Business or Mission Analysis

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The primary start to the engineering of any system-of-interest (SoI) is to obtain an understanding the objectives behind the development of the SoI, which is performed as part of the Concept Definition process.

Business or Mission Analysis, the first process performed in Concept Definition, establishes a definition of the overall strategic problem or opportunity and identification of potential solution classes to address the problem (or take advantage of an opportunity) (ISO/IEC/IEEE 15288). The solution could be a new system, a change to an existing system, a service, an operational change or some other solution.

This analysis effort identifies the primary purpose(s) of the SoI (its "mission"). The second Concept Definition process is called Stakeholder Needs Definition, which explores what capabilities are needed to accomplish the mission or the intended use of the system.

Business or Mission Analysis is often performed iteratively with the Stakeholder Needs Definition process to better understand the problem space, as well as options in the solution space.

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Purpose and Definition

The purpose of Business or Mission Analysis is to understand a mission or market problem, threat, or opportunity, and to establish the goals, objectives and measures of success of a potential solution class. This consists of a strategic analysis related to emerging needs, capability gaps, threats, opportunities, and potential solutions by a project team or by an organization to obtain its business objectives prior to establishing a project team.

Principles and Concepts

For the SoI under development, success depends on the project team's understanding the data and information that constitutes the purpose of the SoI (*why?*), acceptability or desirability of a solution (*what?*), measures (*how well?*), and the conditions in which the SOI must operate (*in what operating environment?*)

Prior to SoI development, a project champion works with key stakeholders to clearly define the problem, threat, or opportunity for which the project team is to address. Identifying the specific problem, threat, or opportunity will enable the project team to understand if the project is worth doing, why the system is needed, and the expected capabilities of the SoI. The next step is to identify the mission, goals, and objectives (MGOs) based on the defined problem, threat or opportunity, as well as the measures of success.

- The *Mission* statement is based on the analysis of a problem, threat, or opportunity that the project was formed to address, the expected outcome of the SoI being developed, and defines the "why". Why does the project exist? Why is the SoI needed? What value does it bring to the organization?
- *Goals* are elaborated from the mission statement to communicate what must be achieved to result in a successful mission. Goals allow the organization to divide the mission statement into manageable pieces and promote a shared understanding between the project team and the business operations level stakeholders of what needs to be done to achieve the mission.
- *Objectives* are elaborated from the goals to provide more details concerning what must be done that will result in the goals and mission to be achieved. What does the project team need to do to achieve the goals? What does the SoI need to do to achieve the goals?
- *Measures* are quantitative metrics used to validate the SoI against the objectives as well as to manage system development across the life cycle, expressed as Measures of Effectiveness (MOE) (reference Measurement).

As part of the Business or Mission Analysis effort, an initial assessment by key stakeholders of the SoI life cycle concepts is used to support identification of candidate solution classes. The organization then performs an evaluation of whether to proceed with development of the SoI based on analysis of the data and alignment with the organization's enterprise strategy. Upon agreement to proceed, the data from the Business and Mission Analysis effort is used by the project team to complete the rest of the concept development process for the SoI, as shown in Figure 1.

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Figure 1. Business or Mission Analysis addresses the effort to generate project success, which is provided to the project team for further concept definition activities. (SEBoK Original)

There are several outputs of the Business or Mission Analysis process:

- identification of major stakeholders,
- definition of the problem, threat, or opportunity to which the project must address,
- elaboration of the MGOs and measures of success,
- identification of preliminary life cycle concepts and the preferred solution classes,
- traceability of strategic problems, threats, opportunities, MGOs, and measures of success to the preferred solution classes, and
- confirmation of organizational support.

The effort of Business or Mission Analysis is often done at a business enterprise level, where the initial assessment results in the authorization for a project and associated budget along with an acquisition concept. For the project team responsible for developing the SoI, this means seeking an understanding of this content to ensure the outcomes of the project align with the organization's overall strategy and rationale for developing that particular SoI.

The output from the Business or Mission Analysis is then provided to the project team for use in additional

analysis that establishes an overall set of needs for the solution (described in Stakeholder Needs Definition).

Process Approach

Identify Major Stakeholders

During this process the initial stakeholder identification is performed. This can be captured in a stakeholder register, noting each stakeholder and their involvement with the SoI and project, as well as establishment a ranking of the stakeholders. This list is expanded upon during Stakeholder Needs Definition. At this phase, the stakeholders will often include key members from the organization at the enterprise level.

Define the Problem, Threat, or Opportunity

Identifying the specific problem, threat or opportunity will enable the project team to understand why the system is needed, and which capabilities, functions, performance, and features that are important to the customers, users, operators, maintainers, and disposers of the system.

There are four steps to defining the problem, threat, or opportunity:

1.   Identification of the organization's strategic and business operations level stakeholders that are impacted by the problem or threat or those who will benefit by pursuing the opportunity.

2.   Collaboration with these stakeholders to understand how they are impacted by the problem or threat, or by those that will benefit by pursuing the opportunity.

3.   Clear definition of the problem, threat, or opportunity.

4.   Stakeholder concurrence with the problem, threat, or opportunity statement.

Example Problem/Threat/Opportunity statement: Marketing is seeing an increase of work from home personnel that are purchasing more coffee makers. Existing coffee makers have single functions while consumers want a multi-function hot beverage maker to produce a blend of options like traditional brew or espresso. There is a huge opportunity if first to market.

Define the Mission, Goals, Objectives and Measures

To achieve the MGOs and measures, the project champion collaborates with the stakeholders that participated in defining the problem, threat, or opportunity to better understand what they view as an acceptable outcome by asking them a series of questions:

- How do they define success?
- What measures would the stakeholders use to determine success?
- What is the intended use of the SoI and in what operating environment?
- What capabilities, features, functions, and performance do they need?
- What are their expectations for quality and compliance (such as with standards and regulations)?
- What specific outcome(s) do they expect once the SoI is delivered?
- What are the measures of success, e.g., measures of effectiveness (MOE), expected of the SoI?

For cases where there is no existing SoI, a common approach is to characterize the "as is" or "present state" in terms of the problem, threat, or opportunity and then characterize the "to be" or "future state" in terms of the resolution of the problem, neutralizing the threat, or the ability to pursue the opportunity.

For existing systems that need to be updated, a common approach is to list the problems or issues with the existing "as-is" system and the reasons it needs to be changed. Key information includes what value they believe will result from the change by addressing: What can the existing SoI no longer do, what performance needs to be improved, what changes need to be made concerning interactions with external systems, what updates are needed as a result of changes to applicable standards and regulations, what updates are needed as a result of changes in the operational environment or new threats (e.g., security)?

It is also important to understand different perspectives. The problem, threat, or opportunity, MGOs, and

measures from a business perspective may be different than the user's perspective, both must be addressed. The user does not necessarily care about the developing organization's profits, time to market, market share, etc., they care about how the resulting SoI meets their needs. Thus, there could be several sets of MGOs and measures that need to be defined and met by the project team from both a business perspective and a user perspective of the SoI to be developed. This may lead to conflicts, e.g., product price vs. profitability vs. market share, which need to be prioritized based on the organizational enterprise strategy.

Examples (derived from INCOSE GtNR 2022):

- Mission statement: Increase revenue by providing a home-based, one-stop, multi-function hot beverage maker.
- Consumer Goals: Product a blend of options. Obtain home brew beverage quickly.
- Consumer Objective: Options of brew or expresso. Receive finished home brew coffee within minutes upon request.
- Consumer-focused Measure: Finished home brew provided within 2 minutes of activation at the selected temperature. Rationale: Consumer survey results.
- Business Goals: Increase revenue. Increase market share.
- Business Objective: Increase market share of Company X sales regions.
- Business-focused Measure: Improve current market share of Company X sales regions by 20%. Rationale: Aligns with the enterprise strategic vision.

Capture Preliminary Life Cycle Concepts

Life cycle concepts, such as the operational concept, define what the SoI needs to do and how well during its intended use in the expected operational environment, from multiple perspectives. This includes various use cases with expected interactions with external systems, identification of drivers and constraints, expected risks to success in the context of the MGOs and measures.

Preliminary life cycle concepts are defined by the organization and include preliminary concepts for acquisition, development, manufacturing or coding, verification, validation, deployment, operations, support,

and retirement. Operational concepts include high level operational modes or states, operational scenarios, potential use cases, misuse cases, loss scenarios, or usage within a proposed business strategy. These concepts enable feasibility analysis and evaluation of solution options. For example, concerning acquisition and development how much of the development effort will be done inhouse or outsourced to a supplier? Who will be the overall integrator? If development is done in house, what are the concepts for the supply chain for parts and components?

In a Model-Based Systems Engineering effort, these life cycle concepts are generated using mission analysis, such as defining use cases associated with users and life cycle stage (Figure 2). Reference Model-Based Systems Engineering (MBSE) for more information regarding usage of MBSE.

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Figure 2. Example Life Cycle Concepts Using MBSE Approaches. (SEBoK Original)

The life cycle concepts will be further refined within the stakeholder needs definition process. As part of the preliminary life cycle concepts, candidate solution classes are suggested for a possible range of approaches to address the MGOs, as part of a Functional Architecture definition activity.

Identify Uncertainties and Risks

The preliminary life cycle concepts include some level of uncertainty. This leads to risks which need to be identified and managed using the Risk Management process. These risks may also serve as inputs to the generation of additional life cycle concepts (such as addressing cyber security or hazards to successful operation).

Identify Preliminary Concepts of the Solution Space, Including Alternatives

A solution class refers to the means of achieving a solution. Examples include development of a new system, modifying or upgrading an existing system, leveraging multiple existing systems, or generating operational changes.

Possible solution classes to address the problem, threat, or opportunity are assessed against the preliminary life cycle concepts, MGOs and measures. Feasibility of a solution class and its capability to meet the strategic needs are key decision criteria, as well as feasibility considerations in terms of cost, schedule, technology, legal, ethical, environmental, sustainability, etc. The Decision Management process is used to evaluate alternatives and to guide selection. The assessment of alternatives can include modeling, simulation, analytical techniques, or expert judgment to understand the risks, feasibility, and value of the alternative solution classes.

The conclusion of this effort results in the identification of preliminary concepts of the solution space, including alternatives, which are traceable to the organization defined problems/threats/opportunities and MGOs/measures.

Assessment of Continuation of Effort

Upon the conclusion of the Business or Mission Analysis process the organization performs an evaluation on

whether to commence with development of the SoI. The key determination is alignment with the enterprise strategy. If the effort is to be continued, a project team will take the outcomes of the Business or Mission Analysis effort and commence with the Stakeholder Needs Definition activity.

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Additional References

None.

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