are involved in a continuous interaction with the environment. Wherein, the environment generates input events at discrete intervals through on or more interfaces and the system reacts by changing its state and possibly generating output events.

System types (reactive types):

1. **Real-time systems** - a system in which the correctness of a response depends on the logical correctness and time at which the response is produced.
2. **Safety-critical** - malfunctioning of the system could lead to a loss of life or the system itself.
3. **Embedded** - the system is embedded within another system.
4. **Control** - determined and/or generate a desired behavior in the environment.

Some common characteristics of a life-system type of organization include:

1. **Emergence** - the way in which complex systems and patterns arise out of a multiplicity of relatively simple interactions. Something unexpected in the collective behavior of an entity within its environment, not attributable to any subset of its parts, that is present (and observed) in a given view and not present (or observed) in any other view). Other definitions state that that which emerges can be expected as well as unexpected benefits or consequences. System properties emerge from the synthesis of the interactions between components, at each level of interconnection within a system. This emergent behavior is something other than what is seen at the level that gave rise to it. The concept of emergence as representing the collective behavior of the system elements that reside in a lower level. The behavior cannot (generally) be predicted from or described by the properties of those elements, but is something unique that manifests when all those elements are joined together and interact with each other. The concept of emergence is intrinsic to all types of systems.
2. **Taxonomy** - an arrangement of concepts and/or objects in which items are presented as being above, below, or at the same level as one another.
3. **Hierarchy** - an arrangement of items in which the items are represented as being above, below, or at the same level as one another.
   A. **Layered** - the hierarchy of system components is clustered into horizontal strata (e.g., open system interconnection, osi, model for computer communications, or google earth GSI with layers of data overplayed onto on the real world geographical model).

B. **Network** - a set of elements (or modules, nodes, or devices) that are connected by a set of interfaces (or links or commas channels or protocols). Formally, a network is a graph. A network topology describes the connectivity (or arrangement) of nodes on a network.

2.5.6 Information systems organization

> **NOTE:** *In information sciences, an organization is a variant of a clustered entity (or its equivalent).*

A 'system' is also known as an 'organization' (in various English contexts). An organization is an identity (a system has a boundary) in which there are component (combined, together) parts (a system has sub-systems).

There are two principal types of organizations, either as structure or process (note, these terms are often used interchangeably in common parlance).

Organization as structure (noun):

1. Function and Condition *of structure.*
2. Shape and Geometry *of structure.*
3. This is prior action.
4. This is project life cycle [knowledge].
5. This is data architecture [in an information system].
6. Structures are designed (aligned), selected, and implemented.
7. Enters materiality as physicalized hardware and software assets (I.e., asset categories).
8. Organizational structures determine information flow within an organization.

Organization as process (verb):

1. Input and Output *of process.*
2. Equation and Algebra *of process.*
3. This is action.
4. This is project progress/process [groups].
5. This is computation [in an information system].
6. Processes are designed (aligned), selected, and executed.
7. Enters materiality as abstract 'service' categories (e.g., HSS).
8. Organizational processes compute information flow within an organization.

Service organizations have a (1) function, and they, (2) will do it at a specifically pre-set quality (it is when we contribute that we may truly do:

1. A 'function' [is a process into] transforms an input into an output
   A. An 'operational process' that uses resources and transforms into outputs, the inputs of individual humans.
2. A 'condition' [is a structure that] orders (regulates or qualifies) how an input is transformed into an output
   A. A 'quality' evaluation of expectation as pre-set by an individual human user's consciousness.

2.5.6.1 Organizational structure

An organizational structure defines how activities therein (e.g., resource allocation and work coordination) are directed toward the achievement of organizational objectives. An organization[al structure] can also be considered the view, visualization, model, or perspective through which individuals observe an organization's presence. And, the organization's observed behavior may be viewed as its active [operational] processes (which exist in relation to an environment and physics).

2.5.6.2 Organizational knowledge

In an information system, knowledge is structure-organization-process (a complete information package) with a high certainty in its alignment to real world existence; thus, carrying a usefulness in navigating within the real world. It is from this understanding of 'knowledge' that societal-level life[style] fulfillment becomes possible.

2.5.6.3 Information system data types

User view of data input types:

1. Data **having** type - was the user prompted to input information (i.e., is the user having a prompt to enter input)?
   A. **Prompted** - Requested input (i.e., requested data is input).
   B. **Unprompted** - Non-requested input (i.e., non-requested data is input).
2. Data **being** type - is the input information numerical (i.e., what type of data pattern is being input)?
   A. **Functional (quantitative, numerical)** - Numbered input (i.e., data of type 'numerical' is input).
   B. **Non-functional (qualitative, conditional)** - Non-numbered input (i.e., data of type 'linguistic' is input).
3. Data **doing** type - does the input information conform to standards (i.e., is the user doing the input information correctly/coherently)?
   A. **Structured information** - Structured input; data fits into model precisely (i.e., data is input per standard structure).
   B. **Unstructured information** - Non-structured input; data does not fit into model precisely (i.e., data is not input per standard structure).

Developer/operator view of data input types:

1. Conceptual design (What, definition)
   A. Technical design (How, explanation)
      1. The design needs to be:
         i. Correct and complete.
         ii. Understandable.
         iii. In alignment with organizational protocols.
      2. The design needs to satisfy a validation criteria:
         i. The users direct requirements.
         ii. The organizations requirements.

In order to meet the expectations of the user, developer, and operator, the system should be sufficiently curious (inquiring) about what [changes] may be needed:

1. A prompt is a mechanism to capture the answer for a specific question.
2. A prompt is a sign on the screen that shows that the computer is waiting for input. The answer provided to a prompt is stored as a parameter that can be used by another question or as a filter value for a data query.
3. A prompt is a way of assigning members to a dimension. Note that in psychology, priming is a prompt is something that is added into the environment to help elicit ("cue") a correct response.

2.5.6.4 Materiality data (spatial data)

Spatial data [infrastructure, SDI] is a data framework of geographic data, metadata, users, and tools that are interactively connected in order to efficiently and effectively modify the environment. In general, this refers to the layered overlaying of data upon a visual reference of the geographic world.

2.6 What does society have as result of systems science?

> *A.k.a., Doing work systematically, society has stability. The design of an organization is causatively dependent on the requirements of that organization.*

The completion of a set of studies that by some relatively designed degree absolutely provides the data required to resolve a new societal system, in the now, and therein, service usability is the result of 'systems science'. These studies inquire and account in order to meet life, technology, and exploratory demand in an uncertain, by degree, environment.

The "proof of truth" is not in the authority [of an expert], but in the experience of using the formal language of systems to represent a [working] real world (and have the individual conscious experience of that proof match with the linguistically shared model). As a data type, a fact is a description of that which has occurred (record of event), is occurring (executing and monitoring if event), or will occur (event predictability/probability). A societal systems-level proof necessitates the application and resolution of an operating system (life platform, where 'life' is the true alignment) populated with factual-type data [about life in the real world]. That which is a proof of true alignment with the highest qualities if life, is that which can be validated.

Both discoverability and reusability are critical to ensuring the reproducibility of the research, a basic principle of the scientific method.

1. **Discoverability** is the ability of a data set to be discovered by someone else.
2. **Reusability** is the ability for a data set to be used again by its producer and/or someone else.

Note that most factual descriptions carry the unifying reference record (meta-tag) of 'certainty of the fact', given all that is known currently by the unified system. Without unity (integration) there is no trust (or less trust) in the certainty of any record. In a dis-unified information system, there is some amount of uncertainty that could be avoided through more unity (more integration). With more integration, there is more trustability and less uncertainty. For a user, a high-quality service is a service that can be trusted. For a user to fully trust the quality of a service, everything about the service must be transparently integrated [at an interface for the user]. For a contributor, a high-quality structure is a team structure for which there is appropriate certainty that contribution will be effective.

> **NOTE:** *In general, more [accurate] information facilitates uncertainty reduction.*

Whether someone is competent and qualified on knowing something, or knowing how to do something, from information in the unified societal information system is not a matter of opinion; it can be verified. In this way, the knowledge and actions of an contributor ("expert") can be tested. In an unaccountable or dis-unified system, where verification and accountability are less present, then "experts" and their "decisions" (opinions maybe) are less trustworthy.

In community, the idea of [a separate group of people known as] "experts" taking decisions on the part of others, is not only a dis-empowering viewpoint (because anyone given motivation can become one), but is also factually incorrect when society is viewed from a project approach (because projects exist for users).

In a societal structure divided by in-group bias, then decisioning and control by socio-technical "experts" may not be desirable for widespread human well-being, because the "experts" cant be verified through the a unified information system. And when an authority figure becomes the source [of all] experts, then the social honor of being an "expert" holds even less reliability ("credibility"). Rule by experts (who cannot also be oneself) is unlikely to create an optimally fulfilling set of conditions. What truly threatens the loss of fulfillment and knowledge is the loss of a contribution-based structure. The way to "protect" knowledge, to know the difference between truth and falsity, is to have unified information access (to ensure transparency), have a method (by which to determine either truth of false), and to use collaboration, where those individuals doing the work are verifiably competent (or in training, and their work can be validated to be so). The idea of rule by experts carries with it that the idea that who they will be ruling are intellectually passive consumers. An open source system could have useful contribution from anywhere.

It is essential when working together to not replace the individual experience of proof (upon the part of any user or contributor) with any authority [figure or leader]. In the context of, "Where does the project propose that 'authority' lie?", the following questions are used to bound the solution to that inquiry.

1. This project does not propose a system controlled by an expert-ruling elite, a technocratic authority.
2. This project does not propose a non-factual (opinion-type) decisioning structure, a political authority.
3. This project does not propose a secret and closed information structure to coordinated societal organization, private [ownership] authority.
4. This project does propose to account for the factual position and composition (past, present, and future) of resource configurations (i.e., of material solutions).
5. This project does propose to account for discoverable human needs within a common, real-world human environment.
6. This project does propose to account for the use of a specific set of value conditions to evaluate the results of different solution configurations. And, this project has reasoned the selection a specific set of condition encodability statements (i.e., the value statements of freedom, justice, and efficiency as core to the economic, parallel socio-decisioning protocol).

2.6.1 How could society be organized through systems science?

Systems science is unique in its mode of inquiry in that it reveals not just how one kind of system, say a biological system, works, but rather how all kinds of systems work. That is, it looks at what is common across all kinds of systems in terms of form and function. In this sense, it is a meta-science, something that informs all other sciences that deal with particular kinds of systems. In part, systems science (a.k.a., information science) is a formal language or formal logic, which is internally consistent and useful for modeling and interacting in a real world.

When applied to the human context, systems science has two problem-based information orientations:

1. There is the <u>problem of understanding</u> the world.
   A. Science explains the mechanism.
2. There is the <u>problem of changing</u> (developing) in the world.
   A. Engineering applies the mechanism.

In systems science, there are three primary questions that acquire information and compose its information set:

1. **Epistemic questions** (*philosophic questions, data structure*) - questions that concern the axiomatic, non-contradictory, and structural flow of information.
2. **Physics questions** (*scientific questions, discovery structure*) - questions that concern shape.
3. **Applied physics questions** (*engineering questions, operating structure*) - questions that concern the application of shape [in service] for a[n intentional] function.

At the societal level, there are three systems science problems domain, the resolved inquiry of which is an optimally discovered societal service system, given what is known:

1. System **application** - *the specific classes of problems* that are appropriate for the usage (ability) of systems science (scientific inquiry, project/ information coordination, and engineering).
   A. Systems applications; systems science as a functional service to some user who has requirements (an intention). Discover how to identify information.
2. System **method** - *the specific function that resolves the problem (solution)*, given multiple names, including but not limited to: techniques, processes, or tools; all of which are used in applications.
   A. Systems methods - systems science as a body of method-based knowledge. Discover how to transform information.
3. System **team** - *the specific humans and technical systems* that execute the method, the highest level of which, in the context of a societal system, is the InterSystem Team. Discover how to most efficiently and effectively operate as a [social] team based upon information.
   A. Systems teams - systems science as a cooperative structure (and body of knowledge) coordinating the experience of a solution to a set of human requirements. In other words, it is

here that society is "executed" for the fulfillment of all as a (or, through a) unified system.

In the content of intentional-conscious change to existence, systems science can be partitioned into five information sets (areas) that form a solution to human requirements:

1. System **axiomatic** - *the accepted knowledge* (principles, theory, concepts, rules/laws) that explain systems and their associated phenomena.
   A. Systems conception - Instantiation of two (or more) objects and a relationship [as a system].
2. System **philosophic** - *the epistemological* (Read: how any system may come to be known by following the flow of information to its source) and *the ontological* (Read: how systems are realized, as shape and structure, at various levels of the world of observation).
   A. Systems visualization - Instantiation of a data structure [for a system].
3. System **methodological** - *the reasoned logical selection of systems-based methods* to inquire into and gain knowledge concerning systems, and how they may be most optimally changed.
   A. Systems logic - Instantiation of a replicable pattern for accessing information [about a system].

> **NOTE:** *Often, the term 'philosophical' is used to describe the core conceptual reasoning for an ontological, or unified life, model.*

Real-world systems are understood through object-processes that form the state of a system; thus existing:

1. Objects exist - objects are that which exist, or can exist. All objects have shape.
2. Processes exist - transformations of objects. All processes transform objects by generating, consuming, or affecting them.
3. States exist - identifiable synchronization of object-processes. All states expresses the situation at which an object can 'be' in a conditional relationship to other object processes).

Herein, a system is an object with a structure, that does a functional process, that expresses a behavioral state condition:

1. Function - what the system does.
2. Structure - how the system is constructed.
3. Behavior - how does the system change, or how is the observably system expressed, over time.

In relation to the systems method,

1. A system is an object.
2. All objects have structure (i.e., shape).
3. All designed (active, dynamic, in motion) structures have a function, represented as a process (a type of sub-object).
4. All designed process functions express sensible (observable) behaviors that change the condition(s) of their environment.

2.6.2 Information flows

Fundamentally, as a result of the application of systems-science, society has awareness and the capability to work with information flows (of a conceptual and spatial nature). For there to exist human global cooperation, it is essential for humanity to have globally transparent awareness of all relevant information flows.

A "flow" of 'information' is defined as a unidirectional series of related data -- a set of 'information' "packets" passing through an observation point during a certain 'time' interval. In an information system, 'flow' is the observed or predicted motion of information. The motion of all information constructions in the conceptual and spatial systems can be planned (with some degree of certainty).

> **NOTE:** *To "flow" is to move, transfer, or behave. There are many types of information movement (e.g., sorting, translocating, calculating, encoding, etc.).*

In any given information system, information generally flows from:

1. Conception (ideation), to
2. Decided execution (algorithm), into
3. Materialization (production-operations), and back again as
4. An information issue (conception), whereupon
5. The materialization is measured and its alignment in quantity and quality are assessed.

There are two general types of information process flow (Read: information flow model types):

1. **Linear type (linearity)** - the process flows sequentially without repetition (or, iteration). In geometric navigation, this concept is visualized as a line.
   A. A sequential flow (motion) of information. Linear, sequential.
2. **Iterative type (continuity/Life-cycle/ extensionality)** - the process flows with repetition (or, continuity; a rotation of the linear into an extension/continuation, of life). In geometric navigation, this concept is visualized as an arc (a line rotated to become, or becoming, circular).
   A. Iteration (repetition) of the flow/motion of information. Looping, overlapping.

B. An iterative process with memory is evolutionary (i.e., is an evolutionary/adaptive process flow).

All process flows can be visualized, because in all process flows there is an object with shape and/or a conception.

A flowchart (a.k.a process flow diagram, chart) - is a visual representation of the sequence of steps and decisions required to perform a process. Each step in the process of information flow is noted with a diagram shape. Objects and steps are linked by connecting lines and directional arrows. Each object/step can be made up of either: a concept (pure information), an object (geometric shape), or two objects and a concept.

The visualization of information process flows is necessary for shared creation and operation:

1. Effective **understanding** of a process.
2. Effective **communication** of a process.
3. Effective **execution** of a process.

Common elements that may be included in a[n information] process flow [visualization] are:

1. Sequence [of process].
2. Inputs and outputs [of process].
3. Decisions [of process].
4. Activities [of process].
5. People [of process].
6. Time [of process].
7. Measurement [of process].

2.7 *What is a living system's approach?*

A living system is the conception of organization–structure–process is one in which a process [self] organizes [its own] structure (autopoiesis). Hence, three criteria are needed for identifying a living system:

1. **The pattern of organization** - A pattern of organization is the configuration of relationships that determines the system's essential characteristics.
   A. Autopoiesis as self-structuring and/or self-replication (defined by Maturana and Varela, 1987).
2. **The structure** - A structure is the physical (i.e., "architectural") embodiment of the system's pattern of organization.
   A. Dissipative structures as defined by Prigogine and Stengers, 1987.
3. **The life process** - A life process is an activity involved in the continual embodiment of the system's pattern of organization.
   A. Cognition as defined by Gregory Bateson, 1979.

All [living] systems can be sub-composed by the three axioms (vectors, ontological forms) of systems:

1. **Shape**: Structure refers to the attributes - distinguishing some thing (trait, value, shape and efficacy) from other things. Structure refers closed systems (or the attributes of the universe that are independent). Also, structure refers to individual things.
   A. A body.
2. **Relation**: Organization refers to parts that comprise some thing - the properties (evident by valued traits), and their relationship (evident by their shape and efficacy). Organization refers to open systems (or the parts of the universe that depend on closed systems). Also, organization refers to categories of things (clusters of individuals, where a part is a category).
   A. More than one body.
3. **Transformation**: Process refers to the constitution of parts - the bundle of related properties that produces a whole thing. Process refers to social systems (or the wholes that are inter–dependent on closed and open systems that make up eco–systems, e.g., the universe). Also, process refers to universal things (all things, e.g., parts as the set).
   A. Changing more than one body.

A [living] system may be analyzed based upon:

1. What the thing is composed of (the structures that distinguish it)?
2. How the thing is composed (the organization of the parts), and that a whole thing is an organized structure (the process of comprising the parts)?

As a coherent whole, a living system is:

1. An autonomous entity (i.e., a system is an autonomous entity with regard to its environment).
2. Organised in a stable structure, identifiable over the course of time.
3. Constituted by interdependent elements, whose interactions contribute in maintaining the system structure, and correlate with its evolution or de-evolution.

The primary attributes of the inputs and outputs are:

1. The outputs may be equivalent and/or changed from the inputs.
2. The inputs may be self-causative and/or environmental-causative.

Basic systems terminology for a living system are:

1. Boundary - that which separates a system from its

external environment (e.g., walls in a building).
2. Inputs -elects that enter the system (e.g., raw materials entering a production plant).
3. Outputs - finished products and consequences of being in the system (e.g., a new vehicle leaving a production plant).
4. Threats - those elements that can potentially affect the acceptability of the system configuration (e.g., lack of knowledge, insufficient time, lack of resources, violence, etc.).

It is common to consider the activities being undertaken throughout the life of a real-world life system to be in either the:

1. Problem domain (problem space) where predominantly logical descriptions are used.
   A. A problem space is a "space" of possible problems that form the decision space.
2. Solution domain where predominantly physical descriptions.
   A. A solution space is a "space" of possible solutions, and a selected solution (if present).

2.8 Complex systems

Systems thinking provides the vocabulary and concepts to deal with complex environments. In the real world, there is a systems network. Within the unified systems network, there are supra-systems and sub-systems. The term 'system of systems' is sometimes used to refer to interacting system elements, some of which may be systems in their own right.

Society is a complex of systems (i.e., a system-of-systems). In systems thinking there is a distinction between:

1. Systems as elements of a 'system of systems'.
2. Sub-systems as elements of a system.

From a design perspective, the 'system of systems' comprises systems that have been optimized for their own purposes before joining the systems of systems. Alternatively, a system that comprises elements (system > sub-systems), the sub-systems, that are not optimized for their own purposes, but have been optimized for the system's purpose. From a higher level perspective, a 'system of systems' is most likely not optimized.

2.8.1 Systems bottlenecking

In general, the term bottlenecking means that one aspect of a system "holds back" (i.e., requires inefficiency) of another, keeping it from reaching its full potential. A good analogy is the merging of a five lane highway into/before a single lane tunnel or accident; one part of the transportation system (e.g., accident or tunnel), will be holding back another one (e.g., getting to the destination quickest), keeping it from reaching its full performance potential. Bottlenecking is a systems builder's problem (or challenge) when designing a system to build.

However, from a designers perspective, "bottlenecking", is a misnomer; there is always a slowest component. If the designer/engineer replaces the slowest component with a faster one, then the designer has just created "bottleneck" (i.e., another point becomes the slowest, or least performable, in the system).

2.8.2 Systems hierarchy

> **PRINCIPLE:** *A society that helps everyone help themselves.*

From a designers perspective, a system 'hierarchy' is a system 'accountability structure' with priority processing (given some meaningful purpose):

1. A hierarchy is a tree-type framework (Read: a top-to-bottom flow of information) composed of related levels of information, and the hierarchy ("tree") representing a unification of information.
2. In maths a hierarchy is called a 'directed' graph - branches of information flow from the initiating directive [entity] at the top, down to the lowest level branches (requirements).
3. A hierarchy is a visual elaboration of organization, where each level [in the hierarchy] can be decomposed to the next level down.
4. Hierarchies require numerical or spatial information to identify separate levels.

Hierarchical multilevel structures are omnipresent in living (real world) systems; both in a purely technical context (e.g., cyber-physical systems) and in a socio-technical context (e.g., InterSystem Teams).

A unified hierarchical structure enables organizational:

1. *Accountability* within an environment of increasing technical and organizational complexity.
2. *Efficiency* by breaking issues down into [decisioning units that solve] sub-problems or sub-integrations.

3 Why does this project propose an information system?

Information is an "abstract" form of resources without, which no system could be produced or operated. Living systems use information for control, so that intelligence can implemented. An information system is, by definition, a unified structure of information. Information systems are common to all [human] organizations.

> **INSIGHT:** *When reality is perceived as data, then computers give users the ability to simulate using data. Computers give individuals the ability to access a common simulation using common data.*

For any given society, there may be one unified information systems with multiple sub-system perspectives. A socio-technical information system is a combination of information technology and human activities using that technology to support decisioning and operations (for user function). A project's 'information system' coordinates the integration of project information. A material-type 'information system' is used to refer to the model of all possible interactions between people, algorithmic processes, data, and technology [in a material world], and to sustain the operation of the current model, which is experienced. In this sense, the term is used to refer not only to the information and communication technology a social organization (or system) uses, but also to the way in which people (the social system) interact with this technology in support of self-organizational processes (e.g., human requirements).

The habitat service system is captured by information [as past states, a current states, and future probable states. As part of the material information system, a geographic/geospatial information system stores, analyzes, and models the [commonly] locatable, [within a visually] positional world. A geospatial information system merges cartography, statistical analysis, and database technology with real world objects in real world positions. Therein, the project 'information system' coordinates, and disseminates data, that are linked to decisions with temporal and location relevant information (decisions that affect the materialized/-ing societal system as the understood conception of an experienced existence by consciousness).

> **NOTE:** *A geographic/geospatial information system (GIS) stores, analyzes, coordinates, and disseminates data that are linked to locations. A GIS is the merging of cartography, statistical analysis, and database technology.*

There are two inter-related levels information system operationally relevant for any given individual in society:

1. **A social-level** [information] operating system - the social organizational structure in actualized operation, capability pre-determined through a method of shared visualization and execution.
   A. The development engineers visualize and test services.
   B. The operations engineers execute and control services.
   C. There are two parallel societal decision system inquiry processes:
      1. The social inquiry [solution] process
      2. The technical inquiry [solution] process
2. **A self-level** [information] operating system - the egoic self (i.e., conscious self-modeling), capability pre-determined through a method of self realization and self determination.
   A. The Individual uses and has issues with service. Individuals take decisions when using services.
   B. The individual contributes to the continuation (iteration) of needed services. Individuals take decisions when producing and operating services.

> **NOTE:** *The real-world is a continuous, dynamic, and [partially] observable environment. An environment that is dynamic and partially observable has uncertainty (and therefore, novelty).*

3.1 What is a real world societal information systems model?

A.k.a., Real world societal human information system.

A real world societal information system is defined as:

1. Real world - it contains the next selection of itself as a model of the real world and the next selection to execute into materiality.
2. Societal - it accounts for all individuals, together.
3. Information - it accounts for the information base of existence.
4. System - it accounts for formal cooperation, integration, and unified communication (unified communications language).

3.2 One unifying information model

In order to operate safely in a material world, intelligence must be applied, and this may be done through a unified model that accounts for an environment:

1. Is the environment deterministic, then apply the actions of planning and search.
2. Is the environment stochastic, then apply MDPs (modeling of interaction to achieve a goal) and reinforcement learning (note, in the real world, the "reward", or reinforcement, is the fulfillment of a

real human requirement).

A. A Markov decision process (MDP) is a discrete time stochastic control process. The process is a mathematical framework for modeling decisioning in situations where outcomes are partly random (environmentally influenced without 99% certainty) and partly under the control of a decisioning [integration] agent. MDPs are useful for studying optimization problems solved via dynamic programming and reinforcement learning. MDPs are used in many disciplines, including robotics, automatic control, economics, and manufacturing. At each time step, the process is in some state *s*, and the decisioning agent [of control] may choose any action *a* that is available in state *s*. The process responds at the next time step by randomly moving into a new state *s'*, and giving the decision maker a corresponding reward $R_{\mathbf{a}}(s,s')$. The probability that the process moves into its new state *s'* is influenced by the chosen action. Specifically, it is given by the state transition function $P_{\mathbf{a}}(s,s')$. Thus, the next state s' depends on the current state *s* and the decision maker's action *a*. But given *s* and *a*, it is conditionally independent of all previous states and actions; in other words, the state transitions of an MDP satisfies the Markov property.

NOTE: *The real-world is a continuous, dynamic, and [partially] observable environment. An environment that is dynamic and partially observable has uncertainty (and therefore, novelty).*

3.3 Societal planning

Societal-level (Read: societal systems-level) planning is possible through a total systems approach to abundant and safe materialization of human fulfillment in a common and complex state-dynamic environment. Therein, each societal system may be accounted for in any given societal project:

1. A **Social** Systems-level project.
2. A **Decision** Systems-level project.
3. A **Lifestyle** Systems-level project.
4. A **Material** Systems-level project.

3.4 What is a real-world, community-information systems model?

In order to resolve real world problems (not just patchwork), then a base foundation of 'information' must be perceived of by consciousness? The perception [by consciousness] of everything as information is necessary if [real world] problems are to [f]actually conceived and resolved by the processing (linguistic sign) and calculation (mathematical sign) of information as 'data'. In other words, "we" perceive of everything as information, which may flow (by means of conscious intention) through a structure, and changing the entropy of the whole information system (towards greater complexity, more order, and thus, more potential [capability], or less complexity, less order, and thus, a lesser potential [capability]. It is here, from the information perspective, that knowledge becomes increasingly available the greater [a consciousness] is able to extend (Read: extensionality/exteriorization - the ability to extend one's view of self; beyond the self to encompass more of the self) its integrated "perception-conception" matrix. In romantic language, the prior sentence could be said as: "knowledge becomes increasingly available the more love one has".

NOTE: *Society is the individual's socio-technical project.*

Community is a single societal system (as in, socio-economic, socio-technical, socio-decisioning), because the user and the contributor are the same (are in cooperation, sharing access). The market-State is not a single system, because the employer (owner) and/or employee and/or consumer are not the same entity (are in competition, ownership of access). Whereas in community, there is recognition and unification of information, other types of society may neither recognize their information base nor seeks its unification.

All human-contextual complex systems exhibit closely interacting technical, decisional, and social components. Within the realm of 'technical' systems, emerging algorithmically unified (information-physical) systems, such as intelligent transportation and mechtronic (or automated robots) systems exhibit close interactions between components of, what was previously considered (now a historical context), a fundamentally different nature, namely, computational and physical components as separate. The informational systems view allows for a unification of the two previously separate perspectives, from which may arise, a second order ["cybernetic"] societal system:

1. A system that evaluates and integrates feedback from the environment,
2. after the execution of a decision,
3. which resolved a solution to a problem,
4. arising [in awareness] from an individual's interaction with an environment,
5. artificially limiting individual's fulfillment, and causatively [in an information system], producing a 'decision' space,
6. resolving through logic (which may be repeated as an algorithm) to an action in the material environment through execution by an individual or system with tools and resources,

7. that reconfigures the state-dynamic of the environment (Read: the habitat),
8. for greater [entropy] or lesser [entropy] states of individual's fulfillment.

What is visible from this description of society as information is that real things are multi–faceted, and that each level (or differentiation) needs to be considered separate and together.

3.4.1 What is a unified approach to societal state change?

A unified approach to societal state change is likely to be composed of:

1. A unified approach to **decisioning**, optimized as algorithmic decisioning.
2. A unified approach as **indication**, optimized through modeling and evaluation.
3. A unified approach as **servicing** (operations for) a user who is also a common[-unity, open source] designer.

3.4.2 How may a societal model be used as a navigation tool?

A.k.a., Organizing societal navigation.

It is possible to coherently organize society so that it navigates the planetary environment safely.

Societal navigation may be said to have two broad controlling principles:

1. **Safety in ensuring fulfillment** of basic and higher potential needs as the direction.
   A. Adapting direction, while following the precautionary principle.
2. **Coordination in organizing the fulfillment** of needs.
   A. Optimizing orientation, while following the efficiency (maximization) principle.

Sufficient for,

- *Next steps are adaptively optimized to the conditions necessary to generate the highest fulfillment of all.*

3.4.3 Science and engineering information sub-systems

Science and engineering have interrelating information flows:

1. Science involves understanding (theory), Engineering involves prediction and creation (invention, implementation and optimization, optimal solutions).
2. Science is why, engineering is how. Science is knowledge; engineering is the application of that knowledge to human purpose.
3. Science is truth-oriented, whereas engineering is goal-oriented.
   A. Science is the work of theory [visualization for understanding] and empirical research [testing, i.e. designing and conducting experiments].
   B. Engineering is goal-oriented is solving a specific set of problems with available tools and techniques.
4. A prediction is an expected future probability: science predictions are about the expected future probability that a model is true (i.e., accurate), and engineering predictions are about the expected future probability that a system will function as expected (i.e., accurately).
5. In terms of data, data science is science (discovering data structures), while data engineering is engineering (designing and creating data structures).
6. The discipline of decisioning (decision making) is decision science. Data science and data engineering both exist to support this discipline.

In a non-unified societal information system, these two disciplines are likely to evolve separately, and have separate cultures, think differently and speak differently, the social networks are different. Societal systems unification requires [the integration of] both.

3.4.4 Societal solution decisioning

In order to optimally sustain fulfillment among individuals in society, there are two societal-level, resource-access requirements:

1. Coordinated and controlled access to common heritage resources (information and material) through societal solution decisioning.
2. Coordinated and controlled design execution of a materializing habitat system through societal solution decisioning.

It is possible to develop and operate a service system with a high probability of fulfilling all [human] population requirements, optimally, when accounting for:

1. Common heritage survey of global resources (as in, area and object; position and reference/standard).
2. Common heritage information space for the open assembly and operation of the operational service system, including its information system.
3. Common heritage index of human need, fulfillment and optimal environmental, solutions.

3.4.5 The projected societal system's development

The development of a unified socio-technical system necessitates a unified, systems approach applying project coordination to a unified, societally engineered system.

Developing a [complex] societal systems is a highly interactive socio-technical process (group) involving many people that have to resolve decisions together (i.e., have to develop and take jointly consistent decisions). In this dynamic process, process organization and engineering must operate in conjunction. Projected systems necessitate the conception of an working information set. The project planning of a societal system necessarily involves the iterative integration of the planned sub-systems.

The principal societal systems include:

1. Societal information system.
2. Material habitat service system.
   A. Service development [engineering] systems.
   B. Service operational [support] systems.
   C. Asset/objects systems.

Decomposed by material operational structure type:

1. Function-based system (functional asset).
2. Non-functional-based (quality asset).
3. Product-based system (service asset).
4. Spatially-based (local [city] asset, global [HSS] asset)
5. Information and digitally-based (community or InterSystem interface).

Decisioning protocols (logic):

1. Execute protocols (decisioning to execution).
2. Control information flow (centralized, decentralized).

Science is used to discover data from an uncertain environment. Scientific sensors are used to discover data from a certain environment (because they are designed based upon an engineering pre-designed model). Information is used to resolve plan issued decisions. Knowledge is used to resolve engineering issued decisions (e.g., technical solution inquiry space; engineering systems control; the engineering problem).

1. The operations (a.k.a., service) problem (i.e., organizationally optimized operations problem).
2. The human operational-functional service [InterSystem] team (i.e., functional human contribution organization problem).
3. The [controlled] habitat service system (i.e., the engineered dis-/integration problem).
4. The materialized existence of a controlled object and relationship, of functional service and conditional quality (a matrix). As functional service and a physical object. As a condition of the services development and functional operation, constraining its operation. As a condition of the services functional and conditional operation, which is evaluated by functional and "performance" (or quality) conditions.

Projects to create that sustain systems composed of two types of primary process:

1. **Information coordination processes** (a.k.a., project life-cycle or project coordination/management processes) These project information processes form a closed loop: the planning processes provide a plan, that is realized by the executing processes, and variances from the baseline or requests for change lead to corrections in execution or changes in further plans. "Management" is the centralized creation, revision, and implementation of plans. The life-cycle is commonly composed of the following processes:
   A. Initiating.
   B. Planning.
   C. Executing.
   D. Controlling.
   E. Closing.
2. **Technical engineering processes** (asset-oriented processes) that specify and create the project product. A social project, such as this societal building project, is a collaborative activity, involving research, design, development, and implementation, that is appropriately planned.

Systems engineering directs project execution of the system's (product's) definition, development (sometimes through deployment and operations), monitor and control project work, and are responsible for closing out the project or phase's technical aspects.

3.4.6 Unified societal information system coordination

A.k.a., Socio-technical information integration; socio-technical unified creation/generation; socio-technical unified engineering.

In a unified societal information system, decisions are taken at:

1. **The project/information-coordination level -** The project level is solely composed of information.
2. **The scientific/technical-engineering level -** The engineering-development level is composed of digital information and material systems.
3. **The service-operations level -** The engineering-

operations level is composed of digital and material systems.

For societal creations there are multiple types of goals; there are:

1. Project goals (because, all societal-level solutions are seen as information projects (i.e., information "packets" or "sets" in a unified societal information "base" or "space". A project represents a complex (multi-part) project to be developed and resolved into a materialized solution
2. Life-cycle goals - projects are sub-composed of life-cycles.
3. Technical goals - life-cycles are sub-composed of technical goals, which become the engineering specifications selected, and then operational, in the societal system.

Approach tags for a unified societal information system's approach include:

1. Information approach (data approach).
2. Systems approach (holistic approach).
3. Project approach (coordination approach).
4. Engineering approach (generation approach).
5. Platform approach (interface approach).
6. Service approach (operations approach).
7. Module approach (task approach).

3.5 Unified economic planning (one economic plan)

NOTE: *One solved [for execution and operation] economic plan. Necessarily, a unified societal information system contains a unified economy.*

When viewing the societal system as an information system, then through technology and computerization there now exists the function/ability to do [economic] access allocation through computation by direct calculation and direct location. Herein, universal product barcodes with universal product codes and computerized stock-taking account for logistics (technological-transportation support).

INSIGHT: *Economics tells us that our prosperity depends on how efficiently we allocate resource to human needs and ecological regeneration.*

3.5.1 Socio-economic planning

Socio-economic planning refers to the planning of a/the society, and relates socio-economic problems to socio-economic solutions. Socio-economic planning means that the economic and social aspects are combined and planned for given what is known. An economic interaction is a social interaction, and hence, socio-economic planning is a component of societal decisioning (or pre-decisioning). Socio-economic planning is the deliberate control [of the flow and timing] of [economic] resources toward a life-cycle of needed services (and service objects or "goods"). In the market, economic planning also involves the "market" mechanism (which, is not present in community).

3.5.2 [Input-output] economic tables

NOTE: *A planned economy, in part, means that the society has an information system that communicates to its material users [in the economy] the number of people who will be doing different tasks each day; including all meta-data about those tasks.*

CLARIFICATION: *An input-output model uses a matrix representation of a nation's (or a region's) economy to predict the effect of changes in one industry (The make table) on others (the Use Table) and by consumers, government, and foreign suppliers on the economy.*

The input-output economic table is the first [basic] tool for doing any systems-based economic planning. Each service support system (and sub-system) in the economy is delineated on both dimensions of a graphing/calculation table (i.e., the system becomes a category in the column and the row dimensions). Generally, an input-output [economic] table contains the following sub-units:

- *Columns [a dimension]* are categorized by <u>what</u> [HSS] system or market-State industry (e.g., mining forestry fishing agriculture -- where the raw resources come from)
- *Rows [a dimension]* are categorized by <u>what system or</u> industry (e.g., mining forestry fishing agriculture -- where the raw resources come from)
- *Cells [a bi-dimensional synthesis]* say <u>how much</u> of one system or industry, or other category if more than multi-dimensional, goes into the other system, industry, or category. Here, the cells list (display) the relative flows between the different systems or industries.

[Service support system] Input-output tables are required in order to 'project' through the outcomes. Here, the concept, 'project' has a double meaning. The concept, 'project' means:

1. To have an information system that supports the informational requirements of a [configuration of the] human habitat service system -- The outcomes desired have a [unified] project-based information system within which calculation is possible.
2. To have the ability to predict the outcomes -- The outcomes require projection (i.e., modeling,

visualization and simulation) of systems, and therefore, transparency (and openness) in concern to the inputs and outputs of those systems.

These tables can be refined:

1. Down (Read: dis-aggregated) to the individual products, and then to the individual modules (if separate).
2. Up (Read: aggregated) to the supra-service system level (i.e., life support, decision support, technology support, facility support).

When something is changed (or integrated/developed; e.g., a new product), these tables are used so that in a "what if" scenario what is the implications for other systems or industries due to a change in what (i.e., a target or given) system or industry.

Input-output analysis is the solution to simultaneous linear equations. In input-output analysis, there are many equations, but each equation has a highly limited number variables.

In mathematics, a connected graph is a system of:

1. Circles (nodes), with
2. Arcs or lines joining the circles.

Relations between the nodes of the graph and the arcs between them is an:

- N log n relationship

Any economy can be calculated and visualized as this [N log n relationship] graph, with each system or industry being a node in the graph and an interconnection between two systems or industries being an arc. Fundamentally, if the economy is unified (i.e., it's not split into two or more separate economies), then there is at least an N log n relationship within the graph (the Erdos diem, Jacobian solution).

3.5.2.1 Efficiency

Start with the basis that society is an information based system, then efficiency, necessarily, becomes a core value. Efficiency is important to computation based systems. If a computation system is inefficient, then is it wasting resources. Systems that remain inefficient become extinct.

> **NOTE:** *Digital information is constantly copy able.*

4 What is the proposed method of integration for work?

The integrated project-engineering approach method involves the measurement of all work in time with resource:

1. **Project** (effectiveness, efficiency).
   A. Measurable goal using identifiable properties.
   B. Measurable criteria for goal using defined parameters.
2. **System** (effectiveness, efficiency).
   A. Measurable goal using identifiable properties.
   B. Measurable criteria for goal using defined parameters.

Systems engineering involves the designed formation of a system through a project-based structure. Ideas are developed into assets (systems) through projects. Projects are information-level organizations with knowledge areas and processes for asset creation. The existence of a project means the presence of presence of engineering and the vision of a resulting asset (state or condition).

Information can be observed (sensed) and processed (computed). In concern to projects, the idea that information [about production] can be observed, leads to the idea of a common "body" of knowledge areas [about a project-type, production information]. Therein, the idea that information can be processed, leads to the project control and coordination processes (organized by process groups). Note that with each iterative development, both at the project-level and product-level, there is the potential of adding to our knowledge (value). We are doing iterative development because we want to learn with each iteration. The development of a functionally optimized, adaptive asset [known as society, highest level asset] is an iterative process.

> **INSIGHT:** *This is a unified social approach.*

There is a unified system [development and operations] view, within which there is a:

1. Project-level view.
2. Engineering-level view.

Systems engineering and project management are two critical aspects in the success of complex real-world projects. A project to develop a complex real world system necessitates both systems engineering and project planning. Wherein,

1. **Projects** define and decide how resources are cycled through a common materiality.
2. **Engineering** defines and determines how resources are configured in the common material environment.

3. **Operations** (Read: continued engineering projects) sustain and executes ongoing project-service configurations.
4. **Evaluations** (Read: Feedback) define learning.

Coupling design and "management" through a decisional model associating the two process categories:

1. The project-level information process.
2. The engineering-level materialization process.

Both project management and systems engineering necessitate a life-cycle decisioning (or "gating") structure. The key principle of development is that it is goal-driven. In a projects should be planned based on explicitly set goals.

To develop [complex and adaptive societal] systems efficiently and effectively, it is essential to align practices in systems engineering and in project "management". This issue of systems engineering and project "management" integration is at the core of all societal concerns (e.g., economic and industrial).

The unification of the processes of engineering (systems engineer), planning (project management), and decisioning (decision management) has been given a number of names, including, but not limited to: collaborative engineering; unified engineering; unified planning; systems engineering management; project integration engineering; and integrated systems engineering.

In a non-unified approach, one without a recognition of the underlying information system, the engineering of a system, and the management of that as a project will likely be carried out separately (as two separate disciplines). Depending on the environment and organization, the two disciplines can be disjoint, partially intersect, or one can be seen as a subset of the other. However, integrating the engineering and project components of system development (i.e., in order to carry out and complete engineering projects) is essential for a unified approach (i.e., an information-based approach). Here, the term 'unified' is a reference to a whole, integrating information system. Both systems engineering and project coordination ("management") are necessary for engineering (or otherwise, developing) a real world system. This represents the integration of systems engineering and project management.

> **HISTORICAL NOTE:** *Traditionally, systems engineering and project management have been practiced separately (i.e., they were considered two separate sets of knowledge and processes, instead of two views into one set).*

In the market-State, generally, competing entities usually attend to systems engineering and project management processes as separated roles (or processes), and do not consider connections between them. Indeed, for many years, the labor roles of systems engineers and project managers have thought of their work as separate, focusing more on their own domains than on the whole project as a unified information system. This compartmentalization of processes has led to significant inefficiencies is system design (and in society as a whole). In the economic labor market, the economic roles of systems engineer and project manager are in some degree of economic competition between one another. Further, in the market, research into the integration of these two roles is motivated by the prospect of improving the business' (or State actor's) competitiveness in the development of a product or service; it is not motivated by the prospect of improving [global] human fulfillment and environmental safety.

Engineering has a social function, and it is the presence of a social function (to lesser and greater degrees of quality, that makes engineering possible. An important point in looking at the social function of engineering is how society makes engineering possible. A complex feedback situation emerges. Societal organizations extend the power and reach of society and the individual. Society, in turn, through its organizations and demands, makes possible the development of complex habitat service systems and stimulates their constant technical evolution and diffusion. Today, to talk about the impact of engineering on society is meaningless without also talking about the impact of society on engineering, and how it shapes the role of engineering. The complexity of the interactions between society and engineering is at the root of unrealistic expectations about engineering, as social entities are often inadequately organized to develop and use engineering effectively. It is also at the root of the frustration of engineers unable to bring their capabilities to bear on the solution of social problems or the effective organization of the engineering enterprise.

Simplistically, the project-engineering of a society involves:

1. Socio-technical issue input.
2. Socially acceptable solution.
3. Technically acceptable social solution.
4. Projects organize the temporally positional information.
5. Engineering organizes the compositionally positional information.

4.1 A unified systems approach

A unified society is highly likely to have two core societal systems applications ("disciplines"). In other words, the two main domains of comprehension involved in a unified societal systems approach are:

1. Systems engineering (a.k.a., engineering development and operations, engineering coordination).
2. Project coordination (a.k.a., project management).

These two disciplines can be more generally categorized as the:

1. Engineering [design and development] approach.
2. Project [information] approach.

There are two [information] domains when engineering a complex system into existence:

1. Systems engineering (technical processes primarily), and
2. Project planning (coordination processes primarily).

An integrated view accounts for both systems engineering and project management. In this sense, project management identifies and coordinates need fulfillment, and engineering is the systematic study and resolution of socio-technical problems. In community, engineering is not handicapped as its effectiveness is some societal configurations (e.g., the market).

The outputs of an integrated view of a solution are:

1. Project coordination involves the project domain.
2. Systems engineering involves the system-service-product domain.

The flows of an integrated view of a solution are:

1. In the production process, the flow is materials and the objective is to make a system from materials.
2. In the engineering process, the flow is technical documents or technical information, and the objective is to provide the necessary technical specifications for the product and production of it.
3. The control process coordinates these other two processes. For the control process, the flow is information.

During the evolving stages of a project, users require (at least) the ability to:

1. Observe (perception).
2. Coordinate (organization).
3. Control (decision).

Together, systems engineering and project coordination (management) decompose a project into tasks and processes, planning tasks and processes with an overall project plan, and monitoring all tasks and processes until the validation of the project is complete.

Therein, effective action toward the users desired resolution necessitates the following information processes:

1. Coordination.
2. Decisioning.
3. Tracking.
4. Analysis.
5. Memory.
6. Feedback.
7. Correction.

A project is an organization designed to fulfill an objective, created with this purpose, and dissolved after its conclusion. A project can be defined as an organization with a clear and well-defined objective; it is working through a planned and coordinated approach with possibly pre-defined parameters of time, cost, quality and resources available.

The aim of project coordination (project management) is first to define the project mission and organization, then to determine the budget and plan a schedule, and then to ensure operational control of said project through an assessment of performance by analyzing possible deviations relative to the initial schedule, and to implement corrective actions or new preventative actions if necessary to mitigate risks. Its role also consists of organizing and monitoring systems engineering processes.

Having in consideration that a project has a well-defined beginning and an end, it can be associate to a life cycle, generally designate project life cycle (PLC). The PLC establishes the work that must be done in each phase of the project and the number of resources needed in its realization. The PLC phases are context specific for that reason it may defer from one organization to another.

Unified project-engineering involves:

1. **Projects that:** Projects are concerned with the overall, [Social organizational context of an environmental change.
   A. Lifecycle of projects: initiation, execution, closing.
2. **Develop systems:** System development as a lifecycle is concerned with the [technical] work/service systems that are to undergoing the change:
   A. Lifecycle of system (loop) - analysis, requirements, design, development, implementation, feedback.

A simplified project-engineering approach may be:

1. Recognize situation (articulate issue, problem, or need)
2. Identify societal requirements (understand system)
3. Identify user requirements (understand user)
4. Analyze gap (understand user demand)
5. Create solution description (design system)
6. Propose viable solution specification (propose system)
7. Select optimal solution specification (determine system, system construction decision)
8. Build new system state to solution specification (produce system)

9. Verify and validate system state (inspect and test system)
10. Cycle (de-integrate and re-cycle as appropriate)

4.2 System life-cycle coordination

The integration of project and engineering information sets requires coordination. The primary coordination systems required to coordinate the development of a unified socio-technical system are:

1. Project planning process group (processes).
    A. Project coordination (parallel inquiry process) .
2. System planning process group (processes).
    A. Engineering coordination (solution/technical inquiry).

Coordinating the development of a system into the life-cycle of a [habitat] service, necessitates the major activities of:

1. Systems [life-cycle] engineering.
    A. The system which is being brought into existence has a lifecycle.
2. Project [life-cycle] coordination/management.
    A. The project to bring the system into existence has a lifecycle.
3. Service/product [life-cycle] operations/ management.
    A. The system in its operation has a lifecycle.

4.3 Service coupling

In order to complete human requirements together as a global population using common resources, a social organization must be coupled to a decisioning organization as a service organization (note that the following are all engineering views, because engineering does the work):

1. **Simple service view** (e.g., concept of operation)
2. **Document concept of service** (e.g., model of service)
3. **Development of physical service** (e.g., designed service system)
4. **Manufacture, fabricate, assemble service actual service** (e.g., produced service system)
5. **In-service operations** (e.g., the operating habitat service system)
6. **Iterate service operation** (e.g., the strategic plan)

In the context of a service [system] operation, the integration of systems engineering and project management become two coupled mechanisms system, those of design (and development) tools and project management (coordination) tools into an effectively operated service. These two mechanisms are used, in part, to propagate the operational-organizational decisions necessary to sustain a service [system] as a solution (to societal system's organization, for example):

1. **Information coupling (information interfacing):** each sub-project is directed by requirements distributed between the two architectures (design & project), leading in some cases to the definition of common indicators. The information flow between these two points of view is based on the definition of these indicators and on their "management". The most straightforward example is resource presence:
    A. From the design point of view, will the resource be available? Are these materials available, or are others optimal [in our selection of a solution]?
        1. To what is information optimally flowing?
    B. From the project viewpoint, can a resources be made available? Are those materials available, or other solutions optimal?
        1. How could information flow optimal?
2. **Structural coupling (real-world, physical interfacing):** each sub-project is broken down into a design architecture and a project-system [management] architecture. These two architectures are logically connected to enable an exchange of information that facilitates the optimal construction of real [world] interfaces. The most straightforward example is, the function of a set of given buildings at a given location (where, the buildings and land are the interface; GIS data):
    A. From the design point of view, the data set is a design specification modeling the function of the buildings at the given location.
        1. What is to be built?
    B. From a project viewpoint, the data set is the construction (or re-construction) of the set of given buildings at a given location.
        1. How is it to be built?

4.4 Integrating project management and systems engineering

> **CLARIFICATION:** *Presently, the integration of project management and systems engineering into a unified approach has no directly attributable name.*

The integration of systems engineering (SE) and project management (PM) has only been considered in the beginning of 21th Century. The point is that, depending on the environment and organization, the two disciplines can be separate, partially intersecting, or one can be seen as a subset of the other. Previously, there were often treated as separate, using different persons, different tools, and different processes. For many years, a cultural barrier has been growing between practitioners of SE and of PM leading them to consider their respective work as separate rather than integrated towards a common objective, that of satisfying the end user. As a result, work is often more costly, takes more time to be completed and provides a suboptimal solution.

A cooperative society requires a tool wherein the high-level process groups of project management and systems engineering are optimally integrated. This is accomplished by:

1. Integrating standards from both domains into a unified domain.
2. Formalizing the definition of integration.
3. Developing integrated assessments.
4. Sharing responsibility for risk, quality, lifecycle planning, etc.

Systems engineering and project management are two critical aspects in the success of system development and system operating projects.

1. Project management is organizational decision processes.
2. Engineering management is solution decision processes.

The integration of project coordination and systems engineering necessitates types of requirements:

1. Decision requirements (organizational).
2. System requirements (service).

Systems engineering is focused on product requirements and should be empowered to handle them autonomously, involving the project manager when a technical requirement has project requirement impacts.

Project management and systems engineering are complementary functions, with great benefit from leveraging each other's strengths in a team environment.

Project manager manages the project life cycle, the systems engineer manages the technical baseline of the product under development. The project manager and systems engineer share requirements management responsibility, and by working closely together they keep the project on track.

A development system requires a repeatable controlled process - a fully integrated project cycle that addresses both the organization (PM) and technical aspects (SE) as an integrated process:

1. A project organization - project coordination (a.k.a., project management) initiates, plans, and then monitors and controls the execution of a technical solution. At any point in the lifecycle, project coordination may close the project or put the project on hold. Projects are closed when:
   A. They are completed.
   B. A decision is taken based on organizational inputs that determine the risk outweighs the expected benefits (safety protocol).
   C. They are terminated by the user.
   D. Phase closure - to define a more prominent gated progression.
2. A technical solution - the work required to realize the result, and the specification, which is acted upon.

4.5 Systems reference standards

In both the project management and systems engineering disciplines there exist a number of globally recognized and utilized [reference] standards for brining into existence (i.e., working) an environmental change in a systematic manner.

> **NOTE:** *Not a single one of these standards (or guides) contemplates an integration or sufficient cooperation between systems engineering and project management, despite the fact that engineers and managers (a.k.a., coordinators) have to cooperate closely throughout all stages of project development.*

4.5.1 Systems engineering reference standards

System engineering has the following recognized standards *(systems engineering reference standards)*:

- **ANSI/EI-632** (ANSI and EIA 1998)
- **IEEE-1220** (IEEE 2005)
- **ISO/IEC-15288** (ISO and IEC 2008)
- **International Council on Systems Engineering** (INCOSE)
- **Systems Engineering Handbook** (SEHBK) (Haskins 2010)
- **NASA Systems Engineering Handbook** (NASA 1992)
- **Systems Engineering, Coping with Complexity** (Arnold et al 1998, 152-168)
- **Systems engineering management plan** (SEMP)

The most important systems engineering standards are:

- **ANSI/EIA 632** - Processes for Engineering a System
- **ISO/IEC 15288** - System Life Cycle Processes
- **IEEE 1220** - Standard for Application and Management of the Systems Engineering Process
- **INCOSE Systems Engineering (SE) HandBook**
- **SEBoK** - Guide to the Systems Engineering Body of Knowledge (SEBoK)

4.5.2 Project management reference standards

Project management has the following recognized standards *(project management standards)*:

- **PMBoK 2018** (Project Management Institute, PMI) - A Guide to the Project Management Body of Knowledge
  - *Notice how the term, “management”, is in both the title of the Institute (PMI) and in the title of the standard (PMBoK).
- **ISO 21500** - Guidance on Project Management

Additional project-related reference standards:

- **ISO 9001:AS9100 Quality Management Systems** – Requirements for Aviation, Space and Defense Organizations
  - **ISO 9001:2015 -** International standard for a quality management system (“QMS”)
- **ISO 55000:2014, ISO 55001:2014, ISO 55002:2014** - Asset management
- **ISO 8000** - Data management
- **ISO 16404, ISO 10795, ISO 14300-1, ISO 21351** - Requirements Management space systems - program management
- **BS 1192:2007 + A2:2016** - Collaborative production

4.5.3 Building information management reference standards

Building information management (BIM) standards:

- **ISO 19650**, Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling
- **Level of development specification** v2013, v2015, v2016
- **BSI PAS 1192-2:2013** - delivery phase
- **BSI PAS 1192-3-2014** - information Operations & Maintenance (M&O) phase
- **PAS 1192:2015** - security phase
- **PAS 1192-6** - Health and safety
- **BIM Guide**

4.5.4 Architecture reference standards

The American Institute of Architects (AIA) has produced an integrated guide for architects:

- *Integrated Project Deliver: A Guide*. Ver. 1. (2007). The American Institute of Architects. [info.aia.org]

4.5.5 Integrated reference standards

Integrated standards are those that integrate both project management and systems engineering. The most recent, important integrated reference standard is:

- **ISO/IEC 29110** - System and Software Life Cycles

4.6 Reference standards re-alignment

The best current reference standards candidates for integration (as the alignment of processes):

- ISO/IEC 15288 standard would represent best candidate to alignment with PM standards.
- PMBoK 2018 standard would represent best candidate to alignment with SE standards.

The five processes of the ISO/IEC 15288 must be executed one after the other (initiating > planning > executing > monitoring and controlling > closing, in series in time). For ISO/IEC 15288, the four process group can be executed concurrently, or not (Agreement Processes, Technical Processes, Project Processes, and Organizational project enabling Processes, in series or parallel). For processes, some of them can run simultaneously, while the others must be executed in a chronological order.

4.6.1 Integrated reference standards data structuring

ISO/IEC 15288 data structure:

1. Process groups.
2. Processes.
   A. Purpose.
   B. Outcomes.
   C. Tasks & Activities.

PMBoK 2016 data structure:

1. Knowledge areas.
2. Process groups.
   A. Inputs.
   B. Tools & Techniques (the processes themselves).
   C. Outcomes.

4.6.2 Standards Software integration

Integrated software solutions (for PM and MS) include, but are not limited to:

1. In project management: Primavera, MS Project, etc.
2. In product life-cycle management: Windchill, Team Center, ENOVIA, BIM software with Autodesk Fusion and Revit, etc.

NOTE: *Generally, software solutions are* *traceable to accepted reference standards. The starting point of software is a reference standard, a specification.*

5 What is the proposed method for life-cycling project-engineered solutions?

Every solution is an integration of project coordination and systems engineering through life-cycle (of process groups). Although there are many variations of project composition, the following is a simple and general composition of the interrelated, synchronously integrated project-engineering phases for a 'solution':

1. Coordinate (project coordination)
   A. Have informed information system.
   B. Establish decision processes.
   C. Decide who.
   D. Determine resource allocation (resource access).
   E. Define quality evaluation standards.
   F. Document processes.
   G. Develop evaluation plan, framework or policy.
   H. Review evaluation (do meta-evaluation).
   I. Develop evaluation capacity.
2. Define (project definition)
   A. Develop initial description.
   B. Develop project theory/logic model.
   C. Identify potential unintended results.
3. Frame (solution framing)
   A. Identify primary intended users.
   B. Decide purpose.
   C. Specify the key evaluation questions.
   D. Determine what results ('success') looks like.
4. Describe (solution description)
   A. Sample.
   B. Use measures, indicators, or metrics.
   C. Collect and/or retrieve data.
   D. Coordinate data usage.
   E. Combine qualitative and quantitative data.
   F. Analyse data.
   G. Visualize data.
5. Understand cause (problem-solution evaluation)
   A. Check the results support causal attribution.
   B. Compare results to the counter-factual.
   C. Investigate possible alternative explanations.
6. Synthesize (design solution)
   A. Synthesise data from a single evaluation.
   B. Synthesize data across evaluations.
   C. Generalize findings.
7. Implement (apply solution)
   A. Execute an action (or multiple and/or dynamic actions) to bring the solution into existence.
8. Report and Support Use (of solution)
   A. Identify reporting requirements.
   B. Develop reporting media.
   C. Ensure accessibility.

D. Develop recommendations.
E. Support use.

5.1 Simplified project systems engineering

The group of functional relationships that form a highly simplified view of project systems engineering are four:

1. Coordination (share plan).
2. Design (concept model).
3. Build (spatial construct).
4. Operate (real-world system).

> *Note that any re-cycling system is itself an operated system; in other words, there is list #5 for re-cycling, because all systems are either operational or under design to become operational (a re-cycling system is either under design, or operational currently).*

5.1.1 Historical note

Neither the project nor engineering approaches represent a new way of developing a system, or providing and operating a service. Before the principles of mass production were developed, all complex production and operation was carried out as projects to produce engineered systems. Craftsman (early term for an engineer) have always made products based on the information, materials, and time, available, and adapted to the requirements of a user.

Therein, project coordination (or more commonly in the market, project "management") has been practiced for thousands of years, and can be dated back at least as far as the Great Pyramid of Giza and Gobekli Tepe. The idea of project "management" is related to early civil engineering projects. Until 1900, civil engineering projects were generally "managed" (coordinated) by the architect(s), engineer(s), and master builders, themselves. It was in the 1950s that organizations started to systematically apply documented project coordination ("management") tools and techniques to complex engineering projects.

In the professional market for labor, 'project management' became recognized as a distinct discipline arising from the labor market's management domain, with material creation (design and development) occurring through the labor market's 'engineering' domain. In 1969, the Project Management Institute (PMI) was established in the USA, and then globally, to solidify and refine the 'project management' [economic] profession. In the professional [labor] market, there are now 'project managers'.

In 1996, the PMI first published "A Guide to the Project Management Body of Knowledge" (PMBoK), which described project management practices that were common to "most projects, most of the time". In 2012, the International Standards Organization (ISO) also realized the importance of project management and published a project management standard ISO 21500. Today, there are many similar and related disciplines of project management, such as program management, project lifecycle management, product lifecycle management, and others.

> **NOTE:** *More technically, beyond the labor-market, a "project manager" is simply a type of information process unit, a unit that coordinates and controls the flow of a high-level project related information.*

5.1.2 A project [development] integration view of the projected system's life-cycle

The project life-cycle provides a framework (of processes) for resolving coordination problems to the production of complex work.

A project life-cycle necessitates:

1. **Project initiation** - In project initiation, the goals for the project need to be consistent (in alignment) with organizational goals. Organizational models, such as the societies decision system help with this.
2. **Project execution and controlling** - The executing and controlling steps of a project is where the 'system development life cycle' exists. This is where/when the analysis of existing systems and processes takes place,and when new ones are developed and implemented.
   A. One way to view the [system] development/ operations [life]cycle is as one executable step in project coordination.
3. **Project planning** - Planning occurs in between (in parallel, often) initiation and execution. This is where the goals of the project (Read: the reasons for doing the project) into actionable steps. A variety of documents are developed during this phase. These documents are used to coordinate ("manage") the project. The three core [project] planning > plan documents (Read: recorded and transparent, living, information sets) are:
   A. The [project] charter.
   B. The work breakdown structure.
   C. The [project] schedule.

Systems are engineered into the coordinated operation of a larger and pre-functioning system; they are integrated:

1. **Integration** - Once characterised and accepted as suitable, the products/services undergo adaptation and integration into the required asset-service system. The maturity of this integration is measured through Integration Readiness Levels (similar to Technological Readiness Levels, but

with operational evaluation information). Any new development elements are integrated with the adapted elements to form the new systems.

2. **Transition into service** - The transition into service utilises project views of materiality (architecture) to schedule the requisite elements of products and services for deployment and use (Read: access). At this stage the asset-service systems are used in their intended environment and undergo validation against the capability requirements (of the architecture).
3. **In service support** - Throughout the sustainment/ operating period, asset and service measures are captured/observed and analysed against the indicator-metrics selected to correct for alignment errors based on alignment requirements, which form the basis of process improvement [in a given information system]. Progressively, the capability [requirements] architecture, system and service models are validated, or not validated. As changes are undertaken (to correct for validation) the architecture, models, and operative services are updated. Any potential change can be modelled prior to commitment to change (i.e., solution) to ensure the changes will contribute to system's objective/requirements.
4. **Dis-integration** - the end-of life-cycle removal (and possible modified replacement) of an asset-service.

5.1.2.1 A system [development] life-cycle view of the integration

The systems development life-cycle provides a framework (of processes) for system creation and integration, for technical (solution inquiry) change in the environment given a user with requirements [for which a project has been composed].

The system development life-cycle includes:

1. **Analysis (of situation)** - The sdlc starts with an analysis of the situation. What can be better? What is going wrong?
2. **Requirements (for systems change)** - describe the solution to the degree that the delivery can be compared in alignment with the [solutions] description. What is required for fulfillment? What are the goals, specifications, and must haves in order to resolve the [systems] change.
3. **Design** - After the situation is fully understood and the requirements for and solution, the you start planning out that solution. What will the future situation look like? What do the technologies look like that support this future situation? Design out what the technologies look like, what they should do, and their expected context(s)?
4. **Development** - Create, build, and prototype and test the technologies.
5. **Implementation** - integration of the technology. Train InterSystem and Community people on them, and InterSystem Team operate the systems as services for our human community.
6. **Analysis of implemented situation** - After implementation, evaluate to see what is working as expected (alignment with requirements) and desired by users (fulfillment as expected)? What is working and what is not? Then, start the process life-cycle all over again with analysis.

Alternatively, the system development life-cycle could be viewed as:

1. System definition.
   A. Collection of user needs.
   B. Translation of user needs into technical requirements.
   C. Initial design concept.
2. System development.
   A. Specifications for functional level.
3. Process development.
   A. Design and prototype manufacturing and assembly processes.
4. Process quality control.
   A. Process parameters (specification for performance/quality level) are determined and evaluated.

When analysing a situation it is important to analyses it in the context of the goals for the organization, the user and the service that meets their needs (in a business goal context, for example, profit, reduce costs, improve customer value)...if these conditions aren't going to happen, are you sure the change should be taken? The usage of a social information model facilitates the analysis of and identifies the requirements for parallel societal decisioning (i.e., the societal decision value alignment inquiry processes).

The system development process includes:

- A development process, where the main activities are represented going from requirement definition to maintenance of the finished product; a life cycle based on evolving prototypes into a fully integrated system; and the methodology itself (why the method was logically selected).

Most generally, the development process is:

1. **Direction** - put together a specification of the objective.
2. **Conceptualization** - put together a specification of the system. Conceptualization involves the

organizing and structuring of acquired knowledge.
3. **Implementation** - implement the concept model to create and/or operate the system.
4. **Evaluate** - execute an evaluation (and "judgement") by doing a technical analysis on the process and result, and correction any mis-alignments with objectives and requirements (system so that all information in all phases is more coherent and/or useful).

The commonly accountable elements of the design phase are (i.e., what is the "design for"?):

1. **Function** - the "means" by which (how) the system operates for user fulfillment. Why and how does the system operate? How is that specific operation determined and measured (or observed)?
2. **Interface** - the "means" by which (how) which two systems interact (Read: share information).
   A. Because an interface's principal purpose of existence is to represent usability between an object and a user, the principal interface design [operational-conditional] principle is: usability. The interface is being designed to literally 'interface' with another system, and so, it must do this effectively for both systems. Humans and other necessary systems can interact with the target system (e.g., a societal system) in a way that allows them to achieve their purposes in an efficient and effective manner, together.
3. **Performance** - the evaluated the quality of the method (means) by which the function occurs (how in alignment with expectations is the function):
   A. Information is shared between systems (per requirements).
   B. The function operates for user fulfillment (per requirements).

5.1.2.2 The planning [development] life-cycle view of the integration

The planning [development] life-cycle view of the integration process involves:

1. **Assess** the articulations alignment (recognition and effectiveness) of the inquiry.
   A. If there are gaps, then change social value set or evolve self value set to remain in coherence so alignment of articulations can be assessed.
   B. If there are [now] no gaps (otherwise, repeat prior step), build the vision (as a model through to simulation as integration over time), while maintaining a set of goal-oriented (need) conditional statements, that will be translated into an extant system.
2. **Simulate** the vision by modeling in real-time to resolves more complexly, completely, and commonly.
3. **Test and evaluate** a prototypical operation of the requirements of the vision.
4. **Planning** - What possible solution fulfills the technical engineering and constraining organizational requirements, together as a system, most optimally? That solution is the selected plan. The planning process is a continuous, dynamic process -- the "creation" of the plan is a continuous activity group.
   A. Plan the project - (information-) oriented components of Information-Project Engineering Development - integration of the following units into a directionally coordinated human societal fulfillment interface (plan) including, but not limited to the following major sub-component systems defined by their "engineering" requirement: requirements coordination (a.k.a., requirements management), schedule coordination (a.k.a., schedule management), resource coordination, [societal] quality coordination, risk [and, cost] coordination, communications [and interface] coordination, computation and logic coordination,
   B. Plan the lifecycle-oriented components of Engineering Operations of the service and/or service asset.
5. **Execute** by resolving the decision to a section, which sends a signal to a controller, causing an execution of action involving a modification to the state-dynamic of the material (habitat) service system, which will either be acted upon uniquely by an InterSystem team(s), or it will be integrated into an active service lifecycle as an asset by an InterSystem team, or it will be removed from active materialization by the core Effectiveness Inquiry Process.
   A. Engineering developments of service systems by applying information processing (Read: lifecycle planning). Engineering controls design process.
      1. As part of the Development InterSystem Team, those individuals who contribute with accountability toward the sustainment of the habitat service system's operation.
      2. As part of the information system, control decisioning (constrain solution to value-alignment), and thus, control design process.
      3. Define technical operational baselines.
      4. Coordinate design solution is the result of a controlled design process and the development of baselines.
      5. Configuration [state of HSS] levels through this the entire design effort can be coordinated via

decision points ("audit") informed by:
   i. Concept [configuration] level study - generate system concept description; what should be done, behave, exist?
      1. System [configuration] level study - describe requirements for integration into service (performance requirements); how will the system perform under different conditions?
      2. Component study [sub-component configuration] of subsystem level - performance requirements - detailed description of characteristics required for production; what are the components of the system that enable the fulfilling of performance requirements?
   ii. Functional baselines:
      1. Allocated baselines (preliminary design definition).
      2. Asset baselines (detailed design definition, product baseline, and material asset realization).

B. Engineering integrations of service systems by accounting (surveying baselines) - sub-component of both systems, simultaneously, indicator-metric-evaluator interface.

C. Engineering operations of service systems by applying systems by applying apply service (operations) knowledge areas (including, principles) and processes.
   1. As part of the Operations InterSystem Team, those individuals who contribute in accountability toward the sustainment of the habitat service system's operation.

5.1.2.3 The system-conception engineering life-cycle view of the integration

The system-conception engineering life-cycle view of project integration involves the following:

> **NEED ANALYSIS QUESTIONS:** *Is there a valid need for a new system? Does there exist a practical approach to satisfy the user need for a new system (is it feasible)?*

1. **Concept** DEVELOPMENT **phase**
   A. Need analysis - a valid need has the form of:
      1. [Human] Needs analysis.
      2. [Social organizational] needs analysis.
      3. Technical needs analysis .
         i. Inputs:
            1. Operational deficiencies (gaps in service).
            2. Technological opportunities (knowledge).
         ii. Processes:
            1. System studies.
            2. Technology assessment (technological readiness levels, or new technology).
            3. Methodological assessment (model readiness level).
            4. Operational analysis (is it feasible to operate).
         iii. Outputs - the output of this is the first (preliminary) iteration of the system's design itself, which is a basic (high level) concept model.
            1. System operation effectiveness.
            2. System capabilities.
   B. **Concept** EXPLORATION **phase**
      1. Concept exploration questions: What are the principal characteristics of the systems concept that can provide the best design between capability, life of system, resource occupation of system (and in the market, cost).
      2. Concept exploration tools: process methods, decision support systems, expert analysis.
         i. Inputs:
            1. System operation effectiveness.
            2. System capabilities.
         ii. Processes:
            1. Requirements analysis .
            2. Feasibility tests (alternative search) - what are the other alternatives available to the system for fulfilling the need(s).
         iii. Output:
            1. System performance requirements.
            2. System concepts.
   C. **Concept** EXPLORATION **phase**
      1. Concept exploration questions: what are the performance requirements of the new system so users needs can be satisfied? Is there at least one feasible approach to achieve the desired performance at an affordable/ acceptable resource usage (and in the market, price)?
      2. Concept exploration tools: process methods, decision support systems, expert analysis.
         i. Inputs:
            1. System performance requirements.
            2. System concepts.
         ii. Processes:
            1. Selection from alternatives ("trade-off" studies).
            2. Architecture (system [architecture] logic; not engineering architecture).
         iii. Outputs:
            1. System functional specifications - a description of what the system must do and how well?

2. System concept definition (a.k.a., system definition).

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Approach: Projecting

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Abstract

This article delves into the intricacies of a project-based approach to the coordination and realization of complex socio-technical systems within the material confines of the real world. It emphasizes that such an approach is not merely theoretical but deeply entrenched in real-time, information-driven processes that aim to navigate the multifaceted stages of designing, constructing, and potentially operating diverse systems. This method stands out for its comprehensive coordination through the tangible realms of materiality, incorporating both hardware and software environments to bring service systems to life.

At the core of the project-based method is the meticulous processing of coordination-related information, which serves as the backbone for the methodical design, development, and life-cycling of service systems. This approach is characterized by a structured methodology that outlines specific, coordinated operations, each culminating in precise deliverables. These projects are conceived as coordinated packages of information, meticulously planned to execute actions and achieve results through tasks that ultimately yield beneficial objects and insights.

Furthermore, this approach underscores the significance of activities within the project framework. These activities, known to contributors as their tasks, are intricately coordinated to ensure seamless teamwork, fostering a collaborative environment that acknowledges and incorporates the perspectives of all stakeholders involved. The article highlights the crucial aspect of scheduling, which is carefully tailored to accommodate the dynamics of team collaboration and stakeholder engagement, ensuring the project is executed efficiently and effectively.

Graphical Abstract

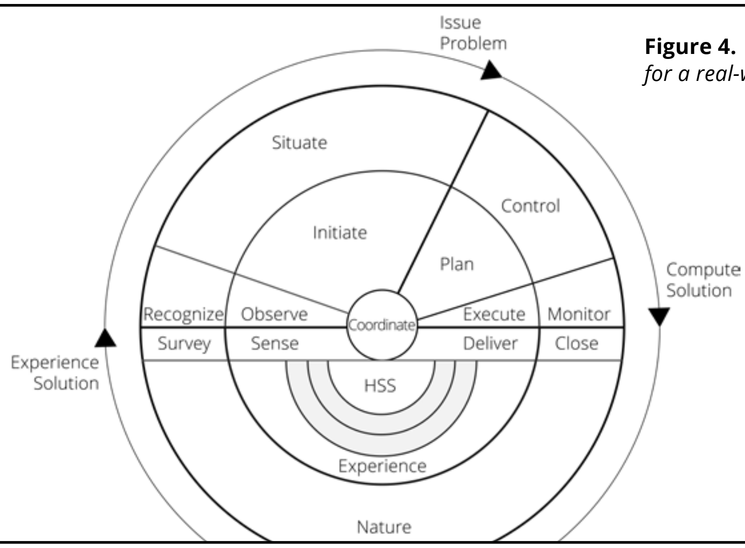

Figure 4. *Project coordination planning for a real-world societal system.*

1 Introduction

A.k.a., the project structure; the project-based approach, and the project method.

A project-based approach is a real-time, information-based approach to coordinating the resource realization of complex socio-technical systems. It involves the processing of coordination-related information in order to design, construct, and potentially, operate, some system in the real world. In other words, a project-based approach involves coordinating the design, development and operative life-cycling of service systems through materiality (i.e., through a material, hardware and software, environment). In practice, the project method is the specific, coordinated way of performing an operation that implies precise deliverables (at the end of each stage of the project).

CLARIFICATION: *"Projectability" (project-ability) is the ability realize (Read: make real or material, to reify) that which is currently unrealized (informational), and to distinguish between the two. Effectively, the project approach allows for (i.e., conveys the capability for) complex, parallel "projections" (i.e., constructions or creations) into a commonly shared, real world environment. When you think about projects you have to think about moving forward. A plan brings common understanding to navigating motion together in a shared space.*

Real world problems and challenges are complex and necessarily approached through projects. Projects define tasks by means of scope and requirement with the purpose of a designed construction as the output. Projects involve teams of individuals working together toward the shared constructive purpose for the projects existence. Here, there are tasks within which are processes for accomplishing the task. There is a spectrum of effort automation for task fulfillment processes. In other words, some tasks and subtasks are entirely automated, some involve a combination of automation and human effort, and some involve only human effort.

2 What is a project?

A.k.a., Program (collection of inter-related projects), portfolio (collection of inter-related programs, projects), plan.

A project is a systematically structured approach to resolving a problem in the form of a[n information through to materialized] solution (e.g., the community's societal habitat service system). The output of a project is an operational system or result, as a selected response to some directional input (e.g., an issue or problem). More technically, the function of a project [in a unified information space] is to successfully deliver one or more requirements in the form of a product or result. In other words, a project is a bounded, directional information space within which a problem space is resolved into the selection and construction of a solution into an operational, materializing environment. At the human level, a project encompasses a set of interrelated tasks and decisions that are executed over an identified period of time within limitations (real world and organizational) to resolve an intention. A project can be visualized as structured flow of information and events, by initiation, through a process or processes, producing an outcome. The purpose of a project is an outcome, a result - a directional "desired" change in a material condition that benefits the user (as the "target" population or group). A projects can be viewed as an organizing mechanism (process organization) for getting work done. Organizations do projects. Projects drive (direct) change [to/in an environment].

CLARIFICATION: *In some organizations there are differences in meaning between the terms 'project' and 'plan', and in other organizations the terms are used interchangeably. Here, the project to bring into existence a network of integrated city systems operating through a unified societal model, and the plan to bring this system into existence is detailed within an information set called the 'project plan'.*

A, 'project plan' may also sometimes known as: a plan; a project management plan; a project coordination plan; an implementation plan; an execution plan; and a construction plan, etc. Psychologically, a plan ensures that the momentum is kept up (because progress and issues can be seen) when a plan is executed. Planning and scheduling in society are a dynamic and a never-ending process. A project is setup to be "successful" when the right environmental conditions exist for it to be successful. Therein, a "successful" project is a project that satisfies its intended purpose in a safe, timely, and resource-effective manner producing a result that aligns with the intention.

NOTE: *In some social contexts, the word "project" is replaceable with the word "mission", and to a lesser extent, the words "goal", "objective", and "outcome".*

Every project relates to a product (system, service, object, etc.). The product could be a tangible product, a software system, a service, or a new organization. Note that the project result is not synonymous with the product. The product definition is the product's boundary condition(s).

> **INSIGHT:** *The deliverable of a societal-level project is that which we all are "collectively" materializing.*

A project is carried out through a series of interdependent tasks - that is, a number of non-repetitive tasks that need to be accomplished in a certain sequence in order to achieve the project objective. A project consists of a coordinated series of activities or tasks performed for a common purpose. Here, phases must be worked through and tasks must be completed (as "gated" processes) in order to complete the whole project. A project utilizes various resources to carry out the tasks and meet the project's stated requirements. Each task is a sub-system containing input, process, and output elements, and is a sub-part of the unified, projected system.

> **Note:** *It is not logically possible to "do a project", it is only possible to "do tasks as part of a project".*

The following is a common list of definitions of the concept, 'project':

1. A project is composed of components, activities, and rules that lead to some "thing's" materialized existence.
2. A project is an forward/series progression ("endeavour") designed to produce a unique service, product, or result. All projects have boundaries for progression (i.e., a life-cycle), progression proceeds through phases, each with a defined beginning (input) and end (closing output). Sometimes the beginning and end are time-constrained, and sometimes not.
3. A project is executed ("undertaken") to meet unique goals and objectives, typically to bring about beneficial, objective change. The change must be objective, as in, measurable. The change must be measurable so that the project's success/ completion can be evaluated.
4. A project is the first [in]formation of a construction. Wherein, a construction is an information and/ or material asset, a designed solution. That asset represents a potential construction or realized construction (into materiality).

The 'solution' characteristics of a project information set are:

1. Given what is known, a project has a synthesized output, known as a 'solution'.
2. Given a motivation by consciousness, a project is the progressive elaboration of a problem (direction, goal, etc.) and its predicted, and then tested and delivered/operated answer, known as a 'solution'.

It is relevant to note here that current operations are run as [continuous] projects with typical task start and end times. Ongoing service issues (operations concerns). In project management, these tasks are considered processes and not projects. However, the habitat service system operations themselves are considered to be run as projects; they are also process or serve groups, and at a lower level, processes. Synonyms for current operations are day-to-day operations of habitat service systems.

Projects may be classified according to a set of characteristics, including, but not limited to:

1. **Novelty** - refers to a derivation, update, or a new system.
2. **Service complexity** - refers to the number of [societal service] systems engaged.
3. **Technology complexity** - refers to the level(s) of technology engaged.
4. **Organizational complexity** - refers to the number of information sets engaged.
5. **Uncertainty** - refers to the degree of unknowns.
6. **Pace** - refers to time (e.g., fast, regular, slow).

For any complex project plan there are two levels of action:

1. **The Project Level** - a plan for developing a community-type society. The top-level for which the purpose of the project is to construct a community-type society. The project level is the level for which the purpose of the project is to meet one or more of the top-level project imperatives.
2. **The Sub-Project Level** - sub-plans for discovering and developing a community-type society. A sub-project plan (a.k.a., project integration plan) is a standard (i.e., not a societal-level) project plan that accounts for integration within the top-level plan, and provides the basis for all coordinating activities between the sub-project and the Project. A sub-project plan ensures alignment with the project level.

2.1 Project structured information set

The three processes of executing, planning, and controlling rely on a single structural representation of the project (e.g., the work breakdown structure type). These three responsibilities (Ex, Pl, and Co) share the same obligation, when programming so dictates or when a malfunctioning warning sign occurs, to embark on a discussion and to go ahead only if a decision has been taken.

1. Executing.
2. Planning.
3. Controlling.

Projected-based information coordination comprises the transformational processes of:

1. Gathering (collecting).
2. Structuring (integrating and generating).
3. Retention (memory).
4. Access.
5. Adaptation (updating).
6. Application (applying).

Information transformation, itself, comprises:

1. Synthesis - put parts together to form a whole.
2. Analysis - separates material or concepts into component parts so that its organizational structure may be understood.
3. Application - applies what was learned.
4. Comprehension - understand the meaning, translation, interpolation and interpretation of instructions and problems.
5. Knowledge - recall data or information.

The common flow of information through a project structure:

1. Project initiating.
2. Project planning.
3. Project execution.
4. Project completion.

2.1.1 Societal project planning phased organization

> **NOTE:** *It is desirable to obtain total agreement from the entire project team regarding these objectives and priorities to ensure alignment.*

The project planning of a habitat involves a set of basic project phases that continuously design, build, and close (or, operate) new states of a habitat [service system]:

1. **Phase 1: Building the project team.**
    A. List stakeholders.
    B. Identify working group (if applicable).
    C. Identify habitat InterSystem service team or InterSystem Habitat Team (if applicable).
    D. Identify resources and tools.
2. **Phase 2: Project definition (establish the context).**
    A. Define project (goals, purpose, objectives).
    B. Establish current state.
    C. Identify needs.
    D. List priorities.
    E. Define objectives.
    F. List available data and gaps to be filled.
3. **Phase 3: Solution definition.**
    A. List requirements.
    B. List outcomes of project.
    C. List available solutions to project.
4. **Phase 4: Plan definition.**
    A. Approach identification.
        1. Outline of phasing, tasking, and scheduling (project coordination).
        2. Local context.
    B. Direction identification.
        1. Purpose and goals (mission and needs).
    C. Execution identification.
        1. Operational criteria.
        2. Evaluational criteria.
5. **Phase 5: Execution (implementation).**
    A. Execute the phases of the plan, either synchronously or asynchronous as appropriate.
    B. Control the implementation of the plan by means of monitoring, communication, deciding, and acting (working) for three types tasks:
        1. Coordination tasks.
        2. Human action tasks.
        3. Automatic action tasks.
    C. Schedule plan by means of time line association between available locations, resources, and actors (e.g., personnel and/or systems).

Master planning for society is a socio-technical project that involves economic, technical, social, and environmental categories of data:

1. Economic resources - visualization of the flow of objects (resources).
2. Economic production - mechanism by which resources are transformed into good and services to meet needs.
3. Technical knowledge and tools - using knowledge and tools to change, advance, and modify the habitat.
4. Social fulfillment - accounting for the fulfilment of needs in habitat services.
5. Environmental regeneration - accounting for the carrying capacity of the environment, controlled [in part] by site modification.

2.1.2 High-level project organization

At a high-level, a project is composed of the following actionable information sets:

1. **Information system or space (system):** All information relevant to the project.

2. **Directionality, purpose, or imperative (input):** Describes the goals (and objectives) for performing the project's process(es).
3. **Results or outcomes (output):** Describes the observable (materialized) state-dynamic expected [in an environment] from the successful/complete performance of the project's process(es).
4. **Tasks, instructions, or activities (process):** Describes the actions intended to produce the outcome(s) using the project's inputs.

Using other terminology, a project is sub-composed of:

1. **Directive component** (input of initialization - that initializes the space) - a directive (or imperative) area represents the point-source intention and defined input for the state-dynamic change.
2. **Knowledge component** (input of learning - that from memory) - a knowledge area represents a complete set of concepts, terms, and activities that make up a usable, specialized information set.
3. **Process component** (input of instruction - that of software code and material task) - a process a specific method, mechanism, procedure, task, protocol, etc. Process components are characterized by their inputs, the tools & techniques that can be applied (and developed), and the resulting outputs.
4. **Constraints component** - that limits the execution of the project and constrains it to a boundary of what is and what can be made available. Every project has constraints (limitation) imposed by some combination of:
    A. Information.
    B. Time.
    C. Energy-power.
    D. Material resources.
    E. Labor resources.
    F. Throughput.
    G. Prerequisites.

The basic flow of information within a project structure could be viewed as:

1. Prioritization.
2. Analysis.
3. Design.
4. Build.
5. Evaluate.

Fundamentally, the projects approach is to have a projects' support service for the fulfillment of the global human population.

2.2 The project direction and orientation (initiation): project objectives, outcomes, outputs, and key results

To fully identify a project and measure the progress of a project it is important to define project objectives, project outcomes, and project outputs, along with the measurable key results that define achievement of each objective and the project as a whole (*Project Managemen*t, 2017):

1. **[Project] Objectives** - A project objective is a statement of the overarching rationale for why the project is being conducted. A project can have one or more project objectives. A useful way to frame an objective is to answer the question, "Why is the project being done?" The result is a one sentence statement, or series of statements, usually starting with the word "To ..."
2. **[Project] Outcomes (a.k.a., key results)** - Project outcomes are the benefits or other long-term changes that are sought from undertaking the project. They are achieved from the utilisation of the project's outputs. Here, key results (outcomes) are determined for each objective. Outcomes are linked with objectives, in that if the outcomes are achieved, then the project's objective(s) have been met.
    A. **[Project] Target outcomes (a.k.a., measurable key results)** - Project target outcomes for a project are outcomes that have a measurable benefit and will be used to gauge the success of the project. Usually there will only be a small number of target outcomes for any project. Each measure[able key result] will be linked to one or more target outcomes. At the end of the project the measures will help answer such questions as, "what have we achieved?" and "how do we know?" Target outcomes are expressed as a sentence in the past tense and usually start with a word ending in "-ed", such as improved, increased, enhanced, amplified, filtered, stopped, decreased, or reduced. Framing target outcomes in this way makes it easier to determine their success measure.
3. **[Project] Outputs** - Project outputs are the products, services, organizations or procedures/practices that will be required to be produced to meet the identified outcomes. They may be products (objects) or services (processes). Outputs link with outcomes, in that the outputs are used by the project's customers to achieve the outcomes. An output can be a verb (process) and/or object (noun).

4. **[Project] Activities and tasks** - are the work that needs to be done to produce the outputs for the project. Activities are the larger, higher-level units of work, which can be broken into tasks, the smaller units. Activities and tasks are dynamic concepts (i.e., processes, verbs, actions). Activities and tasks are written in the present tense using verbs (dynamic concepts including motion).
5. **[Project] Milestone** - a significant, scheduled event that acts as an identifier of progress (i.e., "progress marker") in the progress to completion of a project. A single milestone is usually the completion of a key activity or task, or a deadline. A milestone is like a toggle switch – at any point in time, it is either completed or not completed. The start of an event is rarely a milestone. Milestones are expressed as sentences in the past tense.
6. **[Project] Risks** - any concern that some object, process, or event might adversely affect the successful completion of the project.

2.3 The project direction (initiation): project goals

A goal is, the intention of a 'user'. To an engineer, goals represent the intentions of the system's user. In concern to systems, a goal describes a relationship that a system desires to have with its environment. In general, goals are formulated based on a current situation and a measurement criteria. If consciousness has the intention for something to stay the same, or to change, then a goal is present. Optimal goal selection relies on understanding, and the coordinated layering of direction throughout the flow of a project.

In order to accomplish the Project's primary directive, the goal is to expressly materialize the following three sub-systems:

1. [Conception/Design] A continuously updated specification of the whole societal system. A specification is anything that describes what an actual instance looks like.
   A. We need a commonly shared design plan to iterate [the next state of evolution of] our society.
2. [Materialization/Action] The operation of a network of city systems based upon and expressed through the specification. A city system (or network of city systems).
   A. We need a controlled habitat service system that operates in alignment with the design plan.
3. [Experience] The experience of optimized fulfillment and well-being for each and every individual human, based upon the given conditions.
   A. We need a population of self-motivated, self-integrating, and compassionate humans who understand and align with the design plan.

When these highest-level [project] goals/objectives are complete, then the Project, as specified in this Project Plan, is complete[ly delivered]. In this sense, objectives/goals are the final outcome to the user.

In order to accomplish the Project's primary directive, the proposed societal system maintains the following four goals:

1. Quantitatively identify the different components of the human system, and understand how these components relate to each other.
2. Quantitatively fulfill the needs of individual humans in the human system, and understand how the needs are best fulfilled.
3. Quantitatively determine the habitability of an environment, and understand how different spaces have different habitability potentials. Access past and present habitability potential of location.
4. Sense the experience of a reliable and robust operational service system (intentionally developed).
5. Remain sufficiently uncertain about what humans require to maintain a set of value inquiry thresholds programmed into the decision system as the socio-economic decision inquiry process group and the solution inquiry process group.

In order to accomplish the Project's primary directive, there are coordinate system objectives. Societal coordination objectives are common to all projects.

The primary and secondary goals of the proposed coordinated societal system are to:

1. Ensure positional data of all resources.
   A. In application, the question becomes, are we using environmental resource survey data?
2. Ensure effective and efficient interaction and communication among project participants.
   A. In application, the question becomes, are we using a unified information system?

The supportive sub-goals of the project coordinating system are to:

1. Assure the highest quality technical, organizational, and contractual coordination at every level.
2. Initiate and facilitate the resolution of decisioning at every level.
3. Support active and beneficial collaboration among projects.

In order to accomplish these objectives, the following project coordination processes must be carried out:

1. **Scheduling work and access** - register tasks in time and space. Scheduling activities.
2. **Monitoring work and access** - track the operational work of the project. Monitor activities and results.
3. **Reporting work and access** - communicate an understanding of the projects progress and status. Reporting activities and results.

Each individual process expresses a unique level of resulting information motion:

1. In concern to **controlling**, a decision selection is approved, accepted for inclusion (inclusion).
2. In concern to **scheduling**, when a selected (decided) change is to be executed (as an activity/task), an InterSystem Team role synchronously with a change control coordinator shall be assigned accountability [for the project]
3. In concern to **monitoring**, when a change in a noted characteristic is deemed appropriate, notification of the change shall be sent to the appropriate review and change control coordinator [for the project].
4. In concern to **reporting**, when an expected change is complete, an accountable event log shall be sent to the appropriate review and change control coordinator [for the project].

Each individual contributing to the optimization of a coordinated society maintains a set of life-orienting goal (more commonly called ‘rules’):

1. The design must account for life value regulators from start to finish.
2. The production must have more life value capacity through generational time.
3. The evaluation must compute a life value measure as a criteria to tell (determine) greater from lesser (‘>’ from ‘<’) in any domain by knowledge of life capacity loss or gain.
4. Cumulative life gain is always the organising goal, the intended result.
5. Coherently inclusive decision or action is enables life capacities, the better it always is for common life opportunity capacity.

2.4 Executable project elements

In order for a project to be completely “delivered”, actions (“activities”) must occur. An activity or action is one of a coherent set of specific steps that must be taken to reach the imperative(s) conclusion (i.e., the change for that which the project was initiated). Therein, an executable is an information set upon which action can be taken.

Executability means,

1. From an operator’s perspective - that a service is operational and monitored for alignment with specification.
2. From a user’s perspective - that a system may be validated against specification.
3. From a developer’s perspective - that a specification is verified against the facts of its operation.

The commonly named executable elements of a project include:

1. **Deliverable** - a tangible (materializable), verifiable work service or product.
2. **Activity** - a planned action.
3. **Activity work package** - a deliverable at the lowest level of the deliverable diagram (work breakdown structure). A work package may be divided into activities. Work elements with expected duration and resources requirements (and in the market, costs) that may be subdivided into tasks.
4. **Task** - a deliverable at the lowest level of the work breakdown structure. A work package may be divided into activities.- the selection of a ‘job’, procedure, or other process, to accomplish an effort.
5. **Work package** - a deliverable at the lowest level of the work breakdown structure. A work package may be divided into activities.

The executable project elements are coordinated into existence by an accountability organizational structure and matrix:

1. **Organizational breakdown structure** - relates work packages to organizational [InterSystem] work/team units.
2. **Accountability matrix** (a.k.a., responsibility matrix) - relates the organization structure to a deliverable diagram (work breakdown structure) to ensure that each element of the project’s scope is assigned to an accountable individual or system.

2.4.1 Project selection for execution

For any project, the project is first defined, then projected solutions must be uniquely identified, and then, those solutions are screened for optimality prior to execution of the optimal:

1. “Project selection” refers to selecting (via some decision-determination method) the one project solution which is probably best to execute. To identify the one project solution out of a set of possible project solutions, project identification is required.

2. "Project identification" is formalized by a specified set of objectives and a given the context of an internally and externally bound nature. Internally, projects become identified through their solution. Externally, projects become identified with their results. For any projected solution, solution design possibilities are screened [through a decision control system consisting of logical programs] to provide an optimal project proposal for execution.
3. To "screen a project" is to have a set of criteria for evaluating the project. An appraisal of a project['s success] has to be based on a set of criteria. There are always criteria in screening for optimal solution selection and for evaluating the experienced results of that solution selection.
   A. At a societal-level, the socially defined values for any society represent these set of criteria (i.e., values are societal alignment conditions). In community, these values are reasoned and identified in the Social System Specification. In the market, investment, payback, and likely profit are a good set of [value] screening criteria. For this proposed community-type societal system, the core orientationally stabilizing values of individual freedom, restorative justice, and technical efficiency are a good set of [value] screening criteria.

2.4.2 Execution [tasking] phases

A.k.a., Project execution phases.

In concern to this societal building project, the primary execution tasking phases are:

1. **Project initiation/identification**
   A. A plan is created to change the state of our common living system toward one that meets all human need while facilitating the generation of well-being a the individual, social, and ecological levels.
2. **System specification**
   A. A design is created to model the common system (a unified societal information system), to which the state of the living system may be changed.
3. **System prototype** (minimal to fully integrated prototype)
   A. The design is tested and reworked.
4. **System operation**
   A. The new system becomes fully operation at the population level (context dependent, integration can have a widespread affect and effect due to the rapidly real-time nature of the community's service network).
5. **System feedback**
   A. The integration of feedback for the next iteration of the system.

2.4.3 Execution [tasking] life-cycle

A.k.a., Project execution phases.

Every project is executed through a life-cycle of project phases. Every project [to develop a new system] follows the same (or similar) set of task-based execution phases. Information about changes within a project pass through these "gated" event phases, becoming more coherent and actualized over time, as tasks are performed, until the intended result is met (i.e., the new system is produced).

A project [to develop a new system] may be sub-divided into the following set of execution phases, representing the collection and integration of information relevant to the resolution of the project:

1. **Identification** - define usage of system.
   A. A need or issue is recognized.
   B. A problem and set of requirements is formulated.
2. **Design[ation]** - integrate information into a unified information system.
   A. A design is synthesized.
3. **Development[ation]** - construct the system from the unified information.
   A. Discover[ing] - analyze the situation and acquire information to design the system.
   B. Design[ing] - synthesize the design of the system.
   C. Construct[ing] and Test[ing] - construct the design and integrated into full operation.
4. **Operation** - operate and monitor the system.
   A. Use[ing].
5. **Evaluation** - assess and verify the system
   A. Survey[ing].
6. **Iteration** - update, upgrade, and replace the system
   B. Issue[ing].

Note here that the common "executive" functions include:

1. Panning.
2. Deciding.
3. Checking work.

2.5 Societal-level project execution elements

NOTE: *Projects sustain values.*

The following are axiomatic input-tasks for project development coordination:

1. **Define the system concept through imperatives and requirements**, which are attainable, definitive, quantifiable, and with specific duration and resulting conclusion. The intention of the societal project is composed of a set of imperative requirements. In engineering, the imperatives ("obligations") and proceeding requirements, define the primary problem domain.
   A. Define ("identify") the societal system.
2. **Identify the work (a.k.a., tasks, actions, events, and other activities)**, which is sub-divided into tasks following either a manual system (of input, process, and output), or they may be automated to provide a functional service, of which the societal system is itself in service to fulfillment.
3. **Sequence the tasks**, which involves the mapping of all relationships across all scheduled activities into a visual network map, allowing for effective monitoring of the project by everyone (open source).
4. **Estimate the activity costs and durations**, which allow for resource budgeting, scheduling, and decisioning.
   A. InterSystem Team work packages become available.
5. **Reconcile constraints**, including time, resource, and financial constraints, which will likely necessitate the determination of a decision.
   A. A decision protocol.
6. **Execute the tasks to design and build the system** by executing tasks required for physical and/or digital integration of the system concept.
   A. Design the information system through work packages.
   B. Construct a habitat service system through work packages.
7. **Observe and Review the results** and integrate the changes.
   A. Operate a habitat service system through work packages.

2.6 Project measurement

Measurement is a component of every project. Measurement is used to (i.e., project metrics enable a project coordinator to):

1. Assess the status of an ongoing project.
2. Track potential risks.
3. Uncover problem areas before they become 'critical'.
4. Adjust work flow or tasks.
5. Evaluate the [project team's] ability to control the quality of work products.

2.6.3.1 Process measurement and process metrics

In the context of measurement, process measurement is the efficacy of a process (often, indirectly). Process measurement provides a mechanism for objective evaluation of a process. Process metrics are the measurement's definition. Metrics must reliably and accurately measure the factors that are needed to complete some process (e.g., an objective or need, a decision). Metrics are, by definition, evidence-based, because they are a criteria, that if observed, is evidenced by marking the condition/observation event as occurring by a trusted agent. Hence, measurement (metrics) is an evidence-based method. The success of any project relies on evidence-based decisioning, data collection, evaluation, and adaptive behavior. Metrics required by standard setters (i.e., article and decision working groups) should be well-defined. For example, in terms of allowable measurement approaches, expected level of granularity, etc.), consistent, and objectively measurable.

> **NOTE:** *Frequently, the same measurements can be used for both process metrics (measurement across many projects) and project metrics (measurement upon a single project).*

Process metrics are useful for:

1. Estimation.
2. Quality control.
3. Productivity assessment.
4. Project control.
5. Tactical decisioning.
6. Coordination.

Process metrics can be derived by:

1. Measuring the characteristics of specific engineering tasks.
2. Measuring outcomes that can be derived from the process.

Potential outcomes for process measurement include, but are not limited to:

1. Measures of errors uncovered before release of the product.
2. Defects delivered to and reported by end-users.
3. Work products delivered (productivity).
4. Human effort expended.
5. Power/energy expended.
6. Material resources expended.
7. Calendar time expended.
8. Schedule conformance.

Process metrics include, but are not limited to:

1. Quality (quality-related) - focus on quality of work products and deliverables.

   A. Correctness (e.g., adherence to requirements).
   B. Maintainability (e.g., easy to fix?).
   C. Integrity (e.g., attack vulnerability).
   D. Usability (e.g., training time, number of interfaces).
2. Productivity (productivity-related) - production of work - products related to effort/energy/material expended.
   A. Value analysis (a.k.a., earned value analysis).
3. Statistical SQA data - error categorization and analysis.
   A. Severity of errors (1-5).
   B. Mean time to failure (MTTF).
   C. Mean time to repair (MTTR).
4. Defect removal efficiency - propagation of errors from process activity to activity.
   A. Defects found in this stage.
   B. This Stage + Next Stage.
5. Reuse data - the number of components produced and their degree of reusability.
   A. The number of components produced and their degree of reusability.
   B. Within a single project this can also be a “project metric”. Across projects this is a “process metric”.

2.6.3.2 Project metrics

Project metrics include all measures related to the project used to assess product/system quality on an ongoing basis, and when necessary, modify the technical approach to improve quality. Project metrics measure aspects of a single project to improve decisions taken on the project.

Project metrics include, but are not limited to:

1. Number of team members.
2. Number of external systems interfaced.
3. Number of technology objects used.
4. Number of executable functions.
5. Etc.

Project metrics are used to:

1. Minimize the development schedule by making the adjustments necessary to avoid delays and mitigate potential problems and risks.
2. Assess product quality on an ongoing basis, and when necessary, modify the technical approach to improve quality.

Every project should measure:

1. **Input metrics** (inputs, project input metrics) - measures of the resources required to do the work (e.g., materials, people, tools).
2. **Output metrics** (outputs, project output metrics) - measures of the deliverables or work products created during the engineering process.
3. **Result metrics** (results, project results metrics) - measures that indicate the effectiveness of the deliverables.

Examples of project metrics include, but are not limited to:

1. Effort/time per [engineering] task.
2. Errors uncovered per review hour.
3. Scheduled vs. actual milestone dates.
4. Changes (number) and their characteristics.
5. Distribution of effort on [engineering] tasks.

Best practices for developing and using metrics include:

1. Teams must set clear goals and metrics that will be used to achieve the goals.
2. Never use metrics to threaten individuals or teams.
3. Metrics data that indicate problem areas should not be considered “negative”. These data are merely an indicator for process improvement.
4. Do not obsess on a single metric to the exclusion of other important metrics.

Best practice for developing effective metrics:

1. Simple and computable.
2. Empirical and intuitively persuasive.
3. Consistent and objective.
4. Consistent in use of units and dimensions.
5. Programming language independent.
6. Should be actionable.

Actionable metrics - metrics that guide change or decisions about something.

1. For example:
   A. Actionable - measures the amount of human effort versus use cases completed.
      1. If result is too high: actions may include more training, more designing, etc.
      2. If result is too low: actions may include maybe the schedule can be shortened.
   B. Non-actionable - measures the number of times a word appears in a manual.

QUESTION: *What is to be done if the measured result, in comparison to the metric, is too high or too low?*

2.7 Cybernetic-type project requirements

Projects that are executed with controlled feedback, which is all socio-technical projects, must recognize, organize, and resolve project a set of [cybernetic] project requirements:

The common phase completion requirements for socio-technical projects are (note: the cycle repeats with a complete database from which to design solutions and take decisions):

1. Databases complete.
   A. Initial state visualization [of fulfillment] complete.
   B. Initial processes description [of fulfillment] complete.
   C. Objectives complete.
   D. Requirements complete.
   E. Issues complete.
2. Solution designs complete.
   A. Decision algorithms complete.
   B. Optimization calculations complete
3. Operations complete [signal sensor].
   A. Evaluations complete.
   B. Surveys complete.
4. Updated database complete [result integration and controller updating].
   A. New state visualization [of fulfillment] complete.
   B. New processes description [of fulfillment] complete.

Continuous project coordination requires the integration of a set of lists that [must be completed, and] identify and plan for work/action in the material-informational environment (i.e., in material-time, space-time):

1. Humans list.
2. Teams list.
3. Schedules list.
4. Events list.
5. Concerns/Issues list.
6. Actions/Tasks list.
7. Deliverables list.
8. Tools/Technologies list.
9. Resources list.
10. Locations list.

Note: These lists are always active during the lifetime of a project, and they are filled-in/ populated by project coordinators.

3 [Project] Coordination

NOTE: *Individuals among any society may communicate and coordinate in order to optimize their fulfillment.*

'Project management' is the market-labor term for that which, in community, is referred to (in part) as 'project coordination'. It could be said that the general purpose of project coordination (a.k.a., project management) is to control ("gate") and monitor a project's information flow(s). At the information system level, project coordination ("project management") is an information support service to other Functional-Service InterSystem Teams (composed of contributors), and the whole user-base (through open source creation). The InterSystem Teams, and also, the whole community of users, have several formalized organizational structures common to cooperative teams.

Project coordination is an iterative process. For example, the planning phase is a refinement of the initiation phase. In some instances, phases may be repeated because of changes within the project. Also, project phases may be performed simultaneously as well as sequentially. For instance, the planning, execution, and control phases may be performed in parallel as changes are made to the project baseline.

A fully coordinated societal environment one in which each action taken by each individual in a demarcated set of actions, correctly takes into account (1) the actions in fact being taken by everyone else in the set, and (2) the actions that the others might take were one's own actions to be different. To achieve equilibrium in this model, it is not enough that each subject correctly anticipates the contingent actions of everyone else. It must also be the case that each subject—using these correct understandings - chooses his or her own strategy and actions so as to maximize utility; because, it takes work (effort) to sustain a utility.

In order to sustain a unified information system where actions taken by individuals benefit themselves and others, work organization must be sub-categorized. Project coordination involves the accounting for and directing of information between multiple sets of project-related lists (i.e., categories of data that are useful for coordination purposes):

1. Project 1 (Plan-of-Work 1)
   A. Tasks (actions)
      1. ...
   B. Roles & Personnel (work descriptions)
   C. Resources (objects & data)
   D. Deliverables (services & assemblies)
      1. ...
2. Project 2
3. Project 3
4. Project ...

3.1 *Societal-level project coordination*

> **NOTE:** *At the societal level, project coordination makes the societal system more resilient (i.e., robust) by taking the needs of all the stakeholders (everyone whose human-materialized, conscious life is involved) into account.*

Fundamentally, humans participate in social-technical organizations to increase their chances of satisfying their needs through coordination.

Some common questions necessary for coordination of a project for a type of society include, but are not limited to:

1. **Who coordinates** community [into existence]?
   A. Individual humans are contributors (open, global cooperation) to the societal system
2. **What coordinates** community [into existence]?
   A. A societal decisioning system integrated within a larger societal, real-world information system.
3. **How is community** coordinated [into existence]?
   A. By enabling, and using, a societal information system (while, encoding common individual human need and common access to planetary resources).

> **NOTE:** *From a project perspective, a [living] societal system may be viewed as a problem of project selection.*

3.1.1 Project 'management' [at the societal level] is redefined as project 'coordination and control'

Community can use the discipline of 'project management' (project organization), and it does not need to adopt the market and state elements. In the literature, there are a large range of "accurate" definitions for the term, 'project management'. In its most broad definition, project management is the:

- Application of knowledge, skills (competencies), tools, and techniques (methods) to project activity objectives to meet the project requirements.

In an information-based society, the idea of project 'management' becomes replaced by project 'coordination', which is characterized by:

1. **Unified, global cooperation-based** - accounts for everything, applies everywhere, and is open to view integral in access.
2. **Objective, predictive model-based** - informed by first order real-world abstractions, and not second order abstractions.
3. **Algorithmically, encoded instruction-based (controls-based)** - logical variability, and adapted from previously taken decisions.

Simply, in community, people are not "managed" as they are not coerced or awarded by an authority to work, but are working because they are self-motivated to participate in the development and operation of society as a contributor. Project management is a career profession in the market.

> **NOTE:** *What 'management' does can include secret decisioning. Whereas, the concept of 'coordination' does not carry that association, and instead, carries the association of shared relationships.*

Market-labor parlance terms for project-related coordination include:

1. **Project management (PM)** – "The application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. The role applies to any project or program personnel applying the knowledge, skills, tools, and techniques to project activities to meet the project (not product) requirements" (ANSI and PMI 2008, 6). This term will apply to those project managers, program managers, systems engineering managers (SEM), systems engineers that perform the role-specified activities regardless of their associated discipline. It applies to all disciplines such as finance, contracts, supply chain, quality, and engineering managers.
   A. In community, this is project coordination.
2. **Program [manager]** – "A group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually" (ANSI and PMI 2008, 9). 1209 Project – "A temporary endeavour undertaken to create a unique product, service or result" (ANSI and PMI 2008, 5).
   A. In community, these are service systems, the largest of which is the Habitat Service System (e.g., life-support, energy, water, etc.).

> **CLARIFICATION:** *The PMI defines '***program management'** *(a sub-discipline to project management) as, a group of related projects managed in a coordinated way to secure benefits and control which could not be achieved individually. A program coordinator would thus "manage" a portfolio of projects, whereas a project coordinator would "manage" one project. (PMI 2016; ANSI Prince 2; ISO 21504:2015).*

3. **Project Management Body of Knowledge (PMBoK)** – the knowledge of how and why to "manage" a project as produced by the Project Management Institute (PMI).

   A. In community, this the social knowledge-base within the unified information system.
4. **Project manager (PM)** - a person named to manage the complete project, which includes product and system oversight as a subset of the overarching responsibility, authority, and accountability demanded of a project manager. A project manager is the person accountable for accomplishing the stated project objectives. The term will also be inclusive of the term program manager for this paper.
   A. In community, this is the project coordinator; the project coordinating entity.

The Lifestyle System Specification describes in greater detail how there is not the market-labor profession of "management" in community. Simply, in community, people are not "managed" (as in, not coerced or awarded by) an authority to work as part of an InterSystem [Projects] Team, but are working because they are self-motivated to develop themselves as well as participate in the development and operation of society as a contributor.

In the Community, people are not managed and the interrelationships between people do not have to be managed because everyone is arriving at the same or similar decisions about the system and they recognize their responsibilities both to themselves and to the community. And that those responsibilities to the community are also responsibilities that support themselves and their lifestyle. Not because they are robots, but because they have the same knowledge about the system and a similar set of understandings, values, purpose and approaches to the empirical and life-grounded system that maintains the community.

In an information-based society, the idea of project 'management' becomes replaced by project 'coordination', which is characterized by:

1. **Unified, global cooperation-based** - accounts for everything, applies everywhere, and is open to view integral in access.
2. **Objective, predictive model-based** - informed by first order real-world abstractions, and not second order abstractions.
3. **Algorithmically, encoded instruction-based** - logical variability, and adapted from previously taken decisions.

In the context of logistics (Read: the optimal, logical movement of objects), coordination refers to efforts (Read: the execution of supra-tasks and supra-information processes required) to be in the right place (location) at the right time (temporal) to execute a task as planned; thus, moving an object to its intended destination, optimally.

In an information system, the idea of project "management" is replaced, in part (i.e., the human subjective-management part is replaced), by objectively informed and processed project information. In an information system context, think of project management as an pre-programmed, open source, algorithmic coordinator of information relevant to a project, which processes project-level information in order to achieve all of the project goals and objectives, while remaining in the bounds of constraints.

A project coordinator actively and passively monitors a projects information sets to actively ensure that the solution inquiry (a.k.a., system development lifecycle, engineering development) delivers an optimal and organizationally/societally acceptable solution (through parallel decision inquiry processes).

> **INSIGHT:** *A project, in the market sense, is something that creates "value" for someone. A project could also be viewed as a structure for resolving a greater state-dynamic of fulfillment (i.e., resolving problems with fulfillment).*

Additionally, this coordinator monitors and controls the flow of project-level information. The term project "management" (and "manager") is a misnomer, because instead of the creation of something being the work of management (power-over-other relationships), it is a collaborative effort to bring something new into existence, or maintain the iterative operation of an existent system.

Within the context of a project, there is a need for coordination, which requires intrinsic motivation among the workers, who are voluntary contributors, and not laborers for anyone other than themselves, as users of the service systems they are "co-creating". Among community, there is no need for external reward and punishment, and hence, need for the management of other humans.

That framework which is applied to ensure the successful resolution of a project space is more akin to a coordinator, rather than a manager. A coordinator can still maintain control functions, as managers do, but the term is socially agnostic, whereas the idea of 'management' arises out of an authority-based, transactional set of social relationships.

3.2 Communication coordination

Coordination necessitates precise and accurate communication. Communication, in general, necessitates asking and answering the following five questions; these questions are are essential for coordinators and good practice for all communicators:

1. What do I need to communicate?
2. To whom do I need to communicate?
3. When do I need to communicate?
4. What method is most appropriate for the communication?

3.3 Technical coordination

A.k.a., Unified potential for movement.

Depending on the context of its application, the concept of 'coordination' has several related meanings.

Coordination is the ability:

1. To combine several distinct [informational/physical] patterns into a singular movement, with efficiency [in input usage] and effectiveness [in output delivery].
2. To integrate all the components of fitness so that effective movements are achieved.
3. To unify movements into a coherent and optimally effective pattern of movement.
4. To engineer/develop and apply/operate patterns of [information] movement efficiently, effectively integrating visual information for a purpose [vector].
5. Of system entities (i.e., actors or patterns) to interact beneficially for a higher-order system purpose/function.
6. To optimize the direction and sharing of information and materials.

Simply, coordination is the combined sub-abilities that allow people and/or systems to work together [efficiently and effectively for a common purpose]. Generally speaking, coordination is a global systems ability, made up of several synergistic elements and not necessarily a singularly defined ability. Decisioning, [spatial] orientation, and the ability to organize an effective and efficient pattern of reaction to real world stimulus are core elements of coordination.

> **QUESTION:** *How well are we coordinating information and resources so that people have what they need, where they need it, when they need it?*

Society requires a coordinating structure to support a contribution-based platform. Societal coordination can be broken down into two high-level components (or component systems):

1. **Social-project coordination.**
2. **Technical-engineering coordination.**

And also, one low-level component (or component system):

- **Socio-technical tasks** *(Note: Both social-project coordination and technical-engineering coordination have associated socio-technical tasks)*

As a structure for the flow of information, coordination is an organizational relationship among entities/actors, which may become more or less coordinated over time (due to various internal and/or external factors). Coordination becomes optimized through cooperation (in computation, 'cooperation' effectively means, simultaneous and purposeful operations).

> **CLARIFICATION:** *At a societal-level, project coordination refers to organizing, planning, initializing (execution done by teams), monitoring, evaluating, and deciding multiple societal-project inquiry tasks simultaneously. More simply, coordination refers to organizing and planning multiple tasks simultaneously.*

Coordination requires commonality, a similarity, or pattern with a purpose, otherwise there is less, or not, coordination (i.e., less of an ability to move together). For example, in the context of a project, everyone involved in the project uses ("follows") and informs the same, single, unified project plan, as part of a larger and more unified societal/organizational information system.

> **INSIGHT:** *The idea of coordination is not theoretical; it's application to society, as an information system, will likely change (update) the language of the individuals therein, their comprehension of the real-word, and their ability to create safely together, in the real world.*

In concern to the idea of project management, herein, "management" is a misnomer for coordination and organizational/societal-level decisioning. Instead of a project manager, there is the element of an information system and the coordination of information therein via a project coordinator [that coordinates the flows of information during a project's societal/organizational life-cycle].

> **INSIGHT:** *Coordination is the ability of a system to orient in an environment so that it aligns more closely with a given direction as iteration/motion occurs. And there, a system requires the ability of sub-systems to work together to re-orient its own internally motive system toward a direction of system fulfillment; because the system has a purpose. In concern to system resources, coordination ("management") may be simplistically defined as having and doing what is required/necessary to achieve the greatest access to, and get the most usage out of available resources.*

3.3.1 Monitoring phase - Project quality review

The purpose of quality reviews is to assure that the established systems development and project coordination processes and procedures are being followed effectively, and that exposures and risks to the current project plan are identified and addressed. Quality reviews facilitate the early detection of problems that could affect the availability, reliability, integrity, maintainability, safety, security, or usability of the system or product. Quality reviews enhance the quality of the end work products and deliverables of a project.

All deliverables (work products) are subject to quality review.

> **NOTE:** *In a societal decision process, the Effectiveness Inquiry is continuous, and is part of the quality review process.*

3.3.1.1 Peer review

A peer review is an informal review of systems, including documentation, which can be conducted at any time. These informal reviews are performed by the developer's "peers" -- frequently other developers working on the same project. Informal reviews can be held with relatively little preparation and follow up activity. Review data are collected and the developer determines which data require future action. Some of the work products prepared are considered interim work products as they feed into a major deliverable or into another stage.

3.3.1.2 Structured walk-through

A structured walk-through technique (SWT) is a more formal review and is prescribed by the engineering for all project deliverables. SWTs are used to find and remove errors from work products early and efficiently, and to develop a better understanding of defects that might be prevented. They are very effective in identifying design flaws, errors in analysis or requirements definition, and validating the accuracy and completeness of deliverable work products.

SWTs are conducted during all stages of the project life-cycle. They are used during the development of work products identified as deliverables for each stage, such as requirements, specifications, design, code, test cases (scripts), and documentation. SWTs are used after the work products have been completed to verify the correctness and the quality of the finished product. They should be scheduled in the work breakdown structure developed for the project plan, where, in practice, they are sometimes referred to generically as reviews. SWTs should also be scheduled to review small, meaningful pieces of work. The progress made in each life-cycle stage should determine the frequency of the walkthroughs; however, they may be conducted multiple times on a work product to ensure that it is free of defects.

SWTs can be conducted at various times in the development process, in various formats, with various levels of formality, and with different types of participants. They typically require some advance planning activities, a formal procedure for collecting comments, specific roles and responsibilities for participants, and have prescribed follow-up action and reporting procedures. Frequently reviewers include people outside of the developer's immediate peer group.

3.3.1.3 Exit review

A.k.a., Stage exit review.

The exit review is a process for ensuring a project meets the project standards and milestones identified in the project plan. The exit review is conducted by the project coordinator with the project stakeholders. It is a high-level evaluation of all work products developed in a life-cycle stage. It is assumed that each deliverable has undergone several peer reviews and/or SWTs as appropriate prior to the stage exit review process. The exit review focuses on the satisfaction of all requirements for the stage of the life-cycle, rather than the specific content of each deliverable.

The goal of a exit review is to secure the approval (verification) of designated key individuals to continue with the project and to move forward into the next life-cycle stage. The approval is a "sign-off" of the deliverables for the current stage of development including the updated project plan. It indicates that all qualifications (issues and concerns) have been closed or have an acceptable plan for resolution.

Generally, at a during stage review, the project coordinator communicates the positions of the key personnel, along with qualifications raised during the stage exit process, and the action plan for resolution to the project team, stakeholders, and other interested participants. The stage exit review is documented. Only one stage review for each stage should be necessary to obtain verification ("sign off") assuming all deliverables have been accepted as identified in the project plan.

3.3.2 Alignment and control variables

Alignment is the principal sub-coordination process. Alignment means the ability to adjust the position and/or orientation (Read: alignment) of some directed thing in motion (or iteration).

> **INSIGHT:** *The principles of coherency (or consistency) and alignment (degree of logical relationship of the one to the unified) are required for optimizing coordination.*

Alignability requires control. Some controls can be automated, given what is known and available.

3.3.2.1 For example, project control variables

The following are some of the variables that can be adjusted for any project:

Standard control variables for a project include:

1. Scope.
2. Time.
3. Resources.
4. Cost (market-only).
5. Jurisdictional (State-only).

Complementary control variables (control variables that are particularly salient in undefined projects):

1. Transparency.
2. Inspection.
3. Adaptation.

3.3.2.1 Alignment in cybernetic second-order systems

Alignment is a second-order cybernetic systems control function. Alignment requires the integration of feedback into a control system to determine the current value, and correct for the error, to an objective trajectory. By collecting and collating measurement data (i.e. observing the speedometer and the clock), the driver (the controller) can calculate at any point in time how fast the vehicular system should drive in order to achieve the defined goal [of getting to a location an a specified time]. Or, in the case of the habitat service system, by surveying human [need] requirements, the unified information system project coordinator (the controller, the project information processing unit) can calculate at any point in time how many human services must be produced, and in what time-frame, in order to meet a defined human fulfillment-requirement objective.

3.3.3 Coordination decisions

A.k.a., Coordination decision points.

A unified information system must coordinate between multiple information sets to ensure the fulfillment of the whole population of the society. The following are some common coordination decision points, expressed in the form of decision deliverables:

1. **Decision control coordination** - decide, accept, and approve the inclusion of people and final-decisions for execution.
2. **Decision analysis coordination** - decide the current model of the situation; decide the decision variables; decide the method of optimization.
3. **Technical planning coordination** - decide the scheduling; decide how to track; decide resource and system allocations.
4. **Technical assessment coordination**- decide how to track, measure, and assess metrics (for metrics collection).
5. **Requirements coordination** - decide requirements and decide mode of bi-directional traceability flow tracking.
6. **Risk coordination** - decide how to identifying and mitigate risks.
7. **Technical data coordination** - decide data structure; decide logging, decide data access, data storage, data control, data use; decide formal documentation interface.
8. **System/product coordination** - decide functional, physical, and non-functional, and FAIT (SAITL) specification, provide traceability.
9. **Service coordination** - decide the protocols by which a service operates.
10. **Implementation coordination** - decide the prototype model, simulation model, and testing model.
11. **Verification coordination** - decide the testing and evaluation model.
12. **Validation coordination** - decide how the end user will validate that the end-user's need(s) are met (with no further issues).

3.4 Project situational analysis

Coordination is not possible, at least not optimally, without a persistence of data being analyzed about the project's internal and external situation (i.e., issues with the project or environment as related to the project).

In order to sufficiently form a situation space the following questions must be answered:

1. What is the problem?
2. What causes the problem?
3. Who is affected by the problem?
4. Who cares about (is affected by) whether or not this problem is solved?
5. What are the priorities?
6. How will existing decisioning, research and experience, solve the problem?

> **NOTE:** *If the 'problem' is not recognized, then the situation where an information resolution determination is required is not recognized.*

More generally, project situation analyses involve the following information sets:

1. **Participant analysis** - *who* is involved in the project's situation ("stakeholder/user analysis", person tree, "whose").
   A. Here, there is are people (users, humans).
   B. Here, there are technical systems (users, machines).
2. **Problem analysis** - *what* is problem of situation (problem tree, "ends").
   A. Here, there is an issue with some system from a person and/or some technical system (problem tree, root cause analysis, "cause"). Define the problem. Identify the needs.
3. **Objectives analysis** - *what* are objectives for situation (objective tree, "means")
   A. Here, there is also an outcome tree depicting a change in condition that benefits the user

(target group). Define the objectives. Define achievement for each objective, for purposes of measurement.

4. **Solution analysis** - *what* are alternative solutions for situation (solution tree).
   A. Here, there is a solution analysis at a societal level with societal-level inquiry decision processes.
   B. Here there is a solution analysis at a technical level with technical-level inquiry decision processes.

3.4.1 Assessment

A.k.a., Project evaluation, project analysis, situational analysis, situational assessment, situational report (sitrep).

An assessment is an analysis of a situation in order to acquire additional information in order to inform decisioning. In order to take informed decisions, often, a number of analysis activities are required to be carried out. The analysis data are not an end in themselves, but are used to inform (input into) decisioning.

There are many types of assessments. A conditional assessment (e.g., risk, impact assessment) is an objective analysis (i.e., review) of one or more conditions (e.g., risk) applied to a system, concluding with a determination of the probability or likelihood of the condition being true. However, not all assessments conclude with a probability. For example, a gap assessment analyzes what may be missing from a solution, given what is currently present in the solution (i.e., where are the gaps in the solution?).

An assessment process needs to include details on,

1. How will the project's result be assessed (i.e., what is success; what is the criteria?)
2. What are the difficulties and risks in the project and its final assessment of success?

3.5 The project coordinator

A **project coordinator** is an information processing unit (agent) that coordinates the flow of all project related information.

Project coordinator activities (functions/operations) include:

1. **Identify** project requirements.
2. **Define** clear and [probably] achievable objectives.
3. **Combine (integrate)** the knowledge areas into processes (process groups).
4. **Update/adapt** the specifications, plans, and approaches to users requirements.

A project coordinator integrates (combines) the three constraints (a.k.a., triple constraints) that are present in every project:

1. **Scope** (objective).
   A. **Quality** (condition/value).
2. **Resource** (materials; a.k.a., "budget").
3. **Schedule** (time).

Each constraint constrains the other and is in turn constrained by the other two. Planned projects can be impacted by impacting these variables. All change requests to the values of these variables must go through a formal change request procedure and form.

The 'scope' is the foundation of what is being developed [by a project] through resources and time. Herein, 'scope' is Project coordination carried out by a project coordinator, like a project managing project manager, necessitates the following information system elements:

1. **Documentation(s)** - Project documentation interprets the awareness of a project in the unified information system. To record existence and change within existence.
2. **Surveys(s)** - Project positioning in the information system and transparency with information system resources. Project positioning occurs through surveys, which also provide data for situational analyses. First, there must be known that some "thing" (what) exists.
3. **Integration(s)** - Project integration identifies and integrates the project's imperatives, in relationship to the determined method for their successful completion. There are memory structures, information processes, and the software tools for integration.
   A. To combine available information into a more completely view of what is:
      1. Occurring in the project.
      2. Planned to occur in the project .
4. **Evaluations(s)** - Project evaluations (sometimes "administrations") follows the operational progress of the project and reports on its progress; analysis highlight discrepancies, risks, while protocols issues alerts and requests decisions.
   A. To observe if there is an error between the environmental value and the required value.
5. **Decision(s)** - Project decisioning involves coordinating the resolution of the project space among the common constraints of quality, function, deployment, time, and resources.
   A. To decide the flow of information by "gating" activities within the life-cycle, closing them when they meet completion requirements. Here, "gating" refers to decisions as to whether (Read:

how) information does or does not flow [due to the completion of requirements for a given activity].

6. Plan(s) - Project plans involve ta visualization of the coordinated project resolution space (e.g., the Habitat Service System plans).
   A. To decide prior in time how information will flow. The result is a set structure for the flow information, known as a life-cycle [for the flow of integrating information].
7. **Monitor(s)** - Project monitoring involves the opening of a real-time or recorded visualization of a process in order to maintain transparency and ensure the process was completed as planned (as the rules for the gate were followed).
   A. To provide analytics [through a "dashboard" interface] to those who require calculated data for decisions to be taken concerning a project.
8. **Interface(s)** - Project interfacing refers to the visual interface users have into the project [information space], including the view the interface has into the unified information system, and its visualized and "dashboard" configuration.
   A. To provide a transparent interface into the whole project information space, to all users.

Project plans are organized by a project coordinator. The following is an example organization of project-related plans (Lewis, 2016):

1. Overview *of project.*
2. Definitions *applied in project.*
3. Project organization.
   A. Method of organization.
   B. Internal interface.
   C. External interface.
   D. Roles and responsibilities (accountabilities).
4. Coordinator process plans.
   A. Estimation (schedule, cost).
   B. Work (activities, resources, budget).
   C. Control (quality, metrics).
   D. Risk.
5. Technical [generative] process plans.
   A. Process model.
   B. Methods, tools.
   C. Acceptance plan (decision plan).
6. Analytical process plans.
   A. Configuration coordination (past and probabilistic future configurations).
   B. Verification/validation (of requirements).
   C. Quality assurance (reviews, audits).
   D. Subcontracts.
   E. Process improvement plan.

A common project planning coordination outline is:

1. Project coordination.
   A. Title and approval sheet.
   B. Table of contents.
   C. Distribution list.
   D. Project/task organization.
   E. Problem identification/background.
   F. Project/task description.
   G. Quality objectives and criteria.
   H. Special training/certification.
   I. Documentation and records.
2. Data generation and acquisition.
   A. Sampling design.
   B. Sampling methods.
   C. Sample handling and traceability-accountability requirements.
   D. Analytical methods.
   E. Quality control.
   F. Instrument/equipment fabrication.
   G. Instrument/equipment testing, inspection, and maintenance.
   H. Instrument/equipment calibration and frequency.
   I. Instrument/acceptance requirements for supplies.
   J. Non-direct measurements.
   K. Data storage and coordination.
3. Assessment and oversight.
   A. Assessment and response action.
   B. Reports and roles.
4. Data validation and usability.
   A. Data review, validation and verification.
   B. Verification and validation methods.
   C. Reconciliation with user requirements.

4 [Project] Planning

A.k.a., Planning, system planning, adaptive planning, dynamic planning.

Having a 'project' is a pre-requisite for planning. Projects involve the process of planning under the condition of uncertainty; they require coordination. In a typical project lifecycle, planning occurs in between project initiation and project execution. Project planning applies to all projects regardless of their size. Planning concerns the processes associated with pre-execution inquiries, integrations, and decisions within some predictively-probabilistic environment.

INSIGHT: *Community is a continuous plan. Continuous planning assumes that the system can continually be improved.*

In general application, there is a project-level plan, and then, there are more detailed and progressively elaborated plans for each phase level. Plans are more like snapshots of a desired change or development, instead of static blueprints, and their focus is more on temporality and movement than on the long-term configuration of an emergent structure. Simply, a 'plan' is a course of action (i.e., a model of actions). A plan is a mechanism or set of techniques to guide the activity of economic [socio-technical] decisioning through time toward the achievement of specific goals. A plan is a list of instructions to be executed/performed. A plan is a process with an input, process, output; whereupon, something does work until the output is out/delivered, and the whole thing is then evaluated.

A plan is a socio-technical, action-oriented integration of information:

1. A social-plan is a unified model of action that allows cooperation to work.
2. A technical-plan is the information required to do or build something with complexity.

In application, planning is the unified information processes of:

1. Organizing [of information].
2. Analytical-synthesis [of information].
3. Predicting/estimating (probability value, meta-value) .
4. Tasking (task value, numerical hierarchy of work breakdown, WBS).
5. Scheduling (temporal value with all relevant-associated project information).

Strategic planning is preparing in advance to respond flexibly and transparently to a range of possible eventualities. Planning is deciding (preparing), in advance, what to do, how to do it, when to do it, where to do it, and who is going to do it. Therefore, panning determines:

1. What is going to be done?
2. How is it going to be done?
3. When will it be done?
4. How flexibly can it be done (i.e., production cycle flexibility)?
5. With whom and what will it be done?
6. How will it be known that it is done?

Planning is a precise information processing and task coordination tool. Planning is essential to every project, regardless of the size of the project. The result of all planning is a deliverable, a plan [of action/execution] that is then, executed (and modified, as required). As a plan's execution progresses, more information becomes available, and therein, feedback loops may modify the plan.

The amount of detail required to plan varies according to the needs of a given project. Planning is a repeatable supra-process, which is involved in multiple other processes. The project approach processes information into a high-level usable format.

When planning is conducted in a systematic and precise manner, then execution of effort toward a goal(s) has a greater potential of being optimal, adaptive, effective, and efficient (i.e., execution becomes easier). Without a complete and comprehensive plan, it is difficult to execute and coordinate optimally, or even coordinate at all.

Using a travel analogy, 'planning' is the aligning of an intentional direction with potential action, to explain how to arrive at an intended destination, and what the experience of the intended destination will be, prior to executing the movement toward the intended destination.

Simply, planning is:

1. The word for doing project tasks with documentation.
2. The systematic preparation for action in the [temporal] future (i.e., some future iteration).
3. Deciding about the future "course of" [materialized] action (i.e., some spatial motion).
4. Thus, inherent in all activity (individual or collective), because all activity happens in time-space (i.e., materializing time).
5. Within a community-type society, habitat service systems provide an aggregated framework for the planning of the material [experience] system. There is a reason the material system, and life experience therein, is the way it is.

To plan is to decide ahead of time, to envision, everything about some desired state/output, and what is required to achieve [as checked off criteria] the desired output. Every plan has a predefined goal (or objective). Once there is a goal (or direction), then a plan(s) can be developed (configured, and selected) to achieve the goal and arrive at the objective. Therein, planning is itself, sub-composed of well-defined objectives. Planning is an information process that happens in the context of goals. A plan defines and explains what is needed, and is to executed as an operation, over some period of time

It is relevant to note that a plan can be deviated from. For any team-based plan, there are acceptable and unacceptable divergences off of [alignment of] a plan. For any team-based action, an objective approach is necessary to re-align [and restore] unacceptable divergences from a planned trajectory.

If "to plan" is to decide ahead of time, then "to use an algorithm" is to automate decisioning. If a plan may be coordinated into materialization, then coordination is, in part, the ability to synchronize project information for sequential execution, ahead of time.

In the real world (because of temporal-spatial existence), planning is required for:

- Optimum utilization of resources.

A '**resource**' is any "thing" that may be used in a project. Time, energy and material resources are the minimum. In a community type society, no human is considered a resource for other human; technically, there are no "human resources" as humans are not managed in the hierarchical and authoritarian sense.

The first project integration is planning:

- When time and task become available, planning becomes available.

The requirements identified in project related materials, (e.g., a scope of work, concept of operation). The level of detail will vary depending on project type and size.

The overall planning process can be sub-defined by a linked set of inquiry-deliverables:

Definition of what is to be *the activity:*

1. *What* activities are need (**processes**).
   A. Inquiry: what.
   B. Deliverable: tasks.
2. *Why* are they needed (knowledge and values).
   A. Inquiry: why.
   B. Deliverable: knowledge and values.
3. *How* they are to be performed (**information logic and scientific knowledge**).
   A. Inquiry: how.
   B. Deliverable:
      1. Information processing logic (what function).
      2. Scientific knowledge (what models of useful prediction).

Location of what is to be *the activity*:

1. *When* will the activity be executed (**time**).
   A. Inquiry: when.
   B. Deliverable: temporal information system (Read: schedule).
2. *Where* will the activity be executed (**space**).
   A. Inquiry: where.
   B. Deliverable: graphical information system (Read: GIS).
3. *How much* [resources] are required to be executed (**technical solution design inquiry**).
   A. Inquiry: how much.
   B. Deliverable: technical solution resource flow simulation (and data and logical processing model).
4. *How/what quality* [condition] will the activity be executed (condition-quality solution design inquiry).
   A. Inquiry: how/what quality.
   B. Deliverable: quality-function-deployment (QFD) combinatorial [decision to selection] synthesis.

> **INSIGHT:** *Planning work allows for a sensible society.*

4.1 Environmental surveying

> *A.k.a., Project surveying, environmental surveying of humans and resources.*

Surveying, which feeds into detailed planning directly returns information on what is required (what is the direction and what is accessible -- must have global cooperation as pre-requisite). Note that in the commercial market, a survey is not a direct input; it returns information on price (i.e., the price people are willing to pay in the market). The surveying specified here is primary abstraction surveying (i.e., categorized objective data) and not a survey of secondary order abstraction (i.e., categorized subjective-price data). Surveying feeds objective data into detailed planning (directly) by returning information on what is required.

In the market, a survey is not a direct input; it returns information on price (i.e., the price people are willing to pay in the market).

> **INSIGHT:** *We have to keep track of what is about to happen so we can prepare, and we have to keep track of what has happened because an important part of what we are going to do next is in consideration through what we have just done. The past and the future flow into one another by keeping track of data and integrating it.*

5 [Project] Planning a plan of action

All projects contain one or more plans. A 'project plan' (a.k.a., plan-of-action) organizes and integrates every single bit of information (Read: "all details") that there is with any relevance to a project, combining them to produce information that can be taken action upon. A project plan is the data set integration of situationally relevant information required for the coordinated (as in, allowing for optimality) resolution of a societal, technical problem through action. The design and operation of any [complex] system is approached optimally through project organization, the who integration of which, becomes, a project [access] plan (i.e., a plan for deciding, coordinating, and resolving access to a real-world, socio-economic system). Plans exist to be executed. Herein, a plan is an information model (specification or work package) with the following characteristics:

1. Visually documented.
2. Executable through tasks, which have objective functions separated out at a high level into phases.
3. Related through integration modeling of all objects and processes (and states, stages, or phases).

In general, project plans have at least the following three characteristics:

1. The project ["management" or coordination] plan is an information system that contains all project related (subsidiary) plans (PMBoK 2018).
2. A project plan is an adaptive, iterative information system that gets updated every time something new is learned or otherwise discovered about the project.
3. A project ["management"] plan is a complete/final aggregation of complete planning (control and monitoring) done for a project.

A plan involves the information processes of:

1. **Understanding (knowing)** the meaning of objectives.
2. **Identifying (collecting)** assets.
3. **Analysing (thinking)** the consequences and risks.
4. **Establishing (thinking)** project performance and solution requirements.
5. **Designing (thinking)** a project solution. A **plan** is the result of thinking about the problem and the solution.
6. **Producing (doing)** a project solution.
7. **Delivering (giving)** a project solution.

A project plan is the sole formalized document, repository, interface, tool for project organization, execution and control.

1. The project plan describes and communicates the status (i.e., state) of the project to everyone concerned. As an information repository (or reference-base_, a project plan represents the formal database for all project related content. A project plan facilitates communication and optimizes effort expenditure between participating humans and technical systems.
2. A project plan documents the solution to a degree that the team can produce and deploy the solution effectively. A project plan is formalized in order to ensure coherent communication of the state of a project, which is necessary for complete and efficient project execution.
3. A project plan acts as a project's information control tool; it is the master planning and coordination referent for the project. Herein, 'project control' is the analytical process of comparing the real world progress with the scheduled/planned progress.
4. The project plan must correctly and accurately define the output as best as possible given what is known.

A plan is the result/deliverable of the planning process. In general, a plan is a represented determination of what tasks must be done, and which tasks precede others in order to accomplish some effort, work or created result. Plans focus and coordinate all effort. Simply, a plan is the "step-by-step" proceedings of a sequence of actions (tasks) to achieve a stated goal. A plan is analogous to a map; it maps out a "step-by-step" progression to completion of the some intention (objective, vision, etc.). The primary function of a plan, given a social organization, is to coordinate [social] effort.

More simply, a plan is a directional information set that everyone can see and point to, and say, "look here, this is what we are building, and this is when and how and with what we are building it (given that the language is understood)".

> **INSIGHT:** *If you don't make a plan then someone else is libel to make one for you.*

Effective plans cover all aspects of a project, giving everyone involved a common understanding of the information space and the work ahead. Plans must be kept up-to-date to be continually useful (i.e., they are a "living" information set).

A project plan if often considered a "visionary" piece of information (i.e., a visionary document), because it defines the vision and how the vision is to be achieved. A vision or goal is an end state (a description of). The project plan provides the [required] vision, as well as, how to realize the [complete] vision. The project plan allows participants to observe and control the flow of information through a project, from initial questions, to requirements definitions, to functional designs, and finally through to unit, interface, system, and user acceptance testing (or any similar integration lifecycle flow).

Summarily, a project plan defines the information elements of a solution in detail:

1. What is required?
2. How is it required?
3. Who requires it?
4. Who will build it?
5. When will it be built?
6. Where will it be built?
7. With what will it be built?
8. How will its building affect previous buildings?

In other words, a project plan of any level should be able to answer the four basic project questions:

1. **What?** What is the desired outputs/deliverables for the project? What work needs to be done in order to achieve these outputs?
2. **Why?** Why is the project being undertaken? What is it trying to resolve?
3. **Who?** Who are the team members working on the project? What does each individual do while on the project?
4. **How?** How will the project be completed? What activities must be completed, and in what order?

A project plan should [be designed to] visualize to everyone involved [in the project] the following information sets:

1. *Why* the project is being undertaken. The project plan includes the *why*, the reasoned imperative.
2. *What* will the project produce (i.e., the destination state of the habitat). The project plan includes the what, the described vision (or mission) as an information flow into a set of goals and objectives, which flow into a set of [engineering] requirements. Note, the execution of the project develops the specification, its construction, and potentially, its operation.
3. *How* and *when* will the project produce its intended result (i.e., the path to the destination). The project plan includes the *how* and *when* a project's objectives are to be achieved, by showing (in part) the deliverables, activities, resources, and schedule.

5.1 [Plan] Action structured view

MAXIM: *If you fail to plan, then you are planning to fail.*

In general, a complete project plan will include (most of) the following project content categories:

1. **The imperatives** - Goal-orientation, solution-orientation, problem-based orientation, a direction of orientation. An imperative (objective) is a stated intention of direction (or, direction of intention). The objective may be a mission, a vision, a goal, an end product, etc.)
2. **The approach** - the type of logic (or, not logic) to be applied to the flow of information.
3. **The work** - task information integration (task-based information "work" packages).
4. **The schedule** - time information integration.
5. **The tools and techniques** to be employed - procedural information.
6. **The people** - human InterSystem accountability.
7. **The resources** - common materiality.
8. **The risks** - the probability of harmful [human and ecological] consequence in materiality.

Table 2. Project Approach > Plan of Action: *Planning concepts and their alignment to core project instantiating elements.*

Plan concepts	Alignment to core instantiating elements
Requirement	Need, Value, User
Design	Solution, Need, Context
Plan	Change Solution, Context, User
Risk	Change, Value (reduced)
Benefit	Change, Value (increased), User, Context

5.2 [Plan] Action executable view

In order for a project to arrive at completion, it must integrate several information sets. The complete integration of these information sets is known as a life-cycle - it is the computation to completion of information given what is desired and what is known.

From an action/work coordination view, there are five information sets (or phases) to any given project (this is a recursive list, because 'execution' is a phase itself and part of every other phase):

1. **Breakdown work into tasks:**
   A. A task is another name for a processes with an input and an output.
2. **Identify resources:**
   A. The composition of the input, process, and output.
3. **Identify dependencies:**
   A. Tasks relate in requirements, input, process, and output; their relationships can be visualized through a database matrix.
4. **Schedule time and resource access:**
   A. The time and resource variables are added to determine temporal-location execution, and eventual completion.
5. **Execute:**

A. Tasks are executed as actions/activities at the scheduled time and with the allocated resources. After evaluation, execution is the modifying of tasks.

6. **Evaluate:**
   A. Was the task executed correctly and did it have the intended impact or result.

Herein, the execution of an action has four principal project phases (note that this is a recursive process, and each phase also contains actions; for example, the identification of an activity to take action on requires actions itself):

1. *Identification* of activity.
2. *Preparation* of activity.
3. *Activity* action.
4. *Evaluation* of activity/action completion.

5.2.1 Simplified view of the project action life cycle

A simplified project action life-cycle involves detailed elaboration upon the following phases:

1. **Plan** - plan what needs to be done.
2. **Act** - take action to collect everything that is required for what need to be done.
3. **Do** - do what needs to be done.
4. **Check** - check to make sure what needed to be done has been done.

> **NOTE:** *This life-cycle is sometimes written as: (1) Plan, (2) Do, (3) Act, (4) Check. [the9000store.com]*

5.3 [Plan] Action decisioning tools

The following are information synthesis tools that have application in determining optimal planning decisions:

1. **Category diagram (identification)** - categorize as similar to an entity, such as group or label (entities as shapes but no relationships as lines)
   A. Affinity diagram - generate and group ideas.
2. **Relationship diagram (elaboration)** - categorize as entities with relationships (entities as shapes and relationships as lines)
   A. Activity decision program chart - identify potential problems and contingency measures.
   B. Activity network diagram - identify optimal path and schedule to complete work.
   C. Relationships diagram (interrelationship diagram) - map cause and effect links between items, events or tasks.
   D. **Tree diagram** - map tasks to achieve a goal in increasing detail. High level information is de-composed into lower-level information. An organization chart is an example. It graphically breaks down complex processes into smaller level details.
      1. An issue is known or being addressed in broad generalities and requires specific details.
      2. Developing actions to carry out a solution.
      3. Analysing processes in detail.
      4. To determine the root cause of a problem.
      5. To evaluate implementation issues for several potential solutions.
      6. After affinity diagram or relations diagram has uncovered an issue.
      7. As a communications tool to explain information to others.
3. **Combination diagram (comparison)**
   A. **Matrix diagram** - identify, analyze, and rate relationships between two or more sets of information. Shows the relationship between two, three, or more groups of information. Its completion will give information about the relationship (e.g., no, weak, strong, ...). Graphically establishes relationship between two or more sets of items in such a way as to provide logical connection points between each item.
      1. L-shape matrix diagram.
      2. T-shape matrix.
      3. Y-shape matrix.
      4. C-shape matrix [3D model, cube].
      5. X-shape matrix.
      6. Roof-shaped matrix (used with a L- or T-shape matrix, roof used with QFD) .
   B. **Prioritization matrix** - narrow down options by comparing them against criteria.

> **NOTE:** *Lines indicate links and lines with arrows represent a direction of [information flow in a] relationship.*

5.3.1 Quality function deployment (QFD) tool

A.k.a., Production relationship matrix for evaluation/assessment decisioning

The **quality-function-deployment (QFD) method (matrix)** is a method of combing the articulations of a users needs and expectations, while effectively accounting for the users by understanding their requirements, and then, developing engineering specifications to fulfill their requirements in an executed environment. The QFD method is used, in part, to determine optimal paths (synthesize a selectionable, optimal decision, given what is known). The QFD is a systematic method of translating the requirements of users into both the design and service (production & operation) process. QFD is a visual-logic (calculation) tool for ensuring user requirements are accurately translated into relevant technical specifications (from asset definition to asset design to process development and finally to asset-process implementation).

> **INSIGHT:** *Every organization has users (in the market, customers).*

Quality-function-deployment is used to translate user requirements into measurable design targets, and derive them down through the different compositional categories of an asset:

1. Assembly (of asset).
2. Sub-assembly (of assembly).
3. Components (of sub-assembly).
4. Production process (of components).

Multiple QFD matrices are used to translate this progression.

From a performance perspective, QFD could be viewed as:

1. Conception of performance (qualities).
2. Function of performance (functions).
3. Deployment of performance (deployments).
4. QFD is a decision interface for communication (concerning the engineering of a system).

6 [Project] Execution

> **READ:** *Execution of the plan of action, and the lists therein.*

A project's execution is the result of prior decisioning (and, decisions). Projects are executed under the conditions of a situation and of requirements for a situation to be different. Projects are executed as plans and lists. In actuality, plans are decided, and then executed as lists. Plans are solutions. Plans are an intermediary [information] deliverable of all projects. Plans are descriptions and explanations for current and/or future action. A plan is a documentation set that describes some set of actions and explanations, and how their execution (actualization of an action) will complete a set of [project] objectives. In part, plans are composed of lists. All lists to be executed (actualized, completed) during the execution phase of a project should be planned. Plans exist to be executed upon (i.e., used) in times of need. All plans are executed as a series of lists. That which is executed, is a reasoned plan-of-action likely to complete objectives. A plan-of-action includes project lists, which are the primary executable elements of any project.

To execute is to take action. Execution is a state of motion, a state of movement consciously energizing. In a sense, the project execution is the execution of a set of plans and lists to achieve a desired result. Execution is to take action (i.e., to go from) becoming (potential, design) into actual being (actualized, materialized). Execution done well ("right") is a planned and disciplined process that involves a logical set of connected activities acted upon by an organization to produce an expected result (to make work successful). The execution of any project requires lists and plans. This document details the project's lists and plans. The two most important plans for this project are: the contribution plan and the planned transition to the proposed society.

> **NOTE:** *The three common questions concerning the execution of a societal development project are: how does contribution work, what does justice do, and how do we transition to...?*

In concern to project execution and control, lists are a prerequisite. Lists are presented best as tables (matrices). In a database, tables store computable values. For purposes of execution, lists are an execution [coordination] tool. Relational tables can be computed (combined) by software as an information system. It is possible to operate a society without the price or violence mechanisms in that the information required to make the economy work can be performed by computer simulation, extrapolation, and calculation upon relational tables of project-relevant data so that the value and demand is represented within a software system.

To be effective, the execution of the plan:

1. Must include people and resources coming together to create better conditions, moving everyone, over time, into a community configuration of society.
2. Must use great leadership to generate and sustain community. Here, leadership involves:
   A. Stepping out to go first and take risk (to develop and promote this common direction).
   B. Rational, organizational, and socially relatable abilities and skills (that allow for peaceful integration and harmonious progress).

6.1 *Project executable plans*

The first project deliverable solidifying the project's execution is primary plan of action. In a societal project such as this, there are really three categories of plans, to be executed, each with their own, and interconnected, lists:

1. Local habitat [master] operations plans. There are many locally and regionally operating habitats. These habitats are master planned and carry out planned operational procedures in order to maintain their local habitat services.
2. Global habitat [master] operations plans. There is a global operating information system that facilitates information access and is used for decision support.
3. During transition from a non-community-type configuration of society to a community-type configuration, there is a societal transition plan. Note that this transition plan is different that local re-configuration and re-orientation plans for local habitats (who already exist within a community-type configuration of society).

In this way, there are really two plans, with different objectives and concerns:

1. The plan to operate a community-type society.
2. The plan to construction and transition people and resources into a community-type society.

In total, it is presumed that there are 4 execution plans, each with their own set of lists (some of which mind overlap with the other plans:

1. The community [master] plans.
   A. The standard development plan.
      1. This plan, and its accompanying set of lists, produce the community's societal specification standard.
   B. The local habitat operational plans.
      1. These plans, and their accompanying set of lists, produce the community's habitat services.
   C. The global habitat operational plan.
      1. This plan, and its accompanying set of lists, provides decisional and operational support to the global community network.
2. The transition [master] plan.
   A. The transition proposal plan.
      1. This plan, and its accompanying set of lists, provides for the transition of people and resources into a community configuration, and the successful duplication of that configuration.

6.1.1 Socio-technical materialization plans & planning

In the real world, plans are critical to long-term survival; without planning people tend to live day-to-day, always reacting to unforeseen threats, instead of seeing potential problems and avoiding them completely. This is especially true when there are not enough resources or contributions. Here, the primary concern is a lack of a desire, or of foresight, to take an interest in the plan (which exists regardless of interest, because humanity shares a common plan·et). The following is a list of the project sub-plan deliverables for a community-type societal project:

1. **Design plan** - conception information set. The societal specification standards.
2. **Construction plan** - materialization information set. The masterplan to construct the habitat (city) location. This is a project to construct a network of cities. All construction projects are monitored and controlled through a construction plan. A simplified construction plan may be summarized as follows:
   A. Concept design.
   B. Architecture and engineering design.
   C. Site selection.
   D. Materials and tools acquisition, and transport to and from site (a.k.a., resource collection, including tangibles and intangibles).
   E. Operational team formation (i.e., intersystem team to construct and operate the habitat service system).
   F. Site preparation.
   G. Main construction (phased delivery).
3. **Operations plan** - having a plan of procedures that knowing carried out is sustain the operation of the [production] system.
4. **Maintenance plan** - knowing when to maintain systems.
5. **Configuration plan** - knowing where and how to re-configure systems.
6. **Incident handling plan (operations continuity plan)**- know how to coordinate the occurrence of all types of incidents.

   A. **Disaster recovery plan** - knowing how to recover systems; continuity of operations.
7. **Market-State transition plan** - know how to communicate with entities in the market-State to sustain working relationships.
   A. Political communications strategy (a.k.a., State communications strategy, State relationship plan).
   B. Market communications strategy (a.k.a., business plan, market relationship plan.
   C. Public communications strategy (a.k.a., social/ crowd communication plan).

6.1.2 Project coordination plans & planning

I.e., What are the plannable elements of a project plan?

These plans describe how the project will be coordinated, monitored and controlled throughout the project lifecycle:

1. **Project charter (project definition plan)** - the planned instantiation of a project. The project charter outlines the projects purposeful direction; it is essentially a memorandum of understanding (that is agreed upon).
2. **Communication coordination plan** - the planned protocols (synchronization and acknowledgement) and platforms by which information is understood and used.
3. **Document coordination plan** - the planned publication and dissemination of standard references for usable information.
4. **Schedule coordination plan (time team planning)** - the planned positioning of team elements in time.
5. **Resource coordination plan (object and operation planning)** - the planned positioning and occupation of resources.
6. **Issue coordination plan (change control planning)** - the planned decisioning of issues.
7. **Risk coordination plan (challenge response planning)** - the planned [mitigation & incident] response to negative events.
8. **Human coordination plan (human team planning)** - the planned positioning of individual humans into an organization of InterSystem teams and working groups who accountably complete tasks to sustain and adapt the operation of society.

6.2 Project executable lists

A.k.a., Positive lists, accountable lists, accountabilities.

A project list is a repository of all listable elements relevant to the execution (running, coordination) of a project. Whatever a project is composed of, it can be added to a [project-relevant] list. Lists contain data accessible for execution, which may be software, hardware, or human, or some combination thereof. A list is any information displayed or organized in a logical or linear formation, which is necessary for the coordinated execution of any task.

To take action requires the synchronous integration of a set of project plan lists. There are two categories of list, a list that includes certain information traceable to requirements, and a list that includes uncertain information traceable to risks (detriments to the project). The execution of a plan involves the combining or positive project lists along a timeline (schedule), whereupon risks are mitigated and responded to through reasonable controls. The execution of a societal-level project is complex and multivariate. Human flourishing can be resolved for by applying effort toward the combined resolution (actionable integration) of a set of directional (positive) lists. In the market, these lists represent exchanges of property/ownership. In the State, these lists represent hierarchical relationships of one person having power [of coercion] over another. In order to sustain a fulfillment-oriented society, relationships must be sustained that meet the society's minimum level of informational and spatial requirements.

In terms of computation, which is a necessary component of the execution of a complex socio-technical system, it is useful to understand a list as a data structure that generalizes one or more atomic vectors. An atomic vector is the simplest directional data type. Data without a vector (i.e., scalar values; data without useful decisional information) can be vectorized through operations. Each sub-system of a total societal system has a different set of interrelated "atomic" vectors:

1. In a social system, a 'need' and 'value' (condition), together, are the simplest directional data type (i.e., is an atomic vector). Values are orientationally usable data packets with an identifiable vector (meaningful direction, need). Data organized for meaningful fulfillment [if need] has an atomic vector.
   A. Needing is a human process, conditions allow for needs to get cyclically met.
2. In a decision system, an 'objective' (claim, *requirement*) is the simplest directional data type (i.e., is an atomic vector). Objectives are measurable outcomes. Action taken on the part of objectives has an atomic vector.
   A. Operationalizing values is the process of identifying human-community values and translating them to accessible and concrete concepts so that they can be implemented, validated, verified, and measured as progress and/or completion of a need. An operationalized value is an 'objective'.

3. In a material system, an ‘object’ (matter, *technology*) is the simplest directional data type (i.e., is an atomic vector). Objects have shape. The motion of objects has an atomic vector.
4. In a lifestyle system, an ‘organism’ (life, *feeling*) is the simplest directional data type (i.e., is an atomic vector). Life has consciousness. The experience of consciousness has an atomic vector.

A project is necessarily composed of the following executional list elements (components, parts):

1. **The lists** - The execution of a direction as a set of lists that account for all project relevant data.
2. **The meta-relational database** - The descriptive meaning of each list, and all lists in relation to one another.

6.2.1 The project lists

A.k.a., Project execution list data.

In order complete a project, a project plan must identify and relate the following lists/tables (within a project coordination database), upon which calculation can be done:

1. **Agreements list (a.k.a., alignment checklist)** - the list of what is being agreed to under the initialization of a project.
2. **Needs list (a.k.a., issues list)** - The list of what is needed for the user to have complete fulfillment.
3. **Objectives list (requirement-oriented conditions breakdown) -** An objective/requirement is a capability to which a project outcome (product or service) conforms to a measurable degree.
   A. **Situational analysis** - is the complete context of the real-world situation in which the objectives exist.
4. **Concerns list (a.k.a., risk, incident, problem, issue-oriented breakdown)** - Each concern is either a risk or an issue, which are handled in much the same way via a decisioning prioritization and solution process. Some issues of concerns are incidents (actualized risks). This is a list of issues concerning organizations and events that have been/may/or are adverse [in their effects] to the completion of the project (i.e., “threats”). Here, the issue is either a risk (with some likelihood of), or an incident (current affect of), inhibiting project completion. Incidents require resolution (hence, new actions/tasks to resolve the incident), and risks necessitate mitigation reasoning for project preservation planning. Issues are prioritized (as in, ‘triaged’). In general, issues themselves are not scheduled, although their resolutions may be. A planned “issue” is either a test or a trap.
5. **Requirements list** - Each requirement that must be checked in order for a project objective to be complete.
6. **Resources and locations list (location-oriented breakdown)** - Each available resource at some location in time. The list of locations of everything is -- material and digital [resource] locations. Note that resources can be moved to re-located them over time, and this relocation can be scheduled.
7. **Deliverables list (product/service-oriented breakdown)** - Deliverables are requirements packaged with contextual information into the form of products and services (as outputs of processes) required to complete the project. Note: There are project deliverables (project needs/ requirements), and sub-project deliverables (sub-project needs/requirements). The deliverables list is a list of the outputs (of processes) that must be completed (“ticked off” as done) for the project to be complete and/or meet objectives. There are two possible categories of deliverable: process (service) deliverables and object (technology) deliverables.
   A. **Plans** - The documentation set for identification of actions.
8. **Actions list (action/task/work/deliverable-oriented breakdown)** - The list of all tasks (actions, activities, etc.), all of which are tracked. Some tasks exist to resolve concerns. Actions (activities/work packages) are executable [process or construction] tasks. The items in this list are tasks within a hierarchical structure of textual groupings (a work breakdown structure, WBS). Synonyms for ‘action’ include, but are not limited to: work, task, activity, executable, “something to do”, process, procedure, construction, and resolution. Actions are assigned to systems and/or people. Some actions are automated. Automated actions form automated services - services without the need for direct human effort, no ‘event’ instantiation (no addition to the Events List). *Note: A project produces a product and/or a service, and so, that is why this type of plan, is called a “plan of action”); because, it intends to describe the act of brining something into existence.*
9. **Human user list (a.k.a., stakeholders)** - The list of those who are going to use and/or benefit from the project’s deliverable(s).
10. **Humans contributions list (a.k.a., workers)** - The list of who is contributing, and where and when and with what.
    A. **Contribution accountability list (people/actor-oriented breakdown)** - profile and activity information on every human in the project,

including all their associated project and sub-project information, resource allocations, and roles/responsibilities.

11. **Teams list (a.k.a., roles list)** - The individuals and machines that carry out activities.
    A. The human work package as a 'role' with a "work description" - human placement on a team.
    B. The human work package as - the human selection of tasks as part of a team.
12. **Schedule list (time-oriented breakdown)** - The items in this list are Tasks within a hierarchical structure of groupings called the WBS (Work Breakdown Structure). The temporal association as an activity. In order for action to occur (i.e., "things to happen"), there is time. Actions, deliverables, requirements and events can be organized within time (i.e., they can be scheduled and time delineated). These project information categories can be expressed in terms of a time (i.e., iteration) dimension. A schedule list may also be known be the following labels: timeline, gantt chart, or project schedule. A schedule can be a unified visualization of all (or selected) actions/work, deliverables, requirements, and events per [unit of] time, with all associated meta-/calculable-information. Through the scheduling of accountability project coordination can be calculated and visualized; wherein, it is possible to view: system and human bandwidth; *who's* available; and *who's* busy.
13. **Events list (timeline breakdown)** - A transparent recorded ledger of any change that has occurred. A recorded event always identifies the 'result' of an interaction (e.g., minutes of meeting, a report, a computational result) in the real world.
14. On-going and post-execution lists:
    A. Operations (monitoring and procedures) lists.
    B. Evaluations (feedback) lists.
    C. Integrations (updating information systems) lists.

Simply, the following is the list of executable elements (a.k.a., the project lists, for which there is order to the their positioned instantiation):

1. **Agreements list** - what is being agreed to (and, why is it being agreed to)?
2. **Concerns (risks) list** - what are the concerns (and, why are they concerns)?
3. **Needs list** - what is needed (and, why is it needed)?
4. **Objectives list** - what are the objectives (and, what are their priorities)?
5. **Requirements list** - what is required to complete objectives?
6. **Resources list** - what resources are available for what is required?
7. **Team & role list** - what work [descriptions] are being contributed (per team-role)?
8. **Deliverables list** - what is to be produced (and for whom)?
9. **Decisions list** - what must be decided (now that all else is known)?
10. **Actions list** - what must be done to complete the project?
11. **Schedules list** - when, where, and by whom are actions to be taken?
12. **Deadlines list** - by when must be actions taken?
13. **Events list** - what has been done (and reported analysis on why it was done)?
14. **Costs list** - in the market there is a also a financial costs list.

7 [Project] Life-cycle

A.k.a., Project lifecycle, project life cycle, project process groups.

A project is sub-divided into a set of phases (resolving information sets) as sub-parts of a life-cycle plan for coordination and decisioning (control) purposes. The [project] life-cycle plan forms the foundation for project planning, scheduling, coordination, and estimation.

NOTE: *Different types of projects may have different life-cycle structures.*

All projects have a life-cycle, which involves the division of the project into phases. Through this method of life-cycle modeling, it is possible to plan a whole global habitat network. Life-cycle modeling facilitates the planning and coordination of all project progress. Everything that should be done to accomplish a project is divided into distinct phases, separated by control gates. Phase boundaries are defined at natural points for project progress assessment and *go/no go* decisions (i.e., should the project continue to the next phase, or not)?. Decomposition of a project into life cycle phases organizes the development process into smaller, more ordered ("manageable") pieces ("chunks").

To be a complete life-cycle, a life-cycle (and its engineered design) must cover the entire system's life as a cycle; from conception, extraction to closure, usage and re-cycling (from conception to closure). With increasing project complexity, validation and verification (V&V) becomes increasingly important; the standard should provide a detailed view of the verification and validation (V&V) processes (or the like).

7.1 [Plan] Life-cycle **control**

A.k.a., Planning control, plan control, plan management, plan programming, plan[ned] decisioning, controlling coordination.

In the discipline known as project coordination (project management), when the words 'plan' (and 'control' or 'management') come together, only the knowledge areas change. For example, Plan quality control/management, Plan schedule control/management. The controlling of coordination [as intentional motion in a physical environment] for the purpose of navigation, in time-space, requires 'planning' as the intentional conception and expectation (of a particular sensation, giving rise to a memory of [the unit] experience).

All projects are controlled by:

1. Deciding (approving) who to include in the project.
2. Deciding (approving) final decisions for execution within and without the project.

In documentation, every time the terms 'plan' and 'control'/'management' are together in a project coordination/management title, it means, "the rules or procedures of the [information flow] gating and monitoring process" (i.e., the rules of the gate that allow information to pass). The control of the flow of information, and of all access, can be sub-divided into bounded phases, for easier and more model-like understanding, known as a 'life-cycle' (Read: a whole unified system sub-divided into interrelated boundaries that form a [whole life-]loop).

In a project, these rules are defined [within the unified information system] ahead of the project [phase or sub-process] gate. For example, the term "Plan scope management" means the rules for how to process information associated with scope as, the defined direction, which includes the process group decision-deliverables of: defining objectives, collecting requirements, and producing a "work breakdown structure".

TERMINOLOGY: *A 'rule' is (in part) a pre-decided flow of information from one point to another by the method of a [controlled] relationship that links to one entity out of multiple possible entities.*

In the process group known as **CONTROL**, when plan and coordination come together, it means the logical resolution of information into a decision point to be acted upon in the future by an accountable (i.e., monitored) entity, who understands the plan (decision structure/ procedure) and is able to act). More completely, project coordination "management" is about information-level control and communications under more or less well defined information categorizations and processing goals.

INSIGHT: *Instead of an environment where relationships are based on [market] transaction and power-over-others (i.e., the State-owner-authority), relationships are based on collaboration, as a global cooperation of thought, resolution, and action in a common environment.*

The center (Read: core process) of each process [group] is 'integration'. Integration combines the other 9 knowledge areas into a fully specified understanding of some knowledge area of a project. All terms that start with Control are sub-sets with Integration.

In other words, project integration involves controlling how information is integrated into a decided project plan knowledge-base. Project integration involves:

1. **Initializing project-level information [sets]** - Identifying the issue and the users (as in, those who may be impacted by the issue).
2. **Analyzing project-level information [sets]** - Collecting and analyzing the project data on the

results achieved by the project, ensuring the project meets the project objectives, by constantly monitoring the project's progress.
3. **Delivering project-level information [sets]** - delivering a project plan (supra-plan) through a project information interface that will facilitate the optimal resolution of project objectives.
4. **Closing project-level information [sets]** - doing all the required work at the project-level to meet the requirements, and then closing (exiting, no longer working on) the active project process.

7.1.1 Control gates

A.k.a., The process group gates, control gate.

Each phase in the life-cycle represents a gate in the whole life-cycle process. Each gate in the project life-cycle, at a high-level, is called a 'process group'. Through the gating process, a project (or any deliverable) is broken down into smaller stages or phases, each delimited by a gate, which has a rule-set, wherein information is executed, leading to a decision to pass or not pass the gate. Each gate is a control point where verification that the necessary prior steps (and deliverables) have been completed. At each of these gates, the project requires decision determinations, deliverables, based on specific criteria and the information available at the time, whether to continue, stop, hold, recycle or modify the project/deliverable. To each of these gates corresponds one or several decisions/deliverables.

7.2 [Plan] Life-cycle monitoring

A.k.a., Checking accurate alignment, gating accuracy.

To monitor is to perceive, or not, a quantitative (behavioral) or qualitative presence.

IMPORTANT: *Until a* **measurement** *[of presence] is taken, there is only* **potential** *[for presence].*

Monitoring (which necessitates analysis) is done to meet information needs. Considering the level of abstraction a calculable concept can be composed of other sub-concepts, which could be represented by a concept model (e.g. ISO 9126-1 specifies a quality model based on characteristics and sub-characteristics). A calculable concept is associated to one or more attributes of entities. An entity is a tangible or intangible object that is characterised by measuring its attributes. Types of entities of interest to system engineering are: Project, Asset, Service, Process, and Resource. The attribute is a measurable physical or abstract property of an entity. An entity may have many attributes; only some of them may be of interest for a given calculable concept. For a given attribute, there is always at least an relationship of interest that can be captured and represented in the formal domain by means of a metric, enabling us to explore the relationship mathematically and/or statistically. The metric contains the information of the defined measurement (and/or calculation) method an scale. An attribute may be measured using different measurement methods and scales, hence one or more metrics can quantify the same attribute. (The reader can see the method definition and derived concepts likewise the scale and unit concepts in table 1, and the scale Type attribute).

7.3 [Plan] Life-cycle information sets

In order to fully describe the flow of information within a project-based structure, it is necessary to have a top-level sub-division of information flow known as a life-cycle of different phases known as 'process groups' -- the axiomamtic, divisional categories of information processing required to complete the project. These process groups are, as the category name describes, groups of processes. In order to complete any given process, there must be knowledge:

1. Knowledge about the process itself, and the environment in which it is operating, in order to effectively and efficiently execute and correct the process for a given intention/objective (for change).

Thus, a complete project coordination process flow involves the following information sets project-level [working] information sets:

1. **Process group** (5 total phases) - plan coordination life-cycle.
    A. **Knowledge area** (associated with process groups; 9 total) - the knowledge of how to plan coordination.
        1. **Project processes** (47 total activities)
            i. ITTO (input, tools and techniques, outputs) unique for each process. Some inputs are used for multiple processes. The number of ITTO associated with each project process is proportional to its prerequisites. The inputs, tools, techniques, and outputs when coordinating.

7.4 [Plan] Life-cycle data inputs

A.k.a., Project areas.

For any given project there are four core data [area] inputs include:

1. Project knowledge areas.
2. Life-cycle knowledge areas.
3. Life-cycle process areas.
4. Project process areas.

Core project knowledge areas (data inputs):

1. Integration.
2. Scope (issue & goal).
3. Schedule (time).
4. Quality (& quantifiable evidence).
5. Risk (incidents).
6. Resources.
7. Stakeholders.
8. Communications.
9. Cost (the unnecessary factor).
10. Procurement and disposal (market).

Core life-cycle knowledge areas (data inputs):

1. Integration (system).
2. Research (science).
3. Development (support).
4. Assembly-Operation-Disassembly (service).

Core life-cycle processes (data inputs):

1. Initiate project (initiating) - goal setting requirements.
2. Design system (designing) - modeling solution to requirements.
3. Build system (building) - assemble system.
4. Use system (using) - operate service system
5. Cycle system (cycling).
6. Observe > Analyze > Design > Build > Use > Cycle.

Core project processes (data inputs):

1. Initiating (intentional objective, directive issue).
2. Planning.
3. Decisioning.
4. Executing.
5. Controlling and Monitoring.
6. Closing.

7.5 *[Plan] Life-cycle* **phasing processes**

> *A.k.a., Plan coordination, plan phasing, life-cycle phasing, life-cycle coordination, project progression, project management life-cycle.*

An iterative, cyclic flow of information known as a life-cycle (or lifecycle) bounds the organization of a project, and coordinates the project's forward progression toward resolution/completion. Each sub-organization in this flow of information is a gated process (Read: process group set), known most commonly as a 'phase' or 'stage' in the totality of processes known as its 'life'[-cycle]. The collection of these phases at the information-level is the project lifecycle. And, the collection of these information gating phases at the operation-level is the engineering lifecycle (a.k.a. solution inquiry). These two 'categorically' separate lifecycle cycles are different views (windows) into the same sub-section of the unified information space representing that of the project's direction. In an information systems context, all phases are best viewed as categories of information in a unified information system, essential to the effective resolution of the complex social-project space.

> **LANGUAGE:** *The term lifecycle, life-cycle, and life cycle mean the same thing (i.e., are used interchangeably).*

A project life cycle is the series of 'phases' that a project passes through from its initiation to its closure. A 'phase' is a set of activities that culminates in the completion of one or more deliverables (PMI 2017).

More technically, a 'phase' ('stage') is an invariantly sequenced, qualitatively distinct level that can meaningfully characterize process sequences of abilities. In other words, by measuring a system as it moves through a life cycle, at each of the stages/phases in the life-cycle it is possible to state that there has been a meaningful change, and that change has come (in part) from a technical ability within the life-cycling system.

Project [coordination] phasing is the process of dividing and sub-dividing a project into a number of logically related phases (and related information sets) that must result in completion of the project's associated deliverables (informational and material). At a high-level, project phasing could be considered the project methodology, as in, the study and reasoned selection of a method by which to complete a project.

Project phasing produces the high-level representation of steps (phases) for project fulfilment and show objectives for each of the steps with durations and priorities. Typically the project phases are combined with the 'time' factor to compose a visual coordination tool known as a 'schedule'.

The process of subdividing a project into phases involves the following two intentional [design] processes, informed via project objectives:

1. **Identification** - The first process ("step") is to identify which phases, sub-phases or/and sub-projects will be required for completing the overall project [life-cycle]. The identification should be based on the objectives and expectations stated by the project imperative. Time becomes the critical factor that determines the phasing so schedules (a timing tool) are used to identify the relative positioning of phases. All the objectives are divided into groups considering expected delivery time for each of the objectives. Then for every group the primary goal is to be determined. The goal combines and aggregates all the objectives included in each given group. In such a way project planners can group the objectives by delivery time and therefore divide the entire project implementation life-cycle into certain phases.

2. **Prioritization**. This process ("step") associates priority activities for each of the identified phases. The relative ranking or priorities for the phases should be based on the extent to which every phase carries out a specific objective. Often priority activities are set up by defining the critical path for all the objectives of the identified phases. Practically: an objective with the longest duration in every phase is investigated and selected; such objectives are compared with each other and organized by durations (from shortest to longest). Then priorities are set up for the phases.

7.5.1 [Project] Life-cycle **process groups**

A.k.a., Project phases, project deliverables, project process groups.

The most common project phasing (i.e., life-cycle) is the five project supra-processes (i.e., project process groups). A typical project has the following five major phases, also known as the five project process groups (and, each process group has its own set of information sub-components).

CLARIFICATION: *Coordinating a project usually requires dividing the project's work into more "manageable" pieces called phases. Phases allow the project team to more effectively coordinate and control project activities throughout the life of the project. Collectively, these phases are called the project life-cycle.*

The structure of the following project-specific view of the lifecycle phases is:

1. Life cycle phases (process groups).
   A. Sub-process group processes.

The project-specific deliverable-view of the process groups (phases) are as follows:

1. **Initiation** *(project/phase/process initiation):*
   A. Define initial imperatives.
      1. Develop project charter.
   B. Develop stakeholder registry.
   C. Generate initial plan.
2. **Planning*** *(project/phase/process planning):*
   A. Determine *where*, *when*, and *with what.*
   B. Decide *selection of planned solution.*
   C. Survey (resources and humans).
   D. Identify and prioritize action .
   E. Establishing action performance requirements vis the selection of metrics, used to monitor and assess downstream activities.
   F. Documents that bound scope (what we are and are not doing).
   G. Documents that list detailed requirements.
   H. Documents that provide estimates for cost and time.
   I. Documents that provide for a schedule.
   J. Documents that plan for quality, communications, risk and procurement.
3. **Execution** *(project/phase/process execution):*
   A. Discover > Design > Development > Operate > Evaluate.
   B. Execute the plan through doing/action as directed in the plan.
   C. Determine *what* and *why*.
   D. Build *what*, *where*, *when*, and *with.*
   E. Operate *what, where, when, and with.*
4. **Closing** *(project/phase/process closing):*
   A. Close project or phase (closeout).
5. **Monitoring and controlling** *(project/phase/process M&C; Integration):*
   A. Testing and validation.
   B. Protocols.
   C. Repositories.

**Clarification: There is sometimes confusion concerning 'planning' and 'lifecycle'. Planning is a continuous [project process] group/activity. Planning is a phase specific process group; one that is continuously active while the project is active. It is a continuous phase in project lifecycle.*

Project coordination involves the following domains of information processing, which interrelate:

1. **Initiating (1st phase)** - Instantiation of a project occurs through an imperative or other directional statement. Imperative and/or directional statements include, but are not limited to the following: purpose, needs, goals, objectives. Imperatives denote a direction (with which to align) or outcome (as a condition and conclusion). An imperative necessitates further action, and the application of a structure with which to resolve the imperative. Defining a new project or a new phase of an existing project by obtaining authorization to start it.
   A. The activities performed to define a new project or a new phase of an existing project.
2. **Planning (2nd phase)** - Establishing the scope of the project and defining the objectives and the course of action required to reach the objectives. The planning phase itself focuses on developing sufficient details to allow various project elements coordinate their work optimally.
   A. The activities performed in order to establish the total scope of the project, define and refine the objectives, and develop the course of action

that will be followed to achieve the objectives.

3. **Executing (3rd phase)** - Completing the work defined in the project management and planning to satisfy the project specifications. Execution refers to the completion of informational and psychical work; wherein, work is packaged, distributed and selected, and then, completed.
   A. The activities performed to carry out and complete the work as defined in the project plan. Executing activities includes coordinating people and resources and performing and integrating the activities as specified in the project plan.
4. **Closing (4th Phase)** - Finalizing all activities across all Process Groups to formally close the project (closeout).
   A. The activities performed to finalize the project – to bring it to a conclusion and to meet contractual obligations.
5. **Monitoring and Controlling** - While the other process groups occur sequentially (generally), Monitoring and Controlling hover over the whole project (i.e., happens throughout the project and is not linear). Reviewing and regulating the progress of the project; identifying any areas in which changes to the plan have to be made and initiating the corresponding changes.
   A. The activities performed to track, review, and regulate the execution of the project; identify any areas in which changes to the plan are required; and initiate corresponding changes.
   B. The tools for monitoring and controlling a project include but are not limited to:
      1. **Cause-and-effect diagram** (a.k.a., fishbone diagram) - The causes are found by looking at the problem statement and asking "why" until the actionable root cause has been identified or until the reasonable possibilities on each fishbone have been exhausted.
      2. **Control charts** - Control charts measure the results of processes over time and display the results in a graphical form. These charts are a way to determine whether process variances are in or out of control. A control chart is based on sample variance measurements.
      3. **Histogram** - Histogram is used for illustrating the relationship in the context of two variables. Histograms are typically bar charts that depict the distribution of variables over time.
      4. **Flowchart** - Flow charts are used to understand complex processes in order to find the relationships and dependencies between events. Flowcharts are diagrams that show the logical steps that must be performed in order to accomplish an objective. They can also show how the individual elements of a system interrelate. Flowcharting can help identify where quality problems might occur on the project and how problems happen.
      5. **Checksheets (criteria sheets)**- A check sheet is basically used for gathering and organizing data.
      6. **Scatter diagram** - Scatter diagrams use two variables; one is called an independent variable, the input, and other dependent variable, which is an output. Scatter diagrams display the relationship between these two elements as points on a graph. This relationship is typically analyzed to prove or disprove cause-and-effect relationships.

The core deliverables of a project, separated by [project process] phase, are:

1. **Initiating** - representation of human opportunity, human direction; an issue and/or proposal.
   A. Project charter (a.k.a. statement of work, proposal, estimate response document, complete memorandum of understanding, etc.).
   B. A proposal is a data set of understanding and planned/-able action. Proposals are presented to populations in order to facilitate awareness and alignment, to bring forth and define future action. All solutions are proposals.
2. **Planning** (a.k.a., strategizing, strategy).
   A. Project plans.
      1. Deliverable diagram.
      2. Communications plan - what information needs to be communicated to what person.
      3. Schedule.
      4. Decision coordination (a.k.a., change control) - how do decisions come in, how are they assessed, what or who takes the decision.
      5. Cost management (market only).
      6. Procurement management (market only).
3. **Executing and Controlling** (a.k.a., plan implementation).
   A. Performance reports.
   B. Ongoing issues.
   C. Change logs.
   D. Project progress.
   E. Deliverables (delivered?).
4. **Closing** - the project, itself as a deliverable, is completely delivered.
   A. Acceptance.
   B. Final report.
   C. Documented.

D. Learned.

Take note that sometimes the following combination of information elements is referred to as strategizing (or, strategic thinking):

1. Purpose.
2. Values.
3. Objectives.
4. Metrics.
5. Goals.
6. Capability and capacity.
7. Plan.
8. Action.

The phases (process groups) are expressed below with their sub-processes:

1. **Initiating process group.**
   A. Develop project imperatives (project charter).
   B. Identify stakeholders.
2. **Planning process group.**
   A. Develop project plan.
   B. Identify requirements.
   C. Develop work breakdown structure.
   D. Define activities.
   E. Sequence activities.
   F. Estimate activity resources.
   G. Estimate activity duration.
   H. Develop schedule.
   I. Estimate cost (market).
   J. Determine budget (market).
3. **Executing process group.**
   A. Coordinate project execution (track all project information).
   B. Perform quality assurance.
   C. Acquire project team.
   D. Distribute information.
   E. Conduct procurement (market).
4. **Monitoring and controlling process group.**
   A. Monitor and measure project work.
   B. Report performance.
5. **Closing process group.**
   A. Close project or phase.

CLARIFICATION: *Not all project have a closure -- not all projects have a specified end or end date. Some projects produce services with their own life cycles, and these services may still be managed as projects.*

7.5.1.1 [Project] Life-cycle coordination process phases simplified

Each similar collection of project information processes are called project process groups (PPG, in PMBoK) -- each process group is a phase of the whole common project life cycle. For any given project, all process group processes could be active at any stage.

Every project lifecycle has at least the following three ordered, principal processes (a.k.a, supra-processes, process groups, lifecycle phases):

1. **Initiating** process group.
2. **Phase specific** process group.
3. **Closing** process group.

There are two important points to take note of in concern to a project's principal processes:

1. Note that the processes (i.e., process groups) do not happen only once. They happen at every cycle of phase. Of course that the first time you pass on the process you create the document but in the following ones (other project phases you use what you created to improve the other process). The process does not occur only one time.
2. Note that a project's lifecycle processes are recursive, because each phase of the project's lifecyle itself needs to initiated and closed with processes (Read: the process groups known as 'initiating' and 'closing').
3. Note that different types of projects go through different stages before the result becomes life (or a part of the real world, the extant life cycle).

7.5.2 [Project] Life-cycle **knowledge areas**

The knowledge areas necessary for performing project coordination are:

1. **Scope** coordination.
2. **Time** coordination.
3. **Quality** coordination.
   A. Scope, Time, and Quality = the three triples constraints:
      1. *Scope* - an objective given an environment.
      2. *Time* - schedule.
      3. *Quality* - of resource.
4. **Risk** coordination.
5. **Communication** coordination.
6. **Procurement** coordination.
7. **Cost** [market] coordination.
   A. The *market (competition)* has externality costs.
8. **Human resource** [**contribution**] coordination.
   Integration [processing] coordination.
9. **Stakeholder** [**operating users**] coordination.

Concerning the timing of process groups and the integration of knowledge, the 10 knowledge areas can be executed (as information sets) concurrently (PMBoK 2018) within a project's phases (e.g., initiating, planning, executing, etc). All the knowledge areas will not begin and end at the same time; they are all independent: integration, scope, schedule, cost, resources, stakeholder, procurement, risk, quality, and communication (or any other composition) can be executed in parallel in time.

7.5.3 [Project] Life-cycle **inputs, tools & techniques (as activities), and outputs (ITTO)**

Each process contains a set of knowledge areas, each with the following information set structure (abbreviated ITTO):

1. **Inputs (pre-requisites)** - that which is necessary to start the process.
2. **Techniques and Tools (procedures, methods, mechanisms)** - the type and level of effort necessary to do the process.
3. **Outputs (deliverables)** - one or more of that which results from the process.

Each phase of a project's life cycle is composed of the following input categories:

1. **Resource** life-cycles (materials)
2. **People** voluntarily contributing effort (contribution)
3. The **application** of tools, techniques, and knowledge in the form of an action, activity, event, task, etc. (the executed process).
4. An **intended result** (the outcome)
5. The **actual result** (the evaluation)
6. *Currency* and *authority costs* (market-State only)

More completely, each knowledge area contains a set of ITTO.

1. **Inputs** - Any item, whether internal or external to the project that is required by a process before that process proceeds. May be an output from a predecessor process.
    - For example, plans, specifications, permits, financing, building materials, etc.
    - For example: project charter, project schedule, resource calendars, organizational process assets.
2. **Tools and techniques (for construction)** - skilled labor, concrete, framing, electrical, plumbing, Diagrams,
    - Tools - Something tangible, such as a template or software program, used in performing an activity to produce a product or result.
        - For example: Analytical techniques, modeling, project management information system, benchmarking, product analysis.
    - Techniques - a defined systematic procedure employed by a human resource to perform an activity to produce a product or result or deliver a service, and that may employ one or more tools.
        - For example, meetings, expert judgment, inspection, interviews, decomposition.
3. **Output** - A product, result, or service generated by a process. May be an input to a successor process.
    - For example, the finished product or service, work performance information, project plan updates, organizational process assets updates, project document updates.

In the PMBOK's, ITTO knowledge base is a standardized means of systematically using the same method of developing and executing processes and projects (i.e., the same methodological knowledge). Decomposing processes into systems (i.e., ITTO) reduces each to its most fundamental and basic [system-based] components, and does so in a standardized manner that is equally applicable for all processes and projects.

7.6 *[Project] Plan life-cycle* **coordination process**

The following is the complete project process flow (life-cycle), formatted into processes and their associated knowledge areas:

1. **INITIATING PROCESS** - The initiating process details 'What' the project is about.
    A. **Integration** (4.1 chapter of PMBOK 6th) knowledge - start initiation by integration.
        1. [Develop] Project charter (a project exists, the projects intention and why it exists)
    B. **Stakeholders** knowledge (13.1 of PMBOK)
        1. [Identify] Stakeholders - any person or entity that has any kind of interest in the project (positive or negative interest)
2. **PLANNING PROCESS** - to ensure that the plan will satisfy the stakeholders and deliver the project results. All of the below is part of the planning process.
    A. **Integration** knowledge (4.2) - start Planning by integration.
        1. [Develop] Project management plan
        2. All next content should be indented, but I don't want to do that
        3. At the end of the planning process, everything is consolidated into the project management plan.
        4. The project management plan details 'How' the project has been planned.
    B. **Scope** knowledge (5.1)
        1. Plan scope management - the rules for how you process information associated with scope
    C. **Scope** knowledge (5.2)
        1. Collect requirements (functional, technical, and activities as parts of the work) - things

that need to be done to satisfy Charter and Stakeholders

D. **Scope** knowledge (5.3)
   1. Define Scope - documented scope statement that reflects the scope of the project. Defines how you want to approach the project.

E. **Scope** knowledge (5.4)
   1. Create WBS

F. **Schedule** knowledge (6.1)
   1. Plan schedule management

G. **Schedule** knowledge (6.2)
   1. Define activities - define activities that must be accomplished to deliver the work package on the WBS.

H. **Schedule** knowledge (6.3)
   1. Sequence activities

I. **Schedule** (6.4)
   1. Estimate activity durations

J. **Schedule** (6.5)
   1. Develop schedule - a visualization of how the project will be placed over time. (gantt chart, network diagram, etc). The schedule will provide information on how much time (as a resource) is likely required to complete the project.

K. **Cost** [*Market] (7.1)
   1. Plan cost management - Who has approval to "spend" money? Costs are intimately related to resources and time.

L. **Cost** [*Market] (7.2)
   1. Estimate costs - if you know the activities and have a clear scope, then costs can be estimated.

M. **Cost** [*Market] (7.3)
   1. Develop budget - how and when the spender will spend the money, s-curve. Note, the term 'enterprise resource planning' (ERP) is another term for cost budgeting, in general, the "resource" in ERP is that of financial cost in the market. These planning platforms often include the following modules: sales; purchasing; extracting and manufacturing; inventory management; distribution; accounting/finance; human resources; and, customer relationship management (a.k.a., customer services).

N. **Quality** (8.1)
   1. Plan quality management - what are the quality standards that must be complied? What is expected to be delivered in terms of quality? This is the decision system's non-functional requirement inputs for integration into the extant community system.
   2. Here, the expected [standard] quality is set.

O. **Resource** (9.1) (*6th, in past editions was only humans, no longer just humans)
   1. Plan resource management - rules of the game of how you plan to manage the resources.
      i. Do you have [access to] the resources, in what state, where?
         1. Do you need to discover or extract resources, in what state, where, how?

P. **Resource** (9.2) (*6th, in past editions was categorized under time)
   1. Estimate activity resources - Estimate activity resources (9.2) and Estimate activity durations (6.4) go together and cannot be separated. Because most of the tasks are "effort driven", meaning that if you add more resources you will reduce the time (up to a certain level).

Q. **Communications** (10.1)
   1. Plan Communications management - build/develop the communications plan.
      i. What do you want to communicate?
         1. Who do you want to communicate to?
         2. Where do you want to communicate?
         3. When do you want to communicate?
         4. How much will the communications cost?
         5. How many resources will the communications require?
         6. For example, meetings go here.
   2. What is the best way of visualizing the [societal] system so that the user may understand any inquiry into it?

R. **Risk** (11.1)
   1. Plan risk management - what is the 'tolerance'? Tolerance defines exactly what is risk for the group and organization, and what is not a risk for the group and organization.

S. **Risk** (11.2)
   1. Identify risks

T. **Risk** (11.3)
   1. Perform qualitative risk analysis - an ordinal scale (e.g., low, medium, high; green color, orange color, red color. A standard scale is used.

U. **Risk** (11.4)
   1. Perform quantitative risk analysis - math is used to calculate probability and impact. For example, there is a dice with six sides, and what is the probability of (rolling a) 1.

V. **Risk** (11.5)
   1. Plan risk responses - what can I do to protect my project from each risk.

W. **Procurement** [*Market] (12.1)
   1. Plan procurement management - What do you need to do in terms of internal/external

action (the make or buy decision is here). Will I do everything internally, or not? What must be acquired from the market? What does not need to be acquired from the market?
   i. What must be made?
      1. What must be bought? [*Market]

X. **Stakeholders** (13.2)
   1. Plan stakeholder engagement - map stakeholders via an influence, power, interest (four quadrant matrix), and understand what will be done.
      i. Who needs it? What is its priority to whom needs it? What is the nature of the interest in it? Issue type to whom? Issue priority to whom?

3. **EXECUTING** - to act or take action (occurs in parallel with monitoring and controlling; works together with monitor and control as a fluid process)
   A. **Integration** (4.3)
      1. Direct and manage project work (if you are not the resource that is executing the work) - you direct and manage the work being done by the resources that have been defined for the activities.
   B. **Integration** (4.4)
      1. Manage project knowledge - what new knowledge is available to improve the whole process (i.e., "lessons learned").
   C. **Quality** (8.2)
      1. Manage quality
   D. **Resources** [Materials] (9.3)
      1. Acquire resources
         i. Allocate material resources
            1. Buy material resources [*Market]
   E. **Resource** [Humans] (9.4)
      1. Develop team - ensure that the human (resources) brought to the project are working together as a team (i.e., collaborating), communicating effectively, executing tasks as planned, sharing information, etc.
   F. **Resource** [Humans] (9.5)
      1. Manage team - operational aspects (e.g., someone becomes sick or needs to take a leave). Manage the daily changes to work due to changes on the team.
   G. **Communications** (10.2)
      1. Manage communications - make the meetings (time view)
   H. **Risk** (11.6)
      1. Implement risk responses - this is where the planned risk responses are implemented (executed). If under Plan Risk Responses, the purchase of insurance is a planned risk response, then here, the insurance is purchased. Here, are the actions related to the plans.
   I. **Procurement** [*Market]
      1. Conduct procurement - Execute purchases based on how procurement has been planned
   J. **Stakeholder** (13.3)
      1. Manage stakeholder engagement - what is happening with the stakeholder engagement (e.g., is someone gaining power, is someone losing interest?).

4. **MONITORING AND CONTROLLING PROCESSES** - to observe and correct action (occurs in parallel with monitoring and controlling; works together with monitor and control as a fluid process)
   A. **Integration** (4.5)
      1. Monitor and control project work - Is everything ok? Is everything going as planned? Where are the "flagging" issues around the project?
   B. **Integration** (4.6)
      1. Perform integrated change control - The project will change over time, and the changes must be integrated (everything, not just scope, time, cost and quality)
   C. **Scope** (5.5)
      1. Validate the scope - check that the scope (goals and objectives) defined in the initiating process was delivered through the executing process?
   D. **Scope** (5.6)
      1. Control the scope - concerned with changes in scope. The focus is on scope.
      2. All tasks related to scope.
   E. **Schedule** (6.6)
      1. Control schedule - is something going wrong with time and the schedule? Is a deliverable late? The focus is on time.
      2. All tasks related to schedule.
   F. **Cost** (7.4)
      1. Control costs - all tasks related to costs.
   G. **Quality** (8.3)
      1. Control quality - all tasks related to quality.
   H. **Resources** (9.6)
      1. Control resources - all tasks related to resources. Are the resources sufficient? Do more resources need to be added? Are the resource performing at the level expected.
   I. **Communications** (10.3)
      1. Monitor communications - does some aspect of communicating need updating or changing to become more effective/efficient?
   J. **Risk** (11.7)
      1. Monitor risks - are the risks appearing, or not, as expected?

K. **Procurement** [*Market] (12.3)
   1. Control procurements - receive products, and check (analyze) products to make sure products are as expected.

L. **Stakeholder** (13.4)
   1. Monitor stakeholder engagement - because stakeholders may change.

5. **CLOSING PROCESS**
   A. **Integration** (4.7)
      1. Close project or phase - this can be done for every phase and every project. Check off completion of phase or project and disseminate information via interface.

Related planning areas (essentially, the same process) are:

1. **Schedule estimate activity duration** and
   A. **Resource estimate activity resources**.
2. **Plan communications management** and
   B. **Plan stakeholder management** (because most of the communication will be to reinforce stakeholder engagement).

Related Executing Areas (essentially, the same process):

- **Procurement conduct procurement and Resource acquire resources** (because in the market, most of the time, the way you acquire resources will require a market-based procurement process).

7.7 [Project] Plan list view

A.k.a., Project plan database view.

The plan [executionable] list (database) view shows the accepted executable plan of [future] action broken down as a series of lists (information categories that have some relationship to project execution). Here, a project (and its plan) is composed of a series of information sets (or lists or project database tables).

A project plan acts as the master coordination database containing a record of all information [list] elements relevant to the project. For practical purposes, a unified project information space is subdivided into a set of use-oriented information categories.

In order complete a project, a project plan must identify and relate the following lists, upon which calculation can be done:

1. **Schedule**: The items in this list are Tasks within a hierarchical structure of groupings called the WBS (Work Breakdown Structure).
2. **Concerns**: Each Concern is either a Risk or an Issue which are handled in much the same way via a decisioning process.
3. **Actions**: The list of all tasks (actions, activities, etc.), all of which are tracked. Some tasks exist to resolve concerns.
4. **Locations**: The list of locations of everything in an information storage system.
5. **Humans**: The list of who is contributing and where.
6. **Events**: This is the list of computational integration points on a timeline. More broadly, any notable interaction between two or more people may be listed here. A recorded event always identifies the 'result' of that interaction (e.g., minutes of meeting, a report, a computational result).
7. **Deliverables**: The outputs (of processes) that must be completed ("ticked off" as done).

More completely, a project must identify and relate the following eight top-level project lists/tables (within a database), upon which calculation can be done:

1. **Objectives list (requirement-oriented breakdown)**: An objective/requirement is a capability to which a project outcome (product or service) conforms to a measurable degree.
2. **Deliverables list (product/service-oriented breakdown)**: Deliverables are requirements packaged with contextual information into the form of products and services (as outputs of processes) required to complete the project. Note: There are project deliverables (project needs/requirements), and sub-project deliverables (sub-project needs/ requirements).
3. **Actions list (action/Task/Work/deliverable-oriented breakdown)**: Actions (activities/work packages) are executable [process or construction] tasks. The items in this list are tasks within a hierarchical structure of textual groupings (a work breakdown structure, WBS). Synonyms for 'action' include, but are not limited to: work, task, activity, executable, "something to do", process, procedure, construction, and resolution. Actions are assigned to systems and/or people. Some actions are automated. Automated actions form automated services - services without the need for direct human effort, no 'event' instantiation (no addition to the Events List). *Note: A project produces a product and/or a service, and so, that is why this type of plan, is called a "plan of action"); because, it intends to describe the act of brining something into existence.*
4. **Events list (Human-to-human-oriented breakdown)**: Events are a specific type of task; they are social integration-decision event task. An event (on this list) contains [at least] the location, time, and contents of human-based interactions that have lead to, or will lead to, a change and/or decision about the project (or some aspect therein).

5. **Schedule list (time-oriented breakdown)**: In order for action to occur (i.e., "things to happen"), there is time. Actions, deliverables, requirements and events can be organized within time (i.e., they can be scheduled and time delineated). These project information categories can be expressed in terms of a time (i.e., iteration) dimension. A schedule list may also be known be the following labels: timeline, gantt chart, or project schedule. A schedule can be a unified visualization of all (or selected) actions/work, deliverables, requirements, and events per [unit of] time, with all associated meta-/calculable-information. Through the scheduling of accountability project coordination can be calculated and visualized; wherein, it is possible to view: system and human bandwidth; *who's* available; and *who's* busy.
6. **Concerns list (risk/incident/issue-oriented breakdown)**: Each issue of concern is either a risk or an incident. This is a list of issues concerning organizations and events that have been/may/or are adverse [in their effects] to the completion of the project (i.e., "threats"). Here, the issue is either a risk (with some likelihood of), or an incident (current affect of), inhibiting project completion. Incidents require resolution (hence, new actions/tasks to resolve the incident), and risks necessitate mitigation reasoning for project preservation planning. Issues are prioritized (as in, 'triaged'). In general, issues themselves are not scheduled, although their resolutions may be. A planned "issue" is either a test or a trap.
7. **Contribution accountability list (people/actor-oriented breakdown)**: Profile and activity information on every human in the project, including all their associated project and sub-project information, resource allocations, and roles/responsibilities.
8. **Locations list (Location-oriented breakdown)**: Material and digital [resource] locations. Note that resources can be moved to re-located them over time, and this relocation can be scheduled.

7.8 *[Project] Plan* documentation view

A.k.a., Plan documented deliverable.

This is a high-level view of the multiple deliverables and integrated components necessary to complete a complex project with multiple sub-project plans in the market-State:

1. **Project charter** - Initial visualization of the problem related information set as a solution-oriented project expected to resolve the problem in a specified (procedural, protocol) manner (i.e., via a documented method).
2. **Scope statement (statement of work)**: A description of the who direction, an overview; the statement of work explicates a high-level set of requirements (with references) that define the user expectations of the work ("scope").
3. **Business case or feasibility study**: The business case is a project manager-owned artifact, often part of the Charter. A feasibility studies analyze observations over time to determine whether there are sufficient resources (given what is known and available) to complete the project at all). Not all project require feasibility studies, and in an open source system the processing is done via an open control protocol.
4. **Project coordination plan**: An overarching (project and technical) project planning document that is typically tasked to compose by an executing project coordinator. The project coordinator develops a plan to have all functions of a project fulfilled. In a socio-technical system, this plan should involve active participation by socio-technical systems teams for those items of technical interest, finance for those items of financial interest, contracts for those items of contractual interest, supply chain for those items of procurement interest, manufacturing for those items of production interest, and all of the support functions for an integrated project view. The equivalent plan for the technical aspects is the systems engineering coordination plan (a.k.a., systems engineering plan or technical plan) that expressly plans the technical design of the solution itself by subject matter expert-calculations (experts) within the given unified system.
5. **Work breakdown structure (WBS)**: In an open source system, everyone is a potential contributor, and therein, project coordinators break down problems into issues and how they can be resolves with a series of tasks. Some of these tasks exist at a high level and are called the society's Habitat Service Systems.
6. **Responsibility assignment matrix (RAM; a.k.a., RACI matrix, linear responsibility chart)**: The work breakdown structure is progressed from the product breakdown into activities, tasked to individuals assigned to the InterSystem Team. RAM is a model that describes the participation by various roles in completing tasks or deliverables for a project process. RACI is an acronym derived from the four key responsibilities most typically used: responsible, accountable, consulted, and informed. The RAM/RACI model is used for

clarifying and defining roles and responsibilities in cross-functional or departmental projects and processes. The RAM/RACI model brings structure and clarity to describing the roles that stakeholders play within a project. The RAM/RACI model clarifies responsibilities and ensures that everything the project needs done is assigned someone to do it. The WBS is tightly coupled with the RAM/ RACI model, requiring the project coordinator to account and monitor who is assigned to the team, which work they will be performing, when, and its resulting orientational quality. Systems engineering is a major contributor, although not the only function involved. RACI stands for:

A. **Responsible:** People or stakeholders who do the work. They must complete the task or objective or make and take the decision. Several people can be jointly 'Responsible'.
B. **Accountable:** Person or stakeholder who is the "owner" (Read: finally responsible) for the work. S/he must sign off or approve (i.e., take the decision) as to when the task, objective or decision is complete. This person must ensure that responsibilities are assigned in the matrix for all related activities (to accountable individuals). Success [in any project] requires that there is only one person 'Accountable', which means that "the decision and total responsibility lies here."
C. **Consulted:** People or stakeholders who need to give input before the work can be done and signed-off on. These people are "in the loop" and active participants.
D. **Informed:** People or stakeholders who need to be kept "in the picture." They need updates on progress or decisions, but they do not need to be formally consulted, nor do they contribute directly to the task or decision.

7. **Change control plan** – the project coordinator visualizes a change control plan, that provides the reasoning for the selection (i.e., the methodology) of the project, and how access is decided[to be used/enabled] when processing changes to project information. On the subjective-level, this is called, an 'authority', and on the objective-level this is called, an 'open-source protocol'.
8. **Communications plan** - description of how stakeholders are notified of tasks and/or changes.
9. **Risk and opportunity coordination plan** - The Risk and Opportunity Management Plan provides risk and opportunity oversight for the project manager, but is commonly managed by systems engineering for system-based development. Both disciplines are trained in risk (and in some cases opportunity) management, only using different terminology and slightly different methodologies. This is an area that should be agreed upon up front across all disciplines employing a common language if the organization's processes are not clear.
10. **Risk register** – Some organizations limit the Risk Register to technical risks. Others identify separate registers for technical and business risks. In some cases, the technical risks bubble up to business risks. The project coordinator needs to be aware of both, just as the SE needs to be aware of both.
11. **Issue log (action item list)** – A monitoring service for the schedule. These documents are often created in multiple instances and even formats, dependent on the functions or projects capturing the issues and actions. Coordination of these items is most efficient and effective at the program level, in one format (language), with metrics in place to observe consistent issues across projects. All actions in one place (i.e., in a unified space) seems to make sense, when a project is driven to ensure timely action item closure.
12. **Resource coordination plan** – The project coordinator is accountable for obtaining the required resources for the project, which are decided upon in a temporal-priority technical resources matrix organization.
13. **Project schedule** – The Schedule, whether or not it is for the project or program, is processed via the project coordinator (for large projects/programs, the actual hands-on creation and analysis of the schedule is performed by sub-coordinating schedulers often a separate planning and control group). Technical schedules, at a lower level, feed the Project Schedule including the integrated, unified Societal Schedule (SS). The intersect is not only the "milestones", but also, other "critical path elements".
14. **Project status report with monitoring procedures** – Project status is provided via a project information visualization tool (dashboard).
15. **Lessons learned (from mistakes)** - Learning (integrating) from experience is a critical effort, not only for the project of interest. Future projects can benefit from feedback.
16. **Stakeholder analysis (re-evaluation of impacted)** – Systems engineers identity every human and non-human system involved in the project (a process of information collection and coordination).
17. **Document control** – Configuration and data control through approved documentation [is a function of the project coordinator, because

documentation is coherent social-communication]. The documentation of control is otherwise known as a 'protocol', synonyms of which include: contracts and procedural tasks (a.k.a., procedures, orders, instructions, etc.).

18. **Task completion observation and survey** (e.g., meeting minutes, video and audio recording, transcription) – for project meetings, the PM owns them. For systems engineering meetings, systems engineering owns them.

7.9 [Project] Plan process group deliverables

A.k.a., Plan phasing, plan phase deliverables,

1. **INITIATION (PROCESS GROUP, PHASE)** - issue presence and recognition.
   A. **Project request (activity)** - issue inquiry
      1. A project request is usually the first attempt to describe, document, and estimate the project purpose, benefits, costs, and timeframe. Project estimating is an iterative process that begins at a high level with the project request. If the project request is approved, then more detailed estimates will be developed in subsequent project phases as a more thorough understanding of the project becomes known.
   B. **Review project requests (activity)** - effectiveness inquiry:
      1. Regardless of the organizational context, the review process involves decisioning to reject or postpone some project requests, and then to prioritize those requests that the user group approves (possibly, through a protocol). The decision unit essentially "draws a line" (a threshold) based on what is possible. Those projects above the line are authorized to begin (or even continue), and those below the line are placed on hold until such time as what is necessary is available. The approved list of project requests will likely change over time as new ideas surface and priorities shift.
   C. **Project control (activity)** - parallel control inquiry, project control decisioning:
      1. Approval and prioritization decisioning of the project request by the project coordinating unit.
   D. **Selection of project coordinator (activity)** (i.e., project manager):
      1. The project coordinator unit is selected, and/or designed and selected.
   E. **Project charter (activity):**
      1. Goals and needs.
      2. High level project description.
      3. Measurable project objectives.
         i. In a general sense, an objective is a description of what will exist at the end of a project, expressed in a SMART way.
      4. Project scope – defines the work to be included (in scope), the work not included (out of scope), assumptions, and constraints.
         i. For planning purposes, an assumption is a factor considered to be true, real, or certain.
         ii. A constraint is a restriction or limitation, either internal or external to the project, that will affect the performance of the project. This section provides the opportunity to document constraints, such as:
         iii. *Schedule* – project must be completed by a specific date in order to avoid [financial] penalties.
         iv. *Cost* – funding is limited and cost overruns are not an acceptable alternative.
         v. *Human Resources* – system architect is available only at x time.
      5. Initial high level project planning - It is recognized that planning is an iterative process that becomes increasingly precise as detailed information becomes available. High level planning usually has a fairly large margin of error. Again, the project request information is a good place to start, but the charter provides an opportunity to provide additional detail and rationale for the following estimates:
         i. Resource requirements, including the types and quantities of resources needed to perform the in scope work.
         ii. Project budget, including the cost of resources (human, hardware, software, other products and services) to perform the in scope work.
         iii. Benefits.
         iv. Scheduling dates, including anticipated start date and target completion date.
      6. Project authority - Most, if not all, projects require decisions to be made to keep the project on track. The project charter defines the authority of the individual or organization initiating the project, limitations or initial checkpoint of the authorization, control-oversight of the project, and the level of decisioning of the project coordinator (authority of the project manager).

i. Decision control (Approval authority) – identifies the project initiator by name and title, ensuring that the individual has the authority to apply project resources, expend funds, make decisions, and give approvals.
ii. Project coordinator (Project manager) - identifies the project manager by name and defines the individual's level of authority. A project manager should be given authority to plan, execute, and control the project. For example, the project manager may assign resources in a matrix organization, authorize overtime, conduct staff performance appraisals, and take appropriate corrective actions that do not increase schedule or cost. However, scope changes must be escalated to the project sponsor.
iii. Effectiveness inquiry decisioning (Oversight-steering committees) - describes societal (agency management) control over the project. Within the project, internal control is commonly established to control the day-to-day activities of the project. The project coordinator (manager) should manage internal control. External oversight should be established to ensure that the organization's resources are applied to meet the project and organization's objectives. Also identifies committee members and contact information.

2. **PLANNING (PROCESS GROUP, PHASE)** - The purpose of the planning phase is to define the course of action necessary to accomplish project goals and objectives. This course of action is typically called a project ("management") plan. It addresses all aspects of project management and includes scope, time, cost, quality, communications, human resources, risks, procurement, and stakeholder engagement. Development of the project management plan is iterative, as new information and changes occur throughout the project lifecycle, which require revisiting one or more components of the project plan. Actual coordination of the project, which occurs in the execution and control phases, is the process of doing what was described in the project plan. Project planning is not a single activity or task, it is a the Primary phase of the whole project-oriented process:
    A. Project coordinators are responsible for developing the project plan (as an information set). Wherein, planning is an information processing unit responsible for ensuring the coordination of information such that planning requirements are fulfilled.
    B. The project plan is the deliverable of an information set through means of a project coordinator. The project plan is itself a sub-system of a larger and more unified societal system, which is itself, operated as a projected system.
    C. Project planning defines the project activities that will be performed, end products that will be produced, and describes how all these activities will be accomplished.
    D. **The Project (Management) Plan (the planning deliverable)** - sub-views into a whole project, contained within a larger societal, unified information space. A project (management) plan provides a foundation for all coordination (management) efforts associated with the project. Development of the project (management) plan begins after formal approval of the project charter, which indicates completion of the project initiation phase. The project (management) plan is a document[ed information set] that is expected to change over time. The assigned project coordinator (manager) creates the project (management) plan.
        1. The plan's organization should be as accurate and complete as possible:
            i. **Project Summary.**
                1. Statement of Work.
                2. Project Deliverables.
                3. Project Approach.
                4. Project Results/Completion Criteria.
                5. Critical Success Factors.
            ii. **Project Schedule.**
                1. Purpose.
                2. High Level Milestones.
                3. Detailed Schedule.
            iii. **Human Contribution (Resource Management, Human Resource) Plan.**
                1. Purpose.
                2. Project Team Functional Roles.
                3. Project Team and Cost Estimates.
            iv. **Project Budget Estimate.**
                1. Purpose.
                2. High Level Budget.
                3. Detailed Budget.
            v. **Communication Management Plan.**
                1. Purpose.
                2. Communication Matrix.

vi. **Change Management Plan.**
1. Purpose.
2. Change Management Roles and Responsibilities.
3. Change Management Governance.
4. Capturing and Monitoring Project Changes.
5. Communicating Project Changes.

vii. **Quality Management Plan.**
1. Purpose.
2. Acceptance Criteria.
3. Quality Assurance Activities.
4. Project Monitoring and Control.
5. Project Team Quality Responsibilities.

viii. **Risk Management Plan.**
1. Purpose.
2. Risk Identification Techniques.
3. Risk Assumptions.
4. Timeframes.
5. Risk Ranking / Scoring Techniques.
6. Risk Thresholds.
7. Risk Response Approach and Risk Action Plan.
8. Risk Tracking Process.

ix. **Issue Management Plan.**
1. Purpose.
2. Issue Log.
3. Relationships Among Issues, Risks and Change Requests.

x. **Approval Information.**

2. The plan's explanation should be as accurate and complete as possible:

i. **The Project Plan Summary**: A project summary is a simplified view into the system and could include a high-level description, objectives, and scope, information flows, and control.
1. Statement of work.
2. Project deliverables.
3. Project approach.
4. Project results/completion criteria.
5. Critical success factors (effectiveness inquiry).

ii. **The Project Schedule**: The project schedule is the roadmap for how the project will be executed. Schedules are an important part of any project as they provide the project team, participants/ sponsor and stakeholders a picture of the project's status at any given time.
1. Objective to deliverable mapping ("high-level milestone"): A milestone is an event with zero duration and requires no resources. A milestone is an event that receives special attention. It is used to measure the progress of a project and to signify the completion or start of a major deliverable or other significant metric.
2. Detailed schedule - A detailed schedule is developed, maintained and tracked in a unified information space. This electronic schedule constitutes the project work breakdown structure (WBS). Detailed information on project estimating and WBS development is included in the appendix.

iii. **Human contribution (resource management) plan:**
1. Project team functional roles - a project team matrix/database/chart is identifying functional roles and responsibilities, matching degrees of responsibility to processes, phases, or activities.
2. Identification of required skills and available contributors. It is helpful in the planning process to develop a list of skills-tasks required, which may then be used to determine the type of contributor-system required for the task.

iv. **Project budget estimate**: A view into the project that relates a current project's predicted expenditure of resources to on past similar project's expenditure of resources. In a unified decision space, budgeting is control.

v. **Communication coordination (management) plan**: Formalizes communications protocols for communication within the plan. The interface and interoperability of an openly unified system with the project space, and all communications within that space.
1. How information will be collected and updated.
2. How information will be controlled and distributed.
3. How information will be stored.

vi. **Change control (management) plan**: An information view into the project that describe the process involved with identifying, escalating, and controlling (managing) project changes. A project change is defined as something that is outside the documented and approved project scope or is a change to project requirements, project schedule or project cost (including resource effort). How is a required change [to the project] identified and escalated? A project change requires protocol-approval for additional resources, funding or modifications to the project schedule. The change (management) process defines how to handle project changes that present either a negative or positive impact on deliverables, schedule, budget and/or resources. The unified societal system is the repository for all project changes.

vii. **Quality (management) plan**: The purpose of the quality (management) plan is to describe how quality of the project will be controlled (managed) throughout the life-cycle of the project. It also includes the processes and procedures for ensuring quality planning, assurance and control processes are all conducted. All stakeholders should be familiar with how project quality will be planned, assured, and executed (Read: decisioning). The quality (management) plan establishes the activities, processes and procedures for ensuring a quality system-product is delivered upon the conclusion of the project. Here, verification and validation require acceptance criteria for quality. Herein, what activities will be done to ensure (have measured to be accurate) required qualities are expressed throughout a project?

viii. **Risk (management) plan**: The purpose of the risk (management) plan is to specify the processes used to identify, predict and mitigate (manage) risk. The risk (management) plan addresses both internal and external project risks associated with the project. As the *uncertainty declaration* of a project plan, risks are events or conditions that may occur, and whose occurrence, if it does occur, has a positive or negative effect on the project. Exposure to the consequences of uncertainty constitutes a risk. Although by definition risk planning may include risks that will have a positive impact on the project, the focus is typically on risks that may negatively impact the project.

1. Difference between risks and issues: If something is definitely going to happen or has happened, then it is an issue. If it is something that might happen, whether that is very likely or very unlikely, then it is a risk.
2. Risk ranking / Scoring techniques (such as prioritization ranking): For example, low to high, or 1 to 5. 5. Risk thresholds trigger action. Effectiveness inquiry is largely composed of risk thresholds that trigger action taken on a project because of organization/societal level risk thresholds. Disaster recovery and restorative justice is risk response. There is an active recognition of what to avoid in order to reduce risk. There is an active recognition that transferring a risk does not eliminate the risk. Some risk can be mitigated against (constructive action taken) to reduce the likelihood of the actual expression of the risk. Contribution is risk acceptance (for example, an astronaut today, or whenever), accepts a level of risk. In a coordinated information space, that carries an action plan in order to reduce the consequences should the risk even occur. When risks are specified, risk action plans.
3. Risk mitigation necessitates: Identifying the risk(s), evaluating the risk(s), and defining a resolution method for the risk(s).

ix. **Issue (management) plan** - The purpose of the issue (management) plan (Read: issue tracking) is to specify the processes used to identify and manage project issues. The issue management plan addresses both internal and external issues on the project. The societal (enterprise) issue tracking system is used to enter, track and report issue activity. Both the issue (management) plan and the issue log will be reviewed regularly throughout the project to monitor existing issues and to identify new ones.

3. **EXECUTION**: Project "execution" begins immediately after the project (management) plan is approved by the project creator(s). The execution phase essentially involves carrying out and controlling (managing) all the activities described in the project (management) plan. A decision is taken, at the project-level, and it is acted upon by some entity. A baseline is present, and then a change is observed. Project coordinators monitor and control all phases of a project in order to report accurately. Here, the deliverable is the actual action, an accountable role is completing the planned task(s).

4. **MONITORING AND CONTROLLING**: The collection of new project data by comparing planned and actual performance, analyzing variances and trends, identifying and assessing potential improvements, and recommending corrective action as required. Monitoring and controlling project performance enables accurate assessment of project progress, which in turn increases the likelihood of meeting user expectations.
    A. Sensors, surveys, and individual roles report, and the reports are analyzed and integrated into the project by the project's coordinator.
    B. Change control is itself is a process executed through the monitoring and controlling of changes.
        1. A baseline: A baseline is defined as the original plan, for a project, a work package, or an activity, plus or minus approved changes. A modifier (e.g., project budget estimate, schedule baseline, performance measurement baseline) is usually included.
            i. A baseline is a ruler: A baseline provides the "ruler" by which a project can be evaluated, statistically.
            ii. Baseline changes: Variance identifications.
            iii. Baseline control: Change control, decisioning protocols with thresholds. Scope is controlled through execution upon decisions [related to project information sets].
        2. Project change control action types:
            i. **Preventative action (a.k.a., preventative "measure", proactive)** - to prevent a problem's occurrence, or to ensure a problem doesn't continue to occur.
            ii. **Corrective actions (a.k.a., defect repairs)** - to fix something currently being done that is not being done correctly. Change or introduce something to prevent the appearance of a potential problem.
5. **CLOSEOUT (APPROVAL)**: The last major phase of a project's life cycle is project closeout. Project closeout is performed after all defined project objectives have been met and the user has accepted the project's service-product. This phase finalizes all project activities completed across all phases of the project to formally close (and/or transfer) the project. The project coordinator verifies the acceptance of all. A project closeout is a term that describes any action taken that finalizes all project activities and gives a formal closer to the project.

CLARIFICATION: *Some projects never have a formal closure. For example, there is never any formal closure to a community-type societal engineering project, for community's societal specification standards are an open continuous development, and the habitats in which people are physically preferable, re-configurable environments.*

8 [Project] Imperative

A.k.a., Specified project direction, directive, vision, mission, goal, objective, purpose, need, imperative, desire, problem, ideal, aim, intention, expectation, impact, benefit, output, result.

An imperative is the input of a desired output, causing the formation of a project to resolve the output into existence. Project [strategic] imperatives are specific and measurable, though not directly actionable.

NOTE*: In common parlance, the conceptual boundaries among strategic directions, goals, objectives, needs and requirements are often vague. An objective in one context or organizational level may be a goal in another. The following is intended as a rough guide to understanding project imperatives.*

Imperatives are dependent and interconnected, and hence, they can be arranged in a hierarchy with parent node imperatives following second level imperatives. Here, an imperative tree (a.k.a., objective tree) is a visualization of the hierarchy of imperatives.

QUESTION: *How is a project's [planned] direction specified?*

The directionality of a project can be sub-composed into a variety of possible informations sets, including but not limited to goals, purpose, and objective(s).

8.1 Intention (conscious directive)

A.k.a., Intent.

A [conscious] intention is an act or instance of determining mentally upon some action or result. In application, an intention is an aim that guides action.

8.2 Purpose (state the purpose)

Purpose is a compelling reason to do something. Purpose is a life aim that stimulates and motivates behavior.

NOTE: *In terms of humans, purpose sends signals to the body. When someone is motivated by a purpose that is greater than themselves, then competition disappears and collaboration starts to emerge.*

8.3 Vision (imagine the vision)

A.k.a., Visualization.

Vision refers to a commonly held visualization (description and/or explanation) regarding the deliverable(s) and the imperative (e.g., direction, goals and values) of a project and/or team.

8.4 Mission (define the mission)

A.k.a., Mission objectives.

The mission is a summary of what is to be achieved, and broken down into objectives to successfully complete the mission. Mission objectives are statement(s) that clearly document the goal(s) and constraint(s) of the mission. Constraints are pre-imposed limitations on the project. The mission objective follows from the stakeholders and their expectations.

Note: *Mission environment (a.k.a., a situational analysis) must be included (communicated) in statement of mission goals; because, it does affect design for completion of objectives.*

8.5 Goal (identify the goal)

A goal is a non-specific description of an outcome (the aim of an action), continuous or temporary. Temporary goals have a specified time limit. A goal is a specific target or direction, an end result or something desired. It is a high-level, broad, non-specific, and long-term definition of what is to be accomplished. Goals are not measurable, and several discrete projects may be needed to achieve a larger project goal. Goals are high-level, general statements about the aims of the project. A goal is some result (output) to be achieved (completed) by an action (process). Action planning is necessary to complete all goals.

CLARIFICATION: *In a business, project goals are influenced by business goals. In community, project goals are created by humans for human, and they are not influenced by market-State goals (because those concepts are not encoded, conceptually or technically). And, in engineering, goals focus on problems to be resolved.*

Setting a goal is setting a directive (i.e., an imperative or possibly even intention). It's the first step or movement toward a desired, designed change. An operational project, there is a necessity for two types of goals (operational requirements:

1. **Product (system) goals** - typically, associated with functionality and quality (i.e. functional and non-functional) requirements.
2. **Planning (process) goals** - typically, associated with schedule, resources, risk, team effort, and in the market, cost.

Thus, the first, core services enter into existence as that of information and materialization:

1. The first core information service is planning.
2. The first core material[ization] service is production.

8.5.1 Action planning (plan for action)

A.k.a., Goal execution planning.

The purpose of action planning is to select actions, and order relations among these actions, to achieve specified goals (objectives). Logic must be applied to select [optimal] actions given an probability-based environment.

Goal representation has the following essential criteria:

- A goal (G) is achieved in a state (S) if all the propositions in G (called, sub-goals) are also in S.

Action representation

- An action A is applicable to a state S if the propositions in its precondition are all in S.

Different patterns can be planned through intentional action toward a goal. Here, a pattern is the result or is itself, a rule (a process fractal is a pattern) of logic[al information processing].

8.6 Project charter (document the reasoned overview)

A.k.a., Introduction, overview, or high-level concept of operation.

A project charter is the first documented view through which the organizational case for a change is translated into project planning. Here, a project and its plan may be summarized or described with a linguistic and visual overview.

IMPORTANT: *The project charter is the first planned deliverable.*

In general, project charters include:

1. Project title (project unique categorization and identifier) Project coordinator ("manager").
2. Users/stakeholders (who).
3. Project description (what).
4. Project timeframe, start/end (when).
5. Project justification (why).
6. Project deliverables (how).
7. Constraints (optional).
8. Assumptions (optional).
9. Risks (optional).
10. Approvals (optional).

Common supplemental information includes:

1. Definitions and linguistic clarifications - to ensure effective communication and efficient understanding.
2. Imperative statement(s) hierarchy - A project comes into existence because of a stated imperative, which represents a direction with a problem-solution space. Wherein, the project itself becomes part of the solution space.

8.7 Project scope (identify the work)

A.k.a., Project scope of work, project scope statement, project definition, project mission, project vision, etc.

The scope of a project, also known as the project scope or the work scope, is all the work that must be done in order to meet the deliverable requirements or acceptance criteria agreed upon at the onset of the project. Sometimes the scope includes the identification of work that need not be done. Hence, completely, a project's scope is a definition of the elements that are included in a project, as well as what is not included. Broadly speaking, a project scope is the part of project planning that involves determining and documenting a list of specific project goals, deliverables, tasks, costs and deadlines. The documentation of a project's scope, which is called a scope statement, terms of reference or statement of work, explains the boundaries of the project, establishes responsibilities for each team member and sets up procedures for how completed work will be verified and approved.

NOTE: *It is important to clarify here the terms 'charter' and 'scope'. The term 'charter' is a market-State term, meaning "by contract". The term 'scope' is an optical sighting device (based on a refracting telescope); wherein, everything "in scope" is within the desired direction for the project -- the "on targets" are numerical values to be met (metrics). In this sense, an explicit written scope becomes a "contract" between the project and the participants.*

8.8 Objective (define the objective)

A.k.a., Goal, outcome, result, key results.

The objective states the ultimate goal of the project. At the societal-level, typically, an objective expresses a human need and the long-term condition that is to be achieved when the project is complete. Objectives for which a solution (system) is needed; these are often described as project objectives. Objectives are the outcome(s), the key result(s). An objective is a pre-determined result towards which effort (action) is [to be] directed, informed by intelligence. Key results quantify the success/completion of each objective in a given time period (the objective may span multiple result periods). A key result is the outcome by which success/completion is measured. In application, an objective is a specific intention expressed in measurable terms to achieve a goal (i.e., direction). Objectives may be defined in terms of outputs, results, outcomes and/or benefits (or similar intentional/directional language). More completely, an objective is the described result of the completion of effort toward a direction of intent. An objective is a the linguistic absolute description of a result (output or expectation) to be satisfied at successful completion of effort, within a certain period of time and by means of access to certain resources.

Objectives provide an individual or social organization with clarity on intention, focus, and direction in an uncertain environment. Every objective has a purpose (cause, constructor) that defines the *what* and the *why* of its instantiation.

In concern to teamwork, objectives localize to (i.e., become associated with) *nouns* (objects, physical or digital resources) and *verbs* (functional service operations, processes or protocols) of a given team.

> **NOTE:** *Real world human objectives are also known as: human needs and human requirements.*

Influenced by goals, a project objective is a detailed description of the specific and measureable outcomes desired from a project. A project objective describes the desired result of a project (tangible product or intangible service). Objectives are detailed statements about what the project should accomplish. The project and its objectives must always contribute to the goal, otherwise the project is not being pursued (or, should not be attempted). Objectives document a project's value for the end user. Therein, activities, and most likely deliverables, will contribute to achieving the objective.

All planning and strategic activities occur to resolve objectives, as well as to quantify a level of performance for their resolution.

Objectives express the following characteristics:

1. An objective is specific and measurable.
2. Describe the [business] value of the system and help prioritise features and requirements based on their value.

Project objectives:

1. Are a more refined version of the goals (outcomes and expectations) of the project.
2. Are what must be achieved (in existence, function, status, or state) to consider the project complete.
3. Refers to what the project aims to achieve; a strategic vision.
4. Are a part of the description of the project. Project requirements are derived and created from the requirements of the user and/or system.
5. Different from project coordination/management objectives.

Objectives and key results (OKRs) commonly include:

1. Mission and vision (scope).
2. Goals (delineated scope).
3. Objectives (delineated goals).
4. Results (impacts).
5. Tasks (activities).

In written form, key results are generally syntactically composed of:

1. Verb (e.g., reduce).
2. Specific noun (e.g., time to service).
3. Key result (e.g., elapsed time from first call to service).
4. Target (e.g., 16 hours).
5. Date (e.g., 12, April, 16:45).

Project objectives may be prioritization. Per the language of the existing societal specification, in the case of humans, there is a priority of needs from life support (survival), to technical support (technical services), and facility support (leisure services).

From an action-oriented perspective, an objective is a measurable target that specifies when a problem is resolved. Every objective has a success or completion metric.

> **Clarification:** *In business, project objectives describe the business value of the system. What is the value of the produced system to business interests, and hence, based on its value, what is the priority for requirements and features, materials and motions? In community, project objectives describe the human need for and community value of the system. What is the value of the system to human interests, and hence, based on its value, what is the priority for requirements and features. Also, there is a set of pre-defined values that facilitate this process.*

Among community, the desired outputs of the societal system are derived from the effective needs of the users, which are continuously prioritized. The language of the outputs should be more precise than that of the needs, and should reflect what the system does or provides in response to the eliciting needs.

An objective is a description of what will exist at the end of a project. Generally, objectives are written as linguistic statements. In the statements there are nouns, and those nouns are the project's deliverables, which are listed in the deliverable diagram (a.k.a., work breakdown structure, WBS). The deliverables and outcomes come from objectives.

For example:

- OBJ-001: Develop a design to identify the components and costs for the gardens.

Every project will have several layers of objectives, which are necessary in order to complete a project in the real world. Some objectives are common to all projects, and others are only relevant to the a specific project.

There is an absolute *objective* to fulfill human need on some cyclical basis. In order to engineer a resolution to the *objective* problem, there are multiple types of engineering requirements that must be defined:

1. **Process requirement** to identify human issues (needs, wants and preferences).
2. **Non-functional requirement** to fulfill needs in a specifically assimilated/assembled way.
3. **Availability requirements** for resources and people - when will the process be operated?
4. **Functional [capacity] requirements** - how many times do they operate the process per day?
5. **Reliability requirements** - do the users really need the process and data to be available 100% of the time?

8.8.1 Construction of an objective and key result ("milestone" setup,

The construction of an objective and key result statement (claim) takes on the following linguistic structure:

1. (Quality change; e.g., increase, decrease, continue) (Objectives statement, Key results, Needs) (Target) (Date)
   A. For example, increase habitat service water clean water output to a region. Then when it has clean water, continue to output clean water per master planning specification selection whose operations continue to meet human need fulfillment targets.
   B. There are incident operations in a habitat: for example, increase safe water output to 100% of the population within one week.
   C. And, there are continuous fulfilment services in a habitat: for example, continue to produce safe water output to 100% of the population per master [scientific-design] plan.

8.8.2 Characteristics of objective(s)

In a dynamic system, in order for information to be useful it must maintain the following objectives (which are the characteristics of useful information):

1. **Definable (conceivable)** - can be described and easily understood by the population of contributors.
2. **Manageable (organizable)** - a meaningful unit of information where specific responsibility and access can be assigned to an accountable actor, and where monitoring and tracking is possible.
3. **Predictable (Attainable)** - sufficiently understood that planning is possible in time with resources.
4. **Estimateable (specific)** - duration, time-frames, and resource usages can be estimated to complete the project.
5. **Integratable (Specific)** - integrates with other project work elements at a higher project [system] level.
6. **Measurable (Quantifiable)** - can be used to measure progress; has start and completion dates and measurable interim milestones.
7. **Adaptable** - sufficiently flexible so a change in social intention can be readily accommodated into the project's directive.

The primary measurement creation quality objectives (quality goals) are (SMART):

1. **(S) Specific and clear goals** - What is to be done or realized?
2. **(M) Measurable** - How will it be measured?
3. **(A) Achievable** - Is it feasible, viable?
4. **(R) Relevant and recorded** - Is the goal recorded and relevant to a larger direction?
5. **(T) Time-bound** - What is the timeframe?

Table 3. *Measurement quality objectives list.*

Letter	Meaning/Purpose
S	**Specific** - Is the objective clear in terms of what, how, when, and where the situation will be changed?
M	**Measurable** - Are the targets measurable? For example, how much of an increase or reduction is desired? How many items should be produced, or how many people will be trained?
A	**Action-oriented** - Does the objective specifically state what actions are required to achieve the desired result? In some cases, the A refers to "attainable." Is the objective something that can be reached by the performers?
R	**Realistic** - Are the desired results expressed in a way that the team will be motivated and believe that the required level of involvement will be obtained? Is the description accurate?
T	**Time-bound** - Does the objective reflect a time period in which it will be accomplished (e.g., end of the first quarter or by end of year)?

8.8.3 Real-world objectives

Every project is itself an information system with a real world directive. In order to maintain alignment with the real world, information in a project must be processed into three systems-level objectives, which are common to every project:

1. **Develop an accurate model of the world from which to work (Read: science)** - This becomes a universal information set common to all projects. *Science creates a societies common knowledge base from which to create systems into the material world.*
2. **Design an accurate model of the system to be constructed into the real world (Read: engineer)** - This is a model unique to each project. *Design creates a specification to be constructed.*
3. **Construct the model of the system into the real material world through (Read: hardware production and software programming)** - This is a material creation unique to each project. *Construction creates the materialized creation that humans must live with.*

In order for information to be useful in a project, it must have some sensibly aligned relationship with the real world. In order to design a system which may be effectively constructed in the real world, it is essential to have an accurate model of the real world, informed by logical systems processing, scientific research, and artificial sensors. This model should be as accurate ("lossless") as possible, because it will be used to inform design and final, real world product.

In concern to modelling the real world, the goal is to compress all the data associated with the real world, optimally, into a computational representation (a.k.a., model) of the world with which individuals, and together, everyone, can work on human projects (and at a societal level, on projects that ensure human fulfillment and planetary ecological regeneration).

8.8.4 Project-level objectives

> **CLARIFICATION:** *Project objectives go by multiple different names depending on context; other common names for a project objective include, but are not limited to: strategic direction, strategic imperative, mission, vision, goal, purpose, endeavour, target, etc.*

Every project has a top-level [project] objective to complete the project. This project objective may be sub-divided into a set of [project] sub-objectives related to the categories of material realization. These material realization categories are sub-defined within the project in terms of information flows, tasks, resources, and time (a schedule), and budget (*in the market*).

At the project sub-objective level, objectives are orientational. Project sub-objectives delineate and define what is to be delivered and how it is to be produced.

The objective of a project (which exists as a conscious intent outside of the project). The project's [systems-level] objective(s) is the tangible end product or result that the project team must produce and deliver. The projected systems-level objective is an objective description of what is to be produced and delivered. These objectives state what the project will accomplish in terms of the user's intended value to be achieved.

> **NOTE:** *The term "charter" is sometimes given to the document that lists the full set of project systems-level objectives.*

8.8.5 Community-type society objectives

For a community-type society the objectives include, but may not be limited to:

1. Core objectives (direction indicators, values, at the highest level):
    A. Freedom.
    B. Justice .
    C. Efficiency.
2. Stabilizing objectives:
    A. Learning and integration.
    B. Health and vitality.
    C. Appreciation and compassion.
    D. Regeneration and abundance.
    E. Openness and sharing.
    F. Cooperation and collaboration.
    G. Intrinsic motivation.
3. Evaluation-side (result indicators, at the highest level):
    A. Human fulfillment objectives.
    B. Ecological flourishing objectives.
    C. Economic sustainability objectives.

9 [Project] Deliverables

A.k.a., Work products, work outcome, change deliverables, project outputs, resulting usable objects, work or task output.

A deliverable is a specific, tangible product or thing; an object and/or information packet. One or more deliverables may contribute to achieving an objective, but an objective is not a deliverable. A deliverable is anything produced or provided as the result of a process (i.e., service, operation, etc.). A deliverable is a pre-defined, tangible work product (i.e., the output of time working). A deliverable can be informational and/or material. More generally, a deliverable is an output, something produced or provided as the result of a process. Process is another word for task or action. A work product is any tangible item that results from a project function, activity, or task.

When there is any change, there is an event, and a result. Deliverables are the output/outcome of activities (which complete to produce the deliverables). Deliverables must be aligned to objectives (intention). Deliverables are linked to the tasks (work) that produce them. A deliverable is a grouping of project work elements (tasks, actions, activities, executions, etc.) shown in graphical display to organize and subdivide the total work (as a visual information "scope" of a project). A deliverable involves the reducing of work into tasks, and ultimately, scheduled state changes in the extant, real world. A deliverable is a tangible or intangible (or service, combination) output of a project.

At the societal-level, there are two main project-related deliverable life-cycles:

1. **The project life-cycle:** There are **project-level (information) deliverables**, specified by information standards and practices.
   A. Project coordination deliverables (Read: the project's information-level)
2. **The product life-cycle:** There is **the project's deliverable(s) specified by a user** in relationship to a pre-existing environment that an InterSystem Team sustains.
   A. Product deliverables (Read: the system under project development)

Table 4. *Example deliverables, include, but are not limited to the following types.*

Deliverable No.	Deliverable name
1	Societal specification standard
2	Education materials
3	Software system
4	Hardware system
5	Demonstration experience
6	Dissemination platform
7	Geopolitical analysis and relationship development
8	Habitat site (including, selection)
9	Sufficient market-State currency
10	Habitat service system
11	Human will

9.1 Project deliverable diagram - Work breakdown structure (WBS)

A.k.a., Work process organization.

A project deliverable diagram (and list) is also known as a work breakdown structure (WBS). The basic formula for a WBS is to take the complete scope of a project, break it up into pieces, then organize them into a logical hierarchy. All the items at a lower level are needed to complete the item at the next highest level. A work breakdown structure (WBS) is a key project deliverable that organizes a team's work into coordinated sections work coupled with a deliverable. The work breakdown structure visually defines the scope into categories that a project team can understand, as each level of the work breakdown structure provides further definition and detail. An easy way to think about a work breakdown structure is as an outline or map of the specific project. A work breakdown structure starts with the project as the top level deliverable and is further decomposed into sub-deliverables, which are the output tasks (work). A project team/coordinator creates a project work breakdown structure by identifying the major functional deliverables and sub-dividing those deliverables into smaller systems and sub-deliverables. These sub-deliverables are further decomposed until a single entity (person or machine) and all necessary resources can be assigned. At this level, the specific work packages required to produce the sub-deliverable are identified and grouped together. The work package represents the list of tasks or "to-dos" to produce the specific unit of work represented as a deliverable on the work breakdown structure diagram.

A project deliverable diagram describes (visualizes and lists) the specific activities (delineated into tasks) that must be completed for the project to be complete. More simply, a project's work is broken down into a visual structure -- a project's work is broken down into a usable structure. The WBS is a hierarchical arrangement of major tasks that need to occur in/during the project. Within each of these major tasks there are typically a number of sub-tasks that describe the major task in more detail. These sub-tasks can have their own lower level sub-tasks, and this can be broken down to multiple additional levels depending upon complexity (requirements).

Work breakdown structures are typically visualized as hierarchy diagrams. It is common practice to include time (and in the market, cost) estimates in the WBS diagram. It is important to number the diagram with each sub-task as a decimal integer of the whole number primary task (e.g., 1.0 > 1.1 > 1.1.1 > ...). These numbers are used for: InterSystem team task selection/divisioning and accountability; monitoring activities and schedule alignment; and allocating resources (in the market, allocating budgets). A work-breakdown structure (WBS) in project management and systems engineering, is a deliverable-oriented breakdown of a project into smaller components. A work breakdown structure is a produced information set that hierarchically (by priority) lists all deliverables. A deliverable is an outcome or a result of something. A deliverable provides some value to the project [service] users.

A work breakdown structure identifies all the work (i.e., task, action, doing, activity). A work breakdown structure is a top-down decomposition of deliverables into work packages, which are made available to community contribution.

The work breakdown structure (WBS) represents 100% of the deliverables (given current knowns). A project work breakdown structure may be visualized as a hierarchy chart (of work/task/action packages). The work breakdown structure visually defines 'outputs' of the project at a sub-project level. A work breakdown structures states that the project will produce the worked deliverables in the visualized structure. The WBS provides a hierarchical depiction of all the work outcomes. It is created through progressive elaboration (i.e., it is a "living" document). 100% of what makes up the outcome of the project is listed in a hierarchical chart known as the work breakdown structure.

The WBS, on the other hand, is agnostic to timing, effort, and costs. It only represents what needs to be produced as a result of the project and it.

- **Deliverables** all start with nouns (things to be produced as part of this project) - these are associated with the 'work breakdown structure'.

CLARIFICATION: *Work deliverables (WBS) are described via nouns, whereas schedule activities are described with verbs.*

The WBS tool functions to:

1. Interface: Deliverable-oriented view of the project work - list and visualize deliverables.
2. Organization: Hierarchical grouping of the work outcomes required to meet project objective. In other words, a hierarchical list of project deliverables (outputs).

Type of WBS (always represents tangible deliverables to be produced):

1. **Project WBS** (**product deliverables or project-level deliverables**, specification or blueprint) - all of the components of a product being developed. Projects are initiated to produce specific, unique outcomes based on specific, unique needs. That intention and need must be expressed (delivered) in some tangible form, whether it's a system, a product, a process, an object, a plan, a rule, or some other outcome.
2. **Service WBS** (**service deliverables or operations deliverables**, specification or blueprint) - all of the components of a service provided to a user.
3. **Process WBS** (**process deliverables or method of delivery, mechanistic deliverables**, specification or blueprint) - all of the components of a process or methodology used to coordinate work to provide service to a user [in the form of a product]. All work goes through a set of organizational process, conveying the conditions of being planned (planning), scheduled (scheduling), executed (coordination and monitoring), and assessed (assessing).

For example, a project to produce a bicycle may have the following WBS:

1. The top level of the system (e.g., a bicycle).
2. The 2nd level systems (e.g., frame set, crank set, wheels, braking system, shifting system, project integration)
3. The 3rd level systems (e.g., frame set - frame, fork, handlebar, seat; crank set - pedals, chain; project integration - prototype approval, product test, quality sign off, project management; etc.)

9.2 Product breakdown structure (PBS)

The product breakdown structure (PBS) is a tool for analysing, documenting and communicating the outcomes of a project, and forms part of the product based planning technique. The PBS provides an complete, hierarchical tree structure of deliverables that make up the project, arranged in whole-part relationship. In other words, a product breakdown structure is a hierarchical structure of deliverables that the project will make or outcomes that it will deliver; it decomposes a project product into its constituent parts in the form of a hierarchical structure.

10 [Project] Tasks

A.k.a., Activities, event, action, job, work, process, procedure, instruction, energy.

A task is some amount of work that must be completed within a defined period of time, or by an output date. Tasks exist due to conscious imperatives or automated directives. A "work instruction" describes how to perform a task within a process, which is a more detailed portion of a procedure. Here, task designation is the systematic and purposeful allocation (assignment) of tasks to individuals and groups within an organization. Task-based models chunk effort into short "doable" segments. The purpose of anything (humans, any organism, machines) results in tasks. A new form creates a new task[ing] space.

A task/activity is a distinct, scheduled portion of work performed during the course of a project. An activity is a task that is identified, assigned, executed and controlled as part of a project. Activities are work packages of work[ing roles] available for contribution. Scheduled (i.e., temporally associated) tasks are also known as activities. The activity is what is done to achieve the objective of the task. An activity can be a specific action or a process (it is another word for a task), and many activities will likely be involved to meet project objectives. Activities contribute directly to achieving the objective, and thereby the goal [of the project].

Activity diagrams shows the activities involved in each project coordination process (activities are tasks). All activities occur to complete/meet requirements. The objectives of requirements management activities include collecting, documenting and organizing the requirements, linking requirements to activity items, tracing requirements through execution of activities, and tracking and communicating this information to all stakeholders. This is necessary to ensure that the requirements and their activities are properly handled throughout the project life cycle.

Generally, in project management, the terms "task" and "activity" have similar but different meanings:

1. Task is associated with the input 'requirement'.
   A. Activity is associated with output 'schedule' (as in, the time-binding of tasks).

In this sense, activities are [tasks that are] time-bound within a schedule, which is interconnected (i.e., flows) to a requirement-bound deliverable structure.

NOTE: *Tasks are associated by project, which are issues.*

Tasks that machines carry out are human tasks and not machine task. Machines do not and should not carry out tasks for their own sake. All tasks are human tasks, and machines are extensions of humans that carry out human tasks. As machines become more self-aware, the distribution of all [human] tasks will likely happen more autonomously and intuitively. Over time, humans have increased the number of machines they use, thus extending their circle of tasks (i.e., expanding human task ability).

NOTE: *All work requires tasks. Multiple parallel tasks require coordination processing: [en]rolling and scheduling of tasks.*

Tasking terminology includes, but is not limited to:

1. A **process** states what needs to be done and why. A process is any activity or set of activities that use resources to transform inputs into outputs.
2. A **procedure** states how the process needs to be done. A procedure is a uniform method that outlines how to perform a process.
3. A **work instruction** explains how to carry out the procedure. A work instruction describes how to perform a task within a process.

10.1 Task analysis

A.k.a., Analytical task granularity, activity analysis.

The standard definition of a task is "a piece of work to be done". In more complex terms, a task is a package of information, that when acted based upon by an actor, together produces some qualitative or quantitative result in the status (or state) of a system.

Through project coordination a task analysis becomes a work order (work package), which enters wider scheduling.

APHORISM: *It is when we choose to resolve existence, as a whole, that sufficient information becomes available to see how we can live together in fulfillment.*

In this project plan, task analysis is one deliverable (i.e., element/component). Task analysis is

1. A formal method of describing and analysing actions performed by people and/or systems.
2. The analysis or a breakdown of exactly how a task is accomplished, such as what sub-tasks are required.

In concern to tasks, there are two types of task analysis:

1. Task analysis (high-level) - the work needed to accomplish a large goal broken down into sub-goals and major tasks.
   A. Procedural analysis (low-level) - the specific steps and decisions the user takes to accomplish a task.

A task analysis aims to understand at least these three elements:

1. The users (the creator of the issue).
2. The tasks that are performed (to resolve the issue, activities).
3. The environment (in which the tasks are performed).

Tasks typically involve:

1. A clear start and finish (e.g., requirements and requirements review)
2. Involve discrete steps (e.g., task breakdown)
3. Result in a change of status (i.e., they require energy, work, effort, action, motion, change, etc.)
4. Are specific to clearly defined circumstances (e.g., sufficient unification for situation awareness)

Task analysis data is collected, integrated, and then visualized in a hierarchy.

The purpose of task analysis is to analyze how the user interacts with the space system and to define the tasks, which direct design concepts and decisions. Task analysis is a methodology used to break an event down into tasks and break tasks down into components. A task analysis identifies system-level and subsystem-level tasks, to determine operator needs for established mission objectives and concepts of operation. It is used to understand and thoroughly document how tasks are accomplished. The focus for the analysis may be on how a human(s) perform tasks, how a machine(s) perform tasks, or a combination of both. Task analyses should be performed for all functions for the established system objectives, scenarios, and ConOps. Task analysis is an essential component of human-centered design, focused on providing usable systems for humans throughout a system's entire life cycle. Task analysis is a fundamental design activity necessary for implementing many human system requirements. Task analysis refers to a family of techniques that involve the systematic identification of the tasks and subtasks involved in a process or system and the analysis of those tasks (e.g., who performs them, what equipment is used, under what conditions, the priority of the task, and dependence on other tasks).

An iterative approach to task analysis enables the identification of current and future task demands that can aid in decisions, such as which tasks should be allocated to a human or to an automated system, or how system components should be used. Task analysis also results in the identification of critical team tasks, which are tasks that are absolutely required and necessary for team to successfully accomplish operations and meet project (service or mission) objectives. Critical team tasks may occur nominally or off-nominally and include tasks that are essential to team health or, if done incorrectly, may lead to loss of life, loss of project, or undesirable habitation states (through to, loss of habitat).

NOTE: *Identifying these tasks early, can enable efforts to be made to implement designs that reduce the probability of mishaps or errors and allow crews to perform tasks within expected time limits and environmental conditions.*

Task definitions should evolve as the system capabilities, including the user, become better defined through the conduct of activities in the iterative human-centered design process.

In the context of a human user, it is possible to define the physical and cognitive tasks that must be accomplished, and to describe pertinent task attributes such as:

1. User roles and responsibilities.
2. Task sequence.
3. Task durations and frequencies.
4. Environmental conditions.
5. Necessary clothing and equipment.
6. Constraints or limiting factors.
7. Necessary user knowledge, skills, abilities, or training.

The process of conducting a task analysis commonly involves:

1. The associated decomposition of physical and mental (i.e., cognitive) activities.
2. Activity frequency and duration.
3. Task allocation.
4. Inter-task dependencies.
5. Task criticality and complexity.
6. Environmental conditions.
7. Necessary hardware, software, processes (e.g., clothing and equipment).
8. Any other unique factors involved in or required for one or more people to perform a given task.

10.1.1 Societal-level task analysis

The proposed societal systems highest level task analysis categories are:

1. Lifestyle analysis - of a user's/person's typical day or week; "a day in the life of", "an evening with", "a month in the life of". Here, what is needed and preferred is identified.
2. InterSystem Team Work analysis - all the goals and tasks that someone does in a specific role, and all deliverables - daily, monthly, over long periods. Here, it is described how work moves from person to person.

For example:

1. Personal access:
   A. User self-cultivates at (@) personal dwelling.
   B. User self-cultivates at (@) personal garden zone.

2. Common access:
   A. User schedules at (@) common eating area.
   B. User schedules at (@) common recreating area.
3. InterSystem Team access:
   A. User harvests/forages at (@) culturing zones for foraging.
   B. User serves at (@) culturing zones for food harvesting and processing.

10.1.2 Operations tasks

InterSystem Team operations has the following requirements:

1. Provide system operational availability that meets requirements. Operational availability is a factor that describes the amount of time that a system can perform its function as a fraction of total time – including downtime for maintenance.
2. Monitor the environment (e.g., sensors and surveys). For example, the degree of presence of toxins and "toxic" relationships, either microbial, physiochemical, or psycho-social must accounted for in design. The build-up of toxic substances in a tightly closed environment (e.g., the "tight building" syndrome) is a design challenge.
3. Enable, disable, and monitor processes and capabilities.

10.1.3 Construction tasks

The habitat service system is constructed modularly. Each module has a repair and replacement lifecycle (a duration of existence):

1. Test/Prototype construction.
   A. Prototype fidelity:
      1. [Medium to high fidelity] A prototype is a model of the system delivered in the medium of the system.
      2. [Low fidelity] A mock-up is a representation in a different medium.

Tasking roles include, but are not limited to:

- Engineer or technician - A person who is skilled (has procedural and semantic knowledge) in designing, diagnosing, developing, constructing, maintaining, and repairing technical system (Read: any information or material system).

The following habitat oriented terms are effectively synonymous, but can be loosely separated to mean:

1. Engineering (Engineering/Decisioning as planned) - Development of system and System integration.
2. Technician (Operating/Operations decisioning) - Integration of design and System operation.

10.1.4 Maintenance tasks

In general, maintenance refers to inspection and monitoring, repair, replacement, and updating. Technically maintenance only concerns those tasks necessary to maintain a service once its integration has achieved final valid and verified integration.

Maintenance can be a complementary means to restore fault tolerance, non-critical functions and system/human safety. Because movement is limited by physical mechanics, transport time, and mass and volume constraints, maintenance provisions must be available on [each habitat-city] site.

Tactics to ensure efficient and safe maintenance include:

1. Advance deployment of spares.
2. Component commonality.
3. In-situ manufacturing.
4. Low-level repairs.
5. Autonomous training and procedures.
6. Robotic implementation and preventative attention.

Unless impractical, all equipment that may require maintenance will be located internally; and whenever possible, all external items should be detachable so they can be moved to an interior space for repair. In general, human time and logistics demands must be minimized and conducted under the safest possible conditions.

10.2 Tasking

A.k.a., Task prioritization (task triage).

It is possible to intentional design the next expression of a system to meet a set of desirable conditions (conducive of fulfillment). And, those conditions that remove the likelihood of fulfillment, when included as data, set up a task/time/resource prioritization hierarchy, commonly known as 'triage'. As a continuous systems or a systems level process of prioritizing task systems (tasks, supra and sub).

At a high-level, tasking involves:

1. Identify task.
2. Identify task completion date.
3. Duration (as a probability) is assigned to each task.
4. Resources (as a probability) are assigned to each task.

10.2.1 Task complexity

Task complexity (within the scope of a project) is broken down into two categories of effort:

1. manual skills, and
2. cognitive intelligence.

All tasks (i.e., work) contain both a manual element and a cognitive element, and require both types of effort. Intelligence underscores the interconnected nature of work within a project, emphasizing that successful task completion relies on physical and intellectual ability.

10.2.2 Task dependency

A task 'dependency' is when one task cannot start or complete until another one has been finished, because the later requires (relies on) a resolved output from the earlier task.

10.2.3 Task scheduling

Task are typically scheduled, but when there are incidents, tasks are not scheduled, but needed. The strategic and systematic allocation of resources, time, and dependencies to do work at a single point in time, requires scheduling. Scheduling aims to optimize workflow, balance workloads, and meet deadlines by strategically sequencing tasks based on protocols. Various scheduling techniques, such as Gantt charts or critical path analysis, are employed to visualize and manage the timeline and [cognitive/physical] dependencies of tasks throughout a project's lifecycle.

10.2.4 Milestone

A 'milestone' is a 'task' with zero hours and zero duration, used to mark an important 'event' or 'accomplishment'. In relation to a project's direction, a milestone is a significant advance that must be made or taken (enacted). The milestones for a socio-technical society system are individual (that become social) and technical.

Because there is only consciousness, there are individual self-awareness advances, and there are material-technical advances (Read: consciousness-physics advances, a.k.a., mental-astral physics advances).

The difference between an individual consciousness advance, and a social advance, in 'conception', is:

1. For the individual, the recognition that "we are all one" becoming an integral part of self-conscious awareness, and thus, the urge to resolve social issues in some way other than by killing each other and artificially limiting access to planetary resources (i.e., these ways of deciding become obsolete).
2. For the social, there is, for example, 'social mobility', and 'no war'.

11 [Project] Work

A.k.a., Teamwork role.

'Work' is an 'activity' involving intentional motion in time -- work is scheduled in a time as 'activities'.

In any given human society, there are three types of real work:

1. **Human work (a.k.a., manual work)** - human physical and cognitive work.
2. **Hybrid work** - human work with complex machine work. Hybrid work refers to a socio-technical system composed of humans, information, hardware, and software.
3. **Machine work (a.k.a., automation work)** - hybrid hard-soft machine work.

11.1 Work description

A.k.a., Work package, articles of work, work contract, labor contract, job description, etc.

All work organizations are procedurally based upon a set of contracts of agreement to do work. All tasks and activities are "work packages" run from within projects. Work is done to output (produce) a deliverable through requirement associated tasks and time associated activities. Work packages are assigned to teams who are accountable for the completion of work. In specific, work packages can be assigned to humans, machines, or a hybrid combination. When humans agree to do work, they agree to a description of that work (a "contract").

Visualization of the work package, includes:

1. Deliverables are listed (visualized) in a 'project deliverable structure' or 'work breakdown structure' (WBS).
2. Activities are listed in a 'project schedule'.

Work packages describe

1. The what - Work.
2. The who - Who the work is assigned to.
3. The when - Within what time-frame.
4. The where - Location, position in space-time.
5. The how - The information, tools, techniques, and the -ware (hard-/soft-) systems necessary to complete the work.

11.1.1 Work package details

A.k.a., Work profile/program.

Common work package details include, but are not limited to.

1. Objectives - what is to met, maximized or minimized.
   A. Overarching objective - Strategic goal.
   B. Primary objectives - A statement of purpose expressing a desired satisfaction of required capability; related to why a system is wanted. (No numbers or values).
   C. Define a set of measures (or metrics) for each objective.
   D. Objectives state definable characteristics.
   E. Objectives describe what a system should do (function) and why the user needs it (to fill a defined need or gap).
2. Constraints - what are the boundaries.
3. Functions - what does it do. What is its behavior.
4. Access (Means) - by means of what does it do what it does.
5. Skills (human translation).
6. Number of humans involved as contributors.

11.1.2 Work decisions

Common work decision in a conceptual-spatial system include:

1. **WHAT**: Define the work (e.g., concept of operation, statement of work, etc.).
   A. **How much**: Solution resource requirements.
2. **WHEN**: Schedule the work.
   A. **To whom**: Schedule assignment matrix of human and machine systems.
3. **WHERE**: Allocate resources to the work.
   A. **To whom**: Accountability assignment matrix.
   B. **For what access**: Work-service access-decision effectiveness control.
4. **WHO**: Contribute "your" time and conscious bodily effort.
   A. **How much**: Work contribution.
5. **CONDITIONS**: Assigned role in InterSystem team.
   A. **How much**: Individual and team capability.
6. **UNDER WHAT**: Environmentally situational conditions.

11.1.3 Work execution

The interface between plan and work (a.k.a., "job dispatching" or project execution) is the allocating or assignment of tasks (jobs) to systems, teams, and machines (by a central coordinator).

11.1.4 Work-ability

A.k.a., Workable?

For a system to be 'workable', it must be capable of being coded ("changed"), and possibly, executed ("run") by another system.

Both human and machine systems can work the real world environment:

1. Information can be re-coded and executed upon by information (cognitive and computing) systems.
2. Materiality can be re-coded and executed upon by material (human and robotic) systems.

12 [Project] Stakeholders

> **APHORISM:** *May we all live in honor of one another's potential to contribute [to bettering the self and others].*

Historically, the term stakeholders was applied to 3rd party individuals or organizations that held a financial wager (i.e., held a "stake" in a financial exchange). Some stakes are bigger than others. Anyone with an interest, a metaphorical "stake" or interest in the success of an organization or action. In concern to the financial origins of the term. Project stakeholders are entities that have an interest in a given project. The project stakeholders include:

1. Those who actively participate in a project.
   A. Those who can determine the course of action, the plan, of the project.
   B. Those who take action based on the plan of action.
2. Those who are influenced/affected by a project (or project process).

In practical societal-service, the common stakeholders include:

1. **Users**: Human individuals using the service.
2. **InterSystem Team:** Engineering developers and engineering operators of the service; those who develop and operate the service (Read: those who co-operate to create and continue the service).
3. **Planetary population**: All beings that may be fulfilled or may suffer.

> **CLARIFICATION:** *Not all project stakeholders may be co-operating as working on, and using the result(s) of, a project. A given project may or may not consider a population that is impacted/affected by the project, but not deciding or enacting a project. There is a social organization internal (in affect) to a project, and there may be a social organization external (in affect) to a project. A project that does not account for some influentially affected population [by the project] in decisioning and action upon the project is said to have 'externalities'. It is the case that some societal configurations have the [fulfillment and suffering of the] planetary human population, and the population of other species on the planet, as externalities.*

When the project is in service of the market-State [incentive structure], the common stakeholders include:

1. **Users**: Customers.
2. **Employers**: Businesses.
3. **Employees**: Project team members.
4. **Citizens**: Taxable (extractable) human base.
5. **Planetary population**: All beings that may be fulfilled or may suffer.

The socio-technically conceived project stakeholders are:

1. **End Socio-Technical Users** - as people (citizens, customers, individuals among community) using the project-generated and project-operated service system.
   A. The Community of individual users.
2. **Operational Socio-Technical Users** - as people (citizens, employees, individuals among community) operating the project-sustained system.
   A. The InterSystem Team of contributors.
3. **User Socio-Technical Developers** - as people (citizens, employees, individuals among community) using the operational system to develop new systems.
   A. The InterSystem Team of contributors together with the Community of individual users, where the InterSystem Team of contributors is accountably tasked to develop the controlled habitat service system (HSS).

12.1 What is a stakeholder

A "stakeholder" is anyone who has an interest ("stake") in the outcomes of any decisioning or action in relation to a project. Identifying, mapping, and prioritizing [the flow of information to] stakeholders are important first steps in coordinating the communications for a project. Projects can only be considered successful (complete) when their stakeholders acknowledge that they are a success (validation and verification).

In concern to stakeholders, there is a need for collaboration among:

1. Those who design systems.
2. Those who operate the systems.
3. Those directly served by the operated systems (directly affected).
4. Those affected by the outcome of the operated system, but who are not directly served by the outcome (indirectly affected).

12.1.1 Personal validation

Personal validation is how facts that are possible to be verified are done so by individuals. In a participatory project, any action taken in the project is based on decisioning, and decisioning is transparent to all stakeholders.

12.2 [Project] Stakeholder register

The following table is an example register within a market-State organization (note that a community team register will have different:

Table 5. Project Approach > Stakeholders: *Table shows stakeholder data interrelationship categories.*

Stakeholder interrelationship data category	Description
Position	A unique ID for the Stakeholder
Description	A fuller description of the Stakeholder (Additional information that supplements the Name)
Influence_Power (market-State only)	High, medium or Low
Disposition	Positive, neutral, negative
Requirements	Project objectives as seen by the Stakeholder (what the Stakeholder wants to benefit from the project)
Impact on project	Project concerns that could arise due to the influence of the Stakeholder.
Strategy	Project action plan to ensure the objectives of the Stakeholder are met and that the potential Project Concerns are minimised.

A real world example of a stakeholder registry is a 2012 mapping of project stakeholders for a Kazakhstan gas plant [order-efficiency.com]. (Winter, 2012)

13 [Project] Team

A.k.a., Contributors, stakeholders, engineers, operators, personnel, crew, staff, members, participators, point-of-contact, servers.

A team is a group of people who work well together toward a measurable outcome. Teams take decisions based on expertise. A team is a group of people with complementary skills who are committed to a common purpose, performance goals, and approach for which they hold themselves mutually accountable. In a sense, a team is a human system of organization, of individuals, with the same intention for change to materialization. A team exists to do work [action in time]. Teams use tools, techniques, and resources to do their work. Tools include, but are not limited to methods, rules, procedures, protocols, practices, standards, materials, visualizations, diagrams, etc. In order [for a team] to do work, there must be the communication of information. A team carries out a multiple related tasks. A team is a collection of individuals working toward a common purpose through a similar structure. Teams of individuals "manage" themselves, although coordination may still be present. Systems exist to coordinate the roles and activities of teams.

Those who apply effective communication may be said to have internalized two statements that express the two axiomatic team cooperation-oriented principles. The following axiomatic team-orienting [in alignment] statements are written in natural non-formalized, and then semi-formalized, language:

> **Team statement 1:** *Nothing is done until the paperwork (documentation, logging, record keeping, etc.) is done. All teams require the return of data from an acted upon environment.*

> **Team statement 2:** *All team contributors share access to resources through a controlled and coordinated procedural information set.*

> **Team question 1:** *Can these personnel with this equipment and training perform their tasks to a specific standard under planned conditions?*

A 'project team' is those humans (and other information processing -ware systems) that are internal, in affect, to a project. The 'project team' does the 'work' (of actually developing and operating) a project.

In societal application, the 'work' always includes engineers (developers and operators). In Community, sometimes the 'work' includes the Community end-users themselves. 'Team members' are always 'stakeholders', but 'stakeholders' are not always 'team members'.

> **NOTE:** *A list of labels of anyone who could be considered internal to a project can extend from the 'complementary' (e.g., contributor) to the 'disparaging' (slave). In other words, the work on a project may be done willingly, or not (e.g.,*

through force and coercion).

Continuous projects at the highest societal-level are sustained, developed and operated, by InterSystem Engineering Project Teams. The highest societal-level continuous projects are the (i.e., at the level of a human habitat networked-service system):

1. **Life support** - Human core survival project.
   A. [Human core] Life-support service system and sub-systems.
2. **Technical support** - The human-interfacing -ware (Read: hardware and software) structure.
   A. [Interfaceable structure] Technical-support service system and sub-systems.
3. **Exploratory support** - Support service to facilitate exploration and discovery.
   A. [Human developmental] exploratory support service system and sub-systems.

13.1 Team-based lateral approach

QUESTION: *What organizational work structures are there other than teams?*

A team based lateral structure is an organizational structure that groups individuals working within the organization into teams that perform specific job functions. As the individual team member's abilities increase, so does the performance of the entire team. Being a part of an inter-disciplinary team means you are willing to fulfill your designed, selected, and assigned responsibilities.

A team-based lateral organizational structure is similar to a traditional lateral structure, in carrying less overhead management to cause delays in decisioning and implementation of best practices or new ideas. With no need to climb a lengthy chain of command to receive approval for ideas or changes to the operations model, a team-based lateral structure can make necessary changes on the fly and allow for rapid response to different conditions.

By spreading the responsibility among team members rather than having a single individual in charge of decision-making or management, decisions are arrived at and action can occur rapidly as team members can be assigned to research areas of need, implement changes, or work on other problems while other team members continue to focus on the current situation. Decisions arrived at by a team are sometimes better thought out and more effectively implemented than decisions made by a single individual. This is why the team exists, because everyone in the can work a specialized problem and trust that the others are working and taking decisions effectively in their specialized areas. A team-based organizational structure can eliminate traditional scalar chains of command, which can cause delays, frustration, and can limit an individual's choices due to a fear of reprisal.

13.2 Contribution support

A.k.a., Personnel administration.

Contribution is voluntary activity of interest toward the continuation and betterment of our community. In an extrinsic oriented society the motivation to do things is about money to provide more than destitution, to provide safety, and perhaps even, to provide luxury.

TEAM SELF-AWARENESS STATEMENT:
Good grooming can enhance self-image, improve morale, and increase the comfort and productivity of the team. An aesthetic surrounding can enhance nature connection, improve morale, and increase the felt well-being of everyone.

Because people sign up, instead of having someone assign them, management-type work is highly reduced if not eliminated entirely. In community, skills needed for a teams will be commonly available. People interested in the job can sign up to work on the team. Here, there is careful coordination between people, time, resource, and purpose.

Commonly required team skills include, but are not limited to:

1. Interpersonal skill: Is aware of, responds to, and considers the needs, feelings, and capabilities of others. Deals with conflicts, confrontations, disagreements in a positive manner, which minimizes personal impact, to include controlling one's feelings and reactions. Deals effectively with others in both favorable and unfavorable situations regardless of status of position.
2. Team skill: Establishes effective working relationships among team members. Participates in solving problems and resolving decisions. Identifies where and when action is needed, is willing to make decisions, render judgments, and take action. Accepts responsibility for the decision, including sustaining effort in spite of obstacles.
3. Continual learning: Grasps the essence of new information; masters new technical and knowledge; recognizes own strengths and weaknesses; pursues self-development; co-operates well, seeks feedback from others and opportunities to master new knowledge.

In concern to integrity,

1. Personal integrity – taking care of your physical and mental health. Personal integrity is interconnected with social integrity.
2. Social integrity – working for the sustainment of the community, reducing conflict and power structures,

establishing trust, and engineering and operating services.
3. Ecological integrity – ensuring the integrity of our ecological resources and cycles, together.

13.3 Accountability

A.k.a., Responsibility.

Accountability of tasks involves four categories of communicable information:

1. Responsible:
   A. Identify who (the role that) takes the action.
   B. If leader and follow action scenario, then decide who leads and who follows.
   C. An entity responsible for taking action (i.e., completing an activity).
   D. Responsibility level is determined by individual who is "accountable".
2. Accountable:
   A. An entity with objective decision authorization (authority).
   B. An entity accountable to an objective.
   C. Generally, only one per goal.
3. Consulted:
   A. Notified (kept "in the loop").
   B. Person consulted for input, information, insight and perspectives before a final decision is resolved.
   C. Two-way communication.
4. Informed
   A. One-way communication.
   B. Normally after activity has been performed or a decision has been taken.

The accountable person may, or may not, also be the responsible person.

13.4 Individual status

Under appropriate procedural conditions, team members are monitored (where appropriate) for their performance, which is operationalized through (note, this monitoring generally only occurs in high-risk team situations; e.g., astronauts); however it is good for any contributor to know their limits (and necessarily, the categories), thus making the team safer overall:

1. Physiological status (and, % remaining).
2. Cognitive status (and, % remaining).
3. Psychological status (and, % remaining).
4. Are team members alive, healthy, and happy?

Individual utilization metric & design efficiency:

1. Ratio of [self-]resources used per task (and, over total duration):
   A. Use of physiological resources (and, resources used/total number of tasks).
   B. Use of cognitive resources (and, resources used/total number of tasks).
   C. Use of psychological resources (and, resources used/total number of tasks).

Note: It is clear the metrics that are needed must measure the physiological, cognitive, and psychological state of the an appropriate team member (here, "appropriate is dependent on role/context).

13.5 Team decisions

Teams arrive at decisions the same way proposals are taken for changes to the kernel; the same way the decision system resolves decisions. Each proposal (i.e., solution, decision) is given a numerical score (measurement); supplementary measures are calculated. The criteria lead to the ranking of solutions. A threshold may exist beyond which a solution is acceptable and/or is not acceptable. Team members are trained to follow procedures. Machine team members are operated to follow instructions. Some procedures are more open ended in their separation of conclusions between team members decisions (i.e., the team members will reach different conclusions to the same decision), and others are more closed ended (i.e., the team members will reach the same conclusion). The intention is always closed ended solutions (of 99% certainty at its greatest).

13.6 Team indicators

Team task indicators:

1. Achievement is progress toward a set goal.
2. Knowledge is relevant material for a task.
3. Effort is time and resources used on task. Effort is time on task.

13.7 Team expectations

CLARIFICATION: *Responsibility is the essence of self-direction (or self-regulation). Accountability is the essence of social-direction (or, social-regulation). To accept responsibility people have to define, understand, and take decisions. In the market-State, the tendency is for management to hand the operational people an output of redesign thinking done by others, and expect them to work it. Expecting also, the supervisors to supervise the implementation of a design that management has completed. Alternatively, organizing for real teamwork is a process of getting everyone involved in the total systems improvement.*

For every project, the team must have access to the right tools for the right problem. Understanding the context of use for a particular technology requires asking the right questions. For example:

1. Why is this technology being used? What task and/or process is it being used to accomplish?
2. Who are the end users for this particular technology? What are the characteristics of the end user population (e.g., age, physical and mental capabilities, technical aptitude)?
3. What are the characteristics of the technology itself? What are its component features? Is it fixed or portable?
4. When is this technology used? What triggers the process/task the technology is used to carry out? At what point in the process/task is this technology used? How frequently is this technology used on an hourly, daily, monthly, etc. basis?
5. Where is the technology used? Are there any environmental characteristics – such as dust, lighting conditions, or noise – that may impact the functioning or effectiveness of this technology?

Define what is expected in terms of performance early and clearly and then support adaptations toward appropriate means by which the group can achieve ends. However, do not over-specify -- this is an adaptability principle, which recognizes that we are designing living systems rather than machines. With living systems, the same ends may be reachable by different means.

There are a lot of ways to solve problems and meet a user/community needs. What is critical here is the definition and understanding of the end goal. The "what" is to be highly specified. The "how" is open to local decision and initiative. This enables learning and an increased sense of "efficacy" on the part of team members. Efficacy is the sense that "we" are effective as a team that we can make a difference and do the work well. Efficacy is "fragile" and needs to be supported by continuous learning and improvement.

Teams have to be deeply involved to determine what and where information is needed for self-direction. There needs to be a societal (Read: community) commitment to provide information and resources for task performance and learning. Information has to be provided where it is needed for self-direction, learning, and task improvement. Control has to be subordinated to achievement.

13.7.1 Expected team requirements

To operate effectively, teams require social and or technical ability and access, involving:

1. Knowledge (concept memory).
2. Skill (behavioral memory).
3. Technology (useful material composition).

13.8 [Project] Team standards

APHORISM: *A group of people who correct one another can help one another.*

Even when internal standards are well designed, they can break down. Personnel may misunderstand instructions. They may make judgment mistakes. Or they may commit errors due to carelessness, distraction, or fatigue. Temporary personnel executing control tasks for sick personnel might not perform correctly. System changes may be implemented before personnel have been trained to react appropriately to signs of incorrect functioning.

13.9 [Project] Team categories

Any given Project Team may be assumed to be composed of all of the following three identity categories (colloquially called, "stakeholders").

Any given Project Team is composed of those individuals and systems:

1. **Who are impacted by the work**?
   A. When common heritage resources and a common ecology are impacted, then the whole human-social population is impacted to some probably observable degree of 'certainty'.
2. **Who will do the work**?
   A. The InterSystem Team of Habitat Service System 'Engineers'.
3. Who have **user/customer expectations from the work** to be, or being, done?
   A. The two accessing populations:
      1. The population of individuals, individuated units of human consciousness. Individuals among the community population.
      2. The population of engineers that coordinate and operate the materialized habitat service system. InterSystem Team members (Read: contributing individuals).

For any team structure, there are categories of organization:

1. **Manpower (humans)** refers to the number and type of personnel who operate, maintain, support, and provide training for systems.
2. **Personnel (skills)** refers to the human aptitudes, skills, and experiences required to perform the jobs of operators, maintainers, and support personnel.
3. **Training (education)** prepares personnel to perform the tasks necessary to meet the mission or goals and objectives of the system. Development of training requirements, methods, curricula, and training system design are important parts of the

overall system design process. The length and intensity of training depends on the background, ability levels, and learning styles of the personnel in the training class; the complexity of the system; and the level of skill and knowledge needed to ensure the desired level of performance speed and accuracy. Some training is designed for individual task performance; some for team or unit-level performance. Note that an important input to effective training is a task analysis that identifies the skills and knowledge needed for acceptable performance. Inadequate training can result when work and task descriptions are outdated. Training deficiencies may also result from failure to allocate the necessary training time and budget, lack of flexible training schedules needed to meet learning requirements, and lack of useful proficiency criteria.

Manpower, personnel, and system design decisions should take into account the level of training needed and the feasibility of delivering that training in the allowable time frame.

A team has two fundamental skill-sets:

1. Practical skills (do work):
   A. Practical skills, capabilities and knowledge relevant to the task.
2. Communication skills (intercommunicate):
   A. Present and receive ideas easily between team members. Ability to use a range of communication and visualization methods, and communication techniques should be well documented.

13.10 [Project] Organizational mapping

A.k.a., Organizational chartting, hierarchy chartting.

Teams belong to organizations, and both organizations and teams can be mapped/chartted. Organizational charts are the graphical representation of an organization's (or team's) structure. Its purpose is to illustrate the relationships and chains of communication (or, command in the case of hierarchies) within a social organization. Names, roles, titles, etc. are generally depicted in boxes or circles with lines linking them to other person's in the organization. By looking at the organizational chart, people can gain a quick understanding of how the organization is designed, its number of levels, and where each person fits into the organization.

13.11 [Project] Team and group personnel selection

Project teams and working groups are composed, in part, of personnel (Read: humans). The selection of personnel involves an algorithm that is highly weighted by qualification (subject matter expertise), interest (including curiosity and motivation, and effective communication. Team and group members are individuals with a strong knowledge (and skill) in the subject matter, and also have the ability to understand and be open to multiple points of view.

In concern to qualification, a team is significantly composed of individuals using tools. If a tool user doesn't understand the correct use and safe operation of a tool, then the user can hurt themselves and others. Tools are useful to the extent that the user understands their operating capabilities and safety parameters (or, the degree to which they provide certainty and uncertainty). Any mechanic or philosopher will tell you that tools can be used in a wrong way. How a tool is used is often more determinant on the outcome than the fact that it was used.

Working groups nominate experts (or members) who have requested nomination to participate on teams. The algorithm (software), council (project coordinator team or technical council), or vote, then selects the nominees. This same process can be used for the selection of working group members themselves.

All working group and team members have the responsibility to attend working group and team meetings. A member of the public may attend and observe, but not participate, in working group meetings.

A working group may choose to invite other individuals with special knowledge and expertise related to the priority issue to attend meetings to provide information and/or advice. Advisors will be encouraged to participate in discussions, but shall not participate in the decisioning of the working groups.

> *"We become what we behold. We shape our tools, and thereafter our tools shape us." [The presence and use of tools and technologies affect how we look at the world and how we behave. Think about how airplanes change your perspective on distance.]*
> *- Marshall McLuhan*

13.12 [Project] Team member attributes

Any given project [human] team member has the properties of personality and capability. Team member personality ("attitude") and capability ("skills") are controllable at the team level by means of team composition (Read: staffing a team with certain individuals possessing the specific personalities and capabilities desired). Education and training are self-development activities aimed at improving certain personalities and capabilities before or during projects.

> **APHORISM:** *Those who receive a service from me, receive fulfillment without lessening mine, receive light, without darkening mine (Read: a true social contribution model).*

A [project] team requires individuals with intelligence and ability to compose and to operate a set of components that work effectively.

13.12.1 Role

A **role** is a task related to a function. A role is the continuous carrying out of specific tasks inside a temporal [project] context.

13.12.2 Personality

A.k.a., Intra- and inter-personal composition, attitude.

Whereas personality is all those feelings, thoughts, affects, desires, language, and ideas that expressed, or likely to be expressed, by an individual human. There are some InterSystem positions where personality type is a requirement and there are personality sub-elements (e.g., feelings and language) that are unacceptable given that InterSystem team position. For instance, a nurse must have a personality that is likely to positively influence, and unlikely to negatively influence, the well-being of someone whom they are treating. Personality is required for efficient task completion - the task is unlikely to be completed well unless the individual completing it has the desire and personality structure to do so well.

13.12.3 Capability

A.k.a., Skill, ability.

Team member "skills" are the requisite abilities held by individual team members, which enable them to complete their tasks within the team setting. Capability is required for effective task completion - the task cannot be completed unless it is known how to complete the task.

Teams are partly composed of individuals with capabilities:

1. Technical skills (technical abilities, capabilities).
2. Social skills (interpersonal abilities, capabilities/ feelings).

Social skills include, but are not limited to, the ability to:

1. Perceive another's point-of-view.
2. Involve others in the work process.
3. Understand the technical and organizational constraints the team must confront.
4. Work collaboratively.
5. Follow protocol.
6. Share.

13.13 [Project] Team organization

Naturally, a team [work] organization is an identity in which the activities of individuals are coordinated, motivated, and supporting between each other in order to reach some common target or goal (i.e., the completion of a set of requirements formed from objectives) that requires work and structure.

13.13.1 Team work **organization**

A.k.a., Team organizational structures.

The computational sub-structures of team include, at a high-level:

1. **Role structure** - people interact based in how their roles are supposed to interact as part of an explicit organization. In a role structure, people know how to interact be abuse their role and its relationship to others roles are define.
2. **Team structure** - the roles are nested in a team structure.
3. **Organizational structure** to support coordinated adaptation.
4. **Control structure** to determine how to keep this distributed set of people in sync as the plan is evolving.
    A. *Use version control* to enable reconfiguration of the organizational structures:
        1. Branching - a branch is a copy of an organization that is referenced back to a point in time)
        2. Merging - a coming of two into one.

In an open and contributive organization, any member if the organization can branch, edit, and make pull requests against any organizational structure: roles, teams, tasks. Pull requests are reviewed within a core decisioning framework, and if selected (as the solution) will be merged (e.g., in GitHub through a three-way diff).

13.13.1.1 The dimensions of team organization

The common team organizational dimensions include:

1. Priority.
2. Interaction patterns.
3. Values (norms of engagement).
4. Decisioning logic objectives.
5. Feedback.

13.13.2 Team work **co-operative organization**

A.k.a., Cooperative work environments.

Access to information is available to all team members who can see the same instance of information as other team members, provides a single, unified source of awareness with which to engage together.

A continuous information system means that all digital data can be connected and every piece of digital content can be made aware of all other digital content. Therein, modifications can be more predictably visualized.

13.13.3 Team work **co-operational knowledge**

A.k.a., Social cooperation knowledge areas.

Project-level social coordination and collaborative action require the following necessary operations on the part of individuals whose interests and/or actions are interrelated:

1. **Cognition** of a problem-solution, the project.
2. **Visualization** of the [problem] situation.
3. **Coordination** of a solution.
4. **Communication** of a plan of action to execute the solution into realization (into real-time).
5. **Execution** *(realization)* of the plan by means of development (design and construction); the ability to execute the task at a certain level/condition of performance/quality.
6. **Evaluation** of the execution and results (accountability alignment with pre-decisions).

13.13.4 Team work **recursive operations**

Whereas, 'operations' means the work (or tasks) done, 'design' means the work (or tasks) to be done in a future operation. Note that this set is recursive, because doing the work of determining what is to be done in a future operation is itself work (or, a task).

In other words, the recursion (recursive reason) for understanding the Inter-System nature of the Teams that create and maintain a working human fulfillment service system is:

1. **Operations** - the work/tasks done (as visualized).
    A. **Operations are designed.**
        1. Note: the "Inter-" part of InterSystem Team.
    B. **A system is operated** through a design.
        1. Note: the "-System" part of InterSystem Team.
    C. **A team is operated** through a protocol.
        1. Note: the "Team" part of InterSystem Team.
2. **Design** - the specific[ation] plan (as visualized).
    A. **Design is an operation.**
        1. Note: the "Inter-" part of InterSystem Team.
    B. **A system is designed** through an operation.
        1. Note: the "-System" part of InterSystem Team.
    C. **A team is designed** through an operation.
        1. Note: the "Team" part of InterSystem Team.

13.13.5 Team work **planning activities**

The project team has responsibility for conducting project activities, which may be viewed from the 'work' perspective (information set) through two methods:

1. **The checklist** [method] to visualize ("tell") the team member, *what to do*.
    A. Identify tasks [through tasking, as in, the accountable itemizing of a 'work' function].
2. **The schedule** [method] to visualize ("tell") the team member, *when to do it*.
    A. Relate tasks to time [through scheduling].
3. **The plan** [method] to visualize ("tell") the team member, *what 'it' (i.e., that with shape) is*.
    A. Relate objective to task and time [through planning].

Team members have a continuous interest in observing the state of the project. Therein, team members have (or are likely to have (because, they have an interest in the project): 'Is' questions about their project, such as:

1. Who is asking for the project?
2. Why is the project asked for?
3. What is the expected outcome from doing the project?
4. Who is affected by doing the project?
5. When is the project being done?
6. How is the project to be done?

These 'is' questions comprehensively relate the project objective to the task (work) and time, and are thus, inquiries that compose the information space/set of a 'project plan'.

13.13.6 Team work **communication structure**

In a contribution-based team setting, a 'hierarchy' is having a centralized point of communication between systems -- out of all possible entities that could communicate, one is selected for efficiency. A complex system is one that has multiple levels in a hierarchy of systems, with each level being composed of sub-systems that may themselves be further decomposed into sub-sub-systems; herein, a common team communications structure becomes a requirement for optimality.

Systems teams, in concern to their communications structure, can be identified as being:

1. Simple - For example, the InterSystem Team runs all societal-level operations.
2. Complex - For example, the system teams, of which there are three core, each with multiple sub, operate an information and material network.
3. Complex adaptive (complex adaptive system, CAS) - For example, the InterSystem team operates a second-order cybernetic information system (closed-loop control), which integrates issues and feedback while continuously resolving the most

up-to-date information and material system. All living organisms and ecosystems are complex adaptive systems. Complex adaptive systems are represented by genera (species evolve within), the human being as structuring societal organizations (such as, habitat service systems and corporations).

13.13.7 Team work **influences**

The most common influences on a work team (e.g., the InterSystem team) are:

Individual influences:

1. Attitude/feeling change.
2. Salience.
3. Elaboration.
4. Priming.
5. Knowledge and skill acquisition (training).
6. Behavior change.

Interpersonal (social) influences:

1. Reasoning (justification, logic).
2. Protocols (societal protocols and social norms).

Societal (individual and interpersonal) influences:

1. Organizational structure (unified information system structure).
2. Protocol and structural change (decisions).
3. Diffusion (of information).
4. Access (to resources, services, goods).

13.13.7.2 Manipulation

Common methods of manipulation, of which team members should be aware, include:

1. Logical fallacies (spurious reasoning).
2. Thought-stopping.
3. Goalpost-shifting.
4. Double bind.
5. Idealisation.
6. Intimidation.
7. Shaming.
8. Isolation.
9. Repetition.
10. Denial.
11. Infantilization.
12. Demonization.

The usage of a method of manipulation, itself, does not mean that the information attempting to be propagated is false.

13.13.8 Team work **structure**

INSIGHT: *There is a lot to being a person and there is a lot to being a person who contributes to society; which needs guidance.*

Common team structures include development and operations:

1. Project development work structure.
   A. Traditional development life cycle.
   B. Critical development (i.e.,traditional development sped up).
2. Project operations work (system operations life cycle).
   A. Centralized - the primary InterSystem team members are on the same work team (e.g., responding to an incident).
   B. De-centralized - the primary InterSystem team members are on different work teams (e.g., maintaining a routine energy system).
   C. Specialization - how specialized is the work group (degree of specialized skill set and variability among group members)?

13.14 Team coordination

Team coordination and collaborative action require the processes of forming, executing, and dis-forming a team involves, and involve:

1. Planning human contribution.
2. Planning resource availability.
3. Acquiring a project team.
4. Coordinating a team effort through time.

Functions of the team coordination (management) process are:

1. Coordination of information: Coordination of information is the fundamental concept of acting upon information.
2. Identification of information: Identity is the fundamental concept of uniquely identifying an object (person, computer, etc.) within a context.
3. Authentication of information: Authentication is the process of objectively ensuring trust and accountability (i.e., gaining confidence) in a claimed identity. Once identities are issued, whenever they are used, there is the requirement that the person using the identity is the person that is qualified to use it. This process minimizes decision violations (i.e., in this case, identity "theft").
   A. Revocation is the process of rescinding (i.e., "withdrawing") an identity that has been authorized. This is a process that must be properly recorded for accountability (i.e., transparency/audit) purposes. All systems and processes with which identity has been

established must now be notified that that identity was revoked. This is required to prevent continued use of the identity under potentially false and insecure contexts.

B. Authoritative [control] source(s): An authoritative controlling source exists in an organization to resolve the problem of authorization (i.e., identity formation). From a best practices and manageability perspective, it is important for an organization to make one authoritative source the main source of identity information.

C. Authorization is the category (label) to which a person or an operational entity is assigned, having gained access (i.e., authority or permissions) to do an operation or task (with a set of resources and tools). Authorization is the name of the process where requests to access a particular resource are granted (0, “go”, True) or denied (1, “no go”, False). An authorization is where the system controller (e.g., administrator or protocol) translates a user’s (or a specific group or class of users) request to access a designated set of system resources into a resolved decision. It should be noted that ‘authorization’ is not equivalent to ‘authentication’. Authentication is providing [“me”] and validating [“me”] identity. Authorization includes “me” as a variable in the decision resolution logic (i.e., execution rules) that determine what access systems the user may access, ensuring the accurate decisioning of access after authentication is successful. Service applications need access controls to allow users (with varying privileges) to use the application.

4. Provisioning of users.
    A. Account provisioning (a.k.a., user provisioning) - identity-related information associated with individuals in the unified system. Provisioning has the following functions (i.e., functional processes):
        1. The process of providing users with accounts, the appropriate access to those accounts, all the rights associated with those accounts, and all of the resources necessary to manage the accounts.
            i. Adding an identity: Initially, the identity may never have existed. As credentials of the identity are known and collected, the identity is then added, checked against the authoritative source, and the identity is then provisioned to required systems and services.
        2. Changing the status of an identity: The process of modifying (i.e., assigning, granting, changing, or removing) user access to systems (applications and databases) based on a unique user identity by creation of user accounts on target systems.
            i. Password coordination [password management].
            ii. User access premissioning.
            iii. Analytics and reporting.
            iv. User provisioning and de-provisioning.
        3. Modifying an identity: When an identity exists within an organization in which it has been provisioned and a change (e.g., merger/acquisition) occurs, the identity’s credentials may require review and adjustment in light of changes to the provisioning system’s workflow.
    B. Account de-provisioning - deals with the termination of access rights to systems and services and re-allocation of those systems and services The de-provisioning of identity is the termination of the identity that had been provisioned to services and systems. De-provisioning is critical for organizations to review and assess because accounts that are not de-provisioned in an accurate and (especially) timely manner, lead to considerable risk.
        1. Deleting an identity: Covered under De-Provisioning below.
        2. Suspending an identity: Suspending the identity basically represents the temporary halt of access to systems and services provisioned to an identity. The identity(s) are then suspended, thus suspending access to respective systems and services.
        3. Resuming an identity: Once the identity comes back the identity’s state will be resumed and appropriate resources will be reassigned.
5. Provisioning of resources.
    A. Resource provisioning - assets such as computers, databases, and applications and the management of permissions associated with those assets. Resource provisioning is the provisioning of identities to systems and services that the identity has the approved access to use.
    B. Resources may be classified as the following types of systems (and services, in the HSS context):
        1. Material (i.e., habitat, physical environment).
        2. Non-material (i.e., digital, informational “abstract” environment).

3. Computing (i.e., computational).
4. Non-computing (i.e., non-computational).

13.14.1 Team work **tasking coordination**

Teams complete tasks by coordinating among the factors of:

1. **Accountability** - individual responsibility for an organizational output.
2. **Communication flow** - the paths of relationships that get work understood and done.
3. **Priorities** - the timed structure of actions to ensure the purpose of the organization is me.

Team coordination, thus concerns:

1. Identity coordination (management).
2. Access coordination (management).
3. Schedule coordination (management).

The coordination of individual team members, their authentication, and access occurs within the habitat service system, across [Inter]system boundaries InterSystem Team [service] work positions involve:

1. Service role.
2. Service responsibilities.
3. Service tasks.

Here, a 'work package' is the logical package that makes up work, as a task(s), to be complete.

13.14.2 Team work **budget monitoring**

A.k.a., Tracking team work and budget.

Tracking and analysis of team work:

Formula: Earned value (EV) = % of work complete (actual) x task budget (at completion).

1. Obtain physical % complete for each task
2. Calculate "earned value" (EV) for each task.
3. Sum up "earned value" (EV) for all tasks as project "earned value" (EV).
4. Calculate actual expenditure for actual work complete during the period.
5. Compare the cumulative "earned value" (EV) to actual expenditure.

Actual cost (AC) is the total cost incurred for the complete work to date. Actual cost is also known as actual cost of work performed. The actual cost doesn't have any formula.

13.14.3 Team work **task dispatching**

A.k.a., Job dispatching

Dispatching refers to process of entering a task for the purpose of execution. Job dispatching is a procedure that uses logical decision rules to select a job for processing on a machine that has just come available.
Dispatching consists of two elements:

1. Decision (for selecting task for a workstation from those predefined tasks that are ready for execution),
   - Communicating the assignment (or authorization) to the workstation.

In the case of project coordination, the decision is largely taken care in planning , and thus dispatching is reduced to mere communication of the notification to start work.

13.15 What is 'optimal performance' as part of a team?

Optimal performance is highly qualified and contextual (individual, time, place, and situation). Optimal performance is doing activities "you" (Read: the individual doing the activity) have first deemed intrinsically worthwhile. Continual (or regular) improvement is almost certainly part of optimal performance, but continuous doesn't mean regular, it means incessant. The blind pursuit of continuous improvement can often result in restlessness and inefficiency. Optimal performance requires the alignment of desire, ability, and opportunity towards an optimal goal - a goal whose value is recognized and embraced by all involved.

The three social organizational characteristics (values) of optimal performance:

1. **Effectiveness** - services, products, and individuals are effective if their task (activity, job) is completed as functionally and non-functionally required (as expected).
2. **Efficiency** - services, products, and individuals are efficient if tasks are completed within the pre-determined boundaries of time, resource, personnel, and systems.
3. **Sustainability** - services, products, and individuals are sustainable if they can continue to do tasks as required (or, expected).

Note that these values are described in greater length in the Social and Lifestyle System Specifications.

The two core performance questions are:

1. Desire
   A. What is needed to be done; what is the objective, given what is known?
2. Ability

   A. What can be done; what is possible, given what is available?

The three social organizational questions for performance are:

1. Goals.
   A. What is required to be done?
2. Skills.
   A. What are the individuals trained to do?
3. Systems.
   A. What are the organizational systems set up to do?

13.15.1 Individual, personal accountability

As part of the InterSystem Team, there is individual, personal accountability. When an individual, as part of the Team agrees to do some task, s/he is held accountable to doing it, as agreed upon by the work package and scheduling (registry) of his/her identity. It is the scheduling of identity into the "block chain" to complete some task of benefit in service to everyone, that generates societal accountability. In other words. to work on the habitat service system, "you" must be a part of the InterSystem Team, for which "you" will join a sub-team of your choice constrained by the task's requirements, and "your" own physio-cognitive set. The scheduling of "your" identity as part of an InterSystem Team involves the association of several [technical-value] attributes, most notably, 'accountability'. When active as part of an InterSystem Team "you" become accountable for your behavior and its timing to the totality of society. Some cultures might find this thought appealing and others horrifying; nevertheless, it is a requirement for fulfillment, because it is a requirement for monitoring progress toward the fulfillment of a given need or other objective. A transparent society, when oriented in an independently experienceable way toward fulfillment, may be shocking to consider, but its experience is the expression of the fulfillment we all desire. Hence, "you" become accountable to the community, for "you" are working on some aspect of everyone's fulfillment service system. And, you are working as part of a project team that, because "we" all are interested in the project, have the degree to monitor its progress. InterSystem access is available as 'read' access to everyone in the community. Sensors are used here to monitor activity; this includes inquiry sensors (i.e., surveys and "senses", which are surveys of a humans senses). This includes humans and instrumentation.

13.15.1.1 Role accountability

A.k.a., Service roles.

There is purpose for the existence of anything [in the habitat service system for human access fulfillment] - from the purpose of human life together, to the purpose of any service. Purpose typically derives from tasks that something is carrying out. The continuous repetition of carrying out a certain task results in the attribution of a role (or program, in software; mechanism, in hardware). Within society, the inheritance of a role over time is accepted as part of someone's personality.

The model of role can be applied correspondingly to machines. For example, the purpose of the machine-type 'refrigerator' is to keep food freshly preserved; its purpose in not to cool - the purpose is to keep food fresh. Everyone who eats wants their food to be kept freshly preserved. The purpose of the refrigerator of keeping food fresh derives into the task of maintaining food at a lower-relative temperature, which keeps food fresh, and is the purpose of refrigerator.

Activities based on tasks can result in needs (i.e., additional or secondary requirements). The need of a refrigerator is keeping its door closed in order the keep the temperature at a set level, efficiently. Another need is staying connected to the electrical power to keep its compressor running.

In terms the larger societal information system, an accountable person is accountable to monitoring and controlling some formalized aspect of a [service] system. There is the ability for humans, when adopting roles, to have specialty information and/or ability.

For example:

1. Geologics - someone skilled in geological systems.
   A. Biologics - someone skilled in biological systems.
   B. Mechanics - someone skilled in mechanical systems.
   C. Electronics - someone skilled in electronic systems.
   D. Informatics - someone skilled in information systems.

13.15.1.2 Test engineering

Test engineering (test engineers) test is to check whether something will work or not. A test should be done to prove that something will work. To test a hypothesis is to check whether it is true or not. Some 'test engineers' may specialize; for example, some may be skilled in geologics, where they design and test (by role) mostly geological sub-systems, other 'test engineers' may be skilled in several fields and be capable of designing and testing more integrated supra-systems. Note here that scientists require more specialization than engineers, because the engineers are applying (a horizontal calculation approach), versus scientists who discover and understand the whole reality information system in order to do all engineering safely.

13.15.1.3 Accountability assignment matrix

A.k.a., Accountability visualization.

An accountability assignment matrix is otherwise known as a responsibility assignment matrix. This matrix is simply a table for which one axis is the project's Work Breakdown Structure, and the other axis is the project's organizational breakdown structure. Each point at which these two structures intersect becomes a work execution element, and an individual or system is identified who is responsible for executing the work. If desired, each intersection can also identify the value of that specific element of work in terms of information and physical resources, time (hours), and financial resources (cost).

As a tool, the Accountability Assignment Matrix maintains the following service goals:

1. It serves as input for identifying, planning, progressing, and reporting (recording) work.
2. It serves as input for developing budgets, schedules, and milestones; tracking costs and spending; and preparing progress reports.
3. It identifies individual work responsibility.
4. It controls the release of access to resources by Inter-System Team Contributors.

Human limitations:

1. Humans have very limited short-term memory: 5–7 items.
2. Humans make mistakes, especially under stress.
3. Humans have widely varying capabilities, both physical and mental.
4. Humans have widely varying personal preferences.
5. Humans brains organise their perceived world differently.

Society requires a functional [accountability] matrix organization structure for the InterSystem Team organization. An inter-system team structure necessitates a unified matrix-type organization of effort-accountability.

13.16 Functional teams, functional information society

In a functioning societal information system, societal-level projects are organized by function -- by functional InterSystem Team organization and the solution's expression as a functional habitat service system (Read: network of cities) In its principal application within the habitat service system, functions are called operational processes or [service] procedures (both are equivalent).

The functional groups responsible for the fulfillment of societal-level organizational requirements include:

1. A system development group (strategic planning; organizational project plan decisioning).
2. A system realization group (engineering development).
3. A system operations group (engineering operations)
4. An information system [operations] group. (information service engineering operations).
5. A material system [operations] group (material service engineering operations).

The system realization group is divided into a hardware- and a software branch, which are subdivided into development teams, each responsible for a set of modules. The organization has defined roles responsible for each module. These persons work with function groups during specification and development teams during implementation.

13.17 Societal InterSystem team

A.k.a., Societal interdisciplinary team.

InterSystem teams have accountably tracked access to the engineering system of society. In order to trace access to the engineering system, the whole, unified information and material system must be indexed and searchable; if it can't be indexed or searched, then it doesn't exist.

The value of interdisciplinary teams has long been recognized in many fields, including particle physics, astrophysics, and other "big science" disciplines. Interdisciplinary team systems science broadens the scope of investigation into problems, yields fresh and possibly unexpected discoveries, and gives rise to new inter-disciplines that are more analytically sophisticated.

In concern to the interdisciplinary nature of societal operations, to cut off a single field, any field from the rest of cognition, is to drop the vast context that makes that field possible and which anchors it to reality. The ultimate result, as with any failure of integration, is floating abstractions and self-contradiction, and social conflict. Potentially generating a form of compartmentalization with respect to values, desires and logical self-interest, by the compartments of personal and political life. Instead, relating one context of knowledge to another is necessary for integration. Reality must be viewed as a whole in the formation of concepts that indicate aspects of reality. Percepts are basically self-evident, things that we do not choose to integrate or not. They are just there. The process of reasoning is taking those percepts and integrating them in concepts to delineate things, to find distinguishing characteristics in reality. This is not an arbitrary process as the subjectivists contend, which undermine our ability to comprehend things objectively.

> **NOTE:** *In community, there is an emphasis on InterSystem (interdisciplinary) understanding, as if all fields are connected.*

In InterSystem Team operations and in engineering in general, there should be no subjective interpretation of words or phrases, particularly in specifications, as this can cause major issues. If subjective interpretation is possible, then sufficient reasoning should be present to ensure that qualifications reduce interpretation to satisfactory levels.

Second only to the abilities and collaborative nature of the people in a group is the goal of the group. It is important for the group to have a common, well-articulated, and meaningful goal. This goal can range from a relatively narrow and finite objective, to a broader, longer-term goal. The actions of forming, discussing, and refining the goals of the group help the team create an identity, foster participation by team members, reinforce the participants' desire to contribute, and ensure that individual efforts are aligned.

It is necessary to differentiate an overall sense of teamwork from the task of developing an effective intact team that is formed to accomplish a specific goal. People confuse the two team building objectives. This is why so many team building seminars, meetings, retreats and activities are deemed failures by their participants. Leaders failed to define the team they wanted to build. Developing an overall sense of team work is different from building an effective, focused work team when you consider team building approaches.

Some InterSystem teams may be self-selected, and others may be selected and organized by a Central Selection Program, based on what they have acquired as skills, or already contributed to the system. This is a true "election", based on what a person has done (contribution and education), and not what they say they will do. For example, some randomly selected team in the power service system may be self-selected by its team members, but the first team to pilot a craft to Mars will be program selected based on profile and skill. When there is team selection present, selection is always based on what a person has done, not what they say they will do. It is not everyone's input that is desirable, but rather the input of those who have proven their skills and expertise in some way that would lend solution to the given problem. Under program selected conditions, selection is based on what a person has done, not what they say they will do (too many contributions necessitate filtering and selection of candidates).

An environment of mutual tolerance is critical for an interdisciplinary team to be highly functional. In particular, when a team comprises diverse levels of expertise and many different disciplines, it is essential that all team members are comfortable raising issues, questioning ideas, and fully participating in discussion without fear of being ridiculed or having their ideas discounted. Only when open communication and a high level of respect are present do all of the team members feel comfortable freely sharing their ideas. The leader of a great interdisciplinary team also has to earn the respect of the members, and the team expects their leader to be absolutely trustworthy where the project is concerned. The stronger the culture of mutual respect, the higher the likelihood that everyone will thrive. Another result of mutual respect is that it helps to reflect the value of each team member of the group, regardless of their level of responsibilities or experience. Members of a group who feel valued are more likely to be committed, creative, and contributory, and a group in which each member is respected and valued is much more likely to produce great work.

A team can only function optimally if the members can effectively communicate among themselves, especially under potentially stressful conditions. Sub-teams exist to address the critical pieces of a system. Crucial to the sub-team development and individual staff is the clear delineation of roles and responsibilities within the team. With good communication skills team members are able to define and negotiate (Read: arrive at a consensus) with other team members the roles that each are expected to fulfill within the team context. Team members are asked to write their own role description and bring it to the larger team for discussion and negotiation. Providing an environment where these roles are continuously reviewed and re-negotiated is understood to lead to higher satisfaction, and, likely, more efficient and effective decisions.

Teams use a Team Measure (unpublished, in development) survey instrument to measure team attributes and provide "teamness" feedback. This measure has helps to understand that team attributes are clustered around four domains of team development that appear to have a developmental or hierarchical structure. These domains are cohesiveness, communication, roles clarity, and goals-means clarity. The team attributes within these domains have consistently been observed as the teams develop. Providing feedback to the team on their level of development has allowed them to strategize about how they might improve team processes.

Because of the complexities of the conditions of a society, numerous processes are needed to support that operation, the sub-teams address the critical pieces of the operational process expressed in the material form of a service. In addition to sub-teams based on system/discipline, such as wiring technicians, physicians, and ancillary services, specialized sub-teams exist.

Teams can be formed for various purposes. The purpose of the team can often impact the way in which the team is structured.

Team human factors include, but are not limited to:

1. Personnel - humans with capabilities and demands.
2. Tasks - work to be done.
3. Equipment - tools used to do the work.
4. Environment - where the work is to be done.
5. Schedule - when the work is to be done.
6. Specification - what the work is to be done.
7. Procedure - how the work is to be done.
8. Effort - time (and/or resources) on task.
9. Effectiveness inquiry (global decision system inquiry) - safety of task.