Qualities of great models

Assess against the following qualities of great models how SPSysML and SPSysDP affect the quality of the resulting models (1: decrease significantly, 2: seem to decrease, 3: not affect, 4: seem to increase, 5: increase significantly):

46

Linked to Decision Support: denotes the fundamental quality of models that seamlessly integrate into decision-making frameworks. Exceptional models within this paradigm serve as invaluable tools for navigating scenarios where numerous parameters must be carefully balanced. They excel in elucidating the precise manner in which their outputs inform and guide decision-making processes.

1	2	3	4	5

47

Model Credibility: signifies the degree to which decision-makers trust the results produced by a model. The credibility of a model is pivotal, as it directly impacts the decision-making process. When models lack credibility, decision-makers hesitate to base their decisions on their outputs, potentially leading to squandering time and resources or even jeopardizing the project's success. Building model credibility encompasses various strategies, including the establishment of rigorous standards and processes to evaluate and validate the model's performance.

1	2	3	4	5

48

Clear Scope: defines the extent of system modelling required for a project. This involves determining which system or subsystem will be modelled, ensuring alignment with project objectives. For instance, in automotive design, it could mean broad modelling of all engine components initially, followed by narrower modelling focusing on individual components with stable interfaces.

1	2	3	4	5

49

Verification & Validation With Models: refers to the process of utilizing models to verify and validate products, processes, or businesses. A quality systems engineering model should explicitly demonstrate why modelling is the preferred route for verification and validation tasks. However, it's essential to note that relying solely on a single model for verification and validation is discouraged.

1	2	3	4	5

50

Understandable and Well-Organized: clarifies where and how additional components can be integrated into the model. Following a structured Model Development Process enhances modularity and organization, fostering greater comprehensibility.

1	2	3	4	5

51

Analyzable and Traceable: this quality denotes models that can be readily interrogated and offer clear insight into the factors influencing their outputs. They enable easy identification of the specific variables or sections of the model that contribute to the results.

1	2	3	4	5

52

Data Extrapolation: refers to the capability of models to operate within predefined boundaries of data, conditions, physics, and assumptions. Great models explicitly delineate their validity range, distinguishing where they are applicable and where they are not.

1	2	3	4	5

53

Complete Relative to Scope and Intended Purpose: signifies that the model comprehensively encompasses all pertinent physics or dynamics within its defined scope and purpose.

1	2	3	4	5

54

Internally Consistent: denotes a model that maintains coherence without direct contradictions throughout its components. For instance, assumptions such as the gravity constant remain consistent across all model sections.

1	2	3	4	5

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Verifiable: this signifies that the model's outputs can be verified to meet the modelling requirements and align with calibration data, enhancing its credibility for decision-making purposes.

1	2	3	4	5

56

Validation: entails ensuring that the model aligns with and satisfies customer needs and expectations. For descriptive models, this involves effective presentation of information, often through layered or unlayered approaches. For analytical models, validation requires demonstrating their efficacy in enhancing decision-making processes as intended.

1	2	3	4	5

57

Model Fidelity: refers to ensuring that the model possesses the correct level of detail in relation to the decision being made and the design phase. Excessive fidelity can complicate evaluation and waste resources, while insufficient fidelity can lead to flawed decisions or unwarranted confidence. Selecting the appropriate fidelity level hinges on the system requirements and operational parameters

1	2	3	4	5

58

Elegant: denotes a model crafted with a balance of simplicity and effectiveness, avoiding unnecessary complexity. For instance, an elegant model minimizes redundancy, such as by storing and reusing computed results rather than recalculating them repeatedly from the same data.

1	2	3	4	5

59

Well Formed for Optimization: refers to constructing a model to enable optimization if required. It ensures that the model provides pertinent optimization information, such as gradients or convexity, to facilitate efficient optimization processes.

1	2	3	4	5

60

Avoid Optimizing on a Black Box: advises against optimizing models that operate as "black boxes" with obscure or inaccessible internal features. Such optimization routines may perform inadequately when applied to black box models. Instead, optimization processes should leverage the explicit structure and features of the model whenever feasible.

1	2	3	4	5

61

Availability of Interfaces: signifies that great models offer readily accessible interfaces to interact with underlying data and outputs and components

1	2	3	4	5

62

Reusable: means designing models that are applicable across various systems or scenarios beyond their initial creation context. Achieving this involves adopting a modular model structure and avoiding hardcoded parameters. While model reuse can expedite product development and reduce costs, it may also introduce risks if applied beyond the validated range of applicability.

1	2	3	4	5