

Business-Product-Service Portfolio Management

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Abstract. Product and service development is critical because new products and services are becoming the nexus of competition for many companies. Product and service development is thus a potential source of competitive advantage for many companies. Thus, product and service development is among the essential process for success, survival, and renewal of companies, particularly in competitive markets. Nowadays the design and development of new products and services or modification of existent ones (redesign) is a key and fundamental element to enhance innovation and competitiveness of industrial companies.

This paper presents the Business-Product-Service Portfolio Management (BPSPM) as an approach to manage the business portfolio for versioning and variation of the products and services development in order to succeed a business into more marketable set of products and services, jointly capable of fulfilling the stakeholders needs. BPSPM is a framework that encompassing the versioning and variation of products and services development concurrently for the products, services and their performing organisations analysis over perspectives of the strategic marketing, project management, engineering design and operations management.

There are five issues that the company must consider in BPSPM: the activities of relationship between global market and company; the activities of relationship between the providing company and stakeholders, representing a product-oriented and a service-oriented view respectively; the design activities of versioning and variety of the products and services; the specifications activities for versioning and variety of the products and services throughout all stages of life cycle, regarding the product and service life cycle and the marketing and sales life cycle; the representation activities of specifications and the elements of systems architecture for versioning and variety of the products and services throughout all stages of life cycle in manner of the hierarchy and heterarchy structures. The BPSPM framework uses the concepts of System Engineering, Concurrent Engineering, Service Engineering, Project Management and Business Portfolio presented in five dimensions, being Business dimension, Outcome dimension, Variety dimension, Life dimension and Structure dimension. The framework is described with SysML block definition diagrams.

Keywords. Systems engineering, concurrent engineering, service engineering, product and service portfolio

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Introduction

Changes in the global market environment leave companies with the need of a continuous flow of new innovations and only with the creation of new innovations, companies are able to defeat competitors by successfully bringing products and services to global markets in less time than their competitors [1]. Nowadays the design and development of new products and services or modification of existent ones (redesign) is a key and fundamental element to enhance innovation and competitiveness of industrial companies. Design is the process of specifying a description of a product and service that satisfies a set of requirements. Redesign is the process of changing the description of an existent product and service to satisfy a new set of requirements [2] [3]. The chosen of the projects and its development process are important issues for successful of the new products and services. [4] We identified the first opportunity that is the possible of the framework that encompassing concurrently the new products and services development, in this paper called as versioning, and the modification of existing products and services development, in this paper called as variety that must be evaluation and selection in order to meet the stakeholders needs.

Integrated Product Development (IPD) has traditionally focused on the development activities relating to physical technological artefacts. With the advent of business approaches for manufacturing firms based on providing customers the utility of integrated products and services, the term dubbed product service systems (PSS), companies need to extend their activities to include new dimensions of development. Within the paradigm of mass production and consumption, traditional product-oriented business strategies regarded physical technological artefacts (products) as the mediators of customer value. Value was based on the exchange of products between a providing company and a receiving customer. A customer would buy a product because it represented potential valuable benefits. PSS approaches are business strategies where companies provide value to customers by supporting and enhancing the utility of products throughout their entire life cycle. [5] We identified the second opportunity that is the proposal of a PSS approach that include the Engineering Service processes in Systems Concurrent Engineering. The result is a modeling framework that integrates the product, services and their performing organizations concurrently.

Product and service development is defined as the transformation of a market opportunity and a set of assumptions about product and service technology into a product available for sale. The existing literature on product and service development is vast. To sharpen our understanding of the literature, it is useful to organize this literature into a few competing paradigms. Such a clustering is an attempt on our part to elucidate differences, and may lead in some cases to an exaggeration of these perspectives. There are at least four common perspectives in the design and development research community: marketing, organizations, engineering design, and operations management. [6] We identified the third opportunity that is the proposal of an approach that encompassing concurrently the versioning and variation of products and services development over perspectives of the strategic marketing, project management, engineering design and operations management.

This paper presents the Business-Product-Service Portfolio Management (BPSPM) as an approach to manage the business portfolio for versioning and variation of the products and services development in order to succeed a business into more marketable set of products and services, jointly capable of fulfilling the stakeholders needs. BPSPM is a framework that encompassing the versioning and variation of products and

services development concurrently for the products, services and their performing organisations analysis over perspectives of the strategic marketing, project management, engineering design and operations management. The paper presents in Section 1 the Business-Product-Service Portfolio Management (BPSPM) approach modeled with SysML. Section 2 presents the concepts of Business dimension. Section 3 presents the concepts of Outcome dimension. Section 4 presents the concepts of Differentiation dimension. Section 5 presents the concepts of Life dimension. Section 6 presents the concepts of Structure dimension. And section 7 draws some conclusions.

1. Business-Product-Service Portfolio Management (BPSPM)

BPSPM approach uses the concepts of Business Portfolio, System Engineering, Concurrent Engineering, Service Engineering, Project Management and Strategic Marketing presented in five dimensions, being Business dimension, Outcome dimension, Differentiation dimension, Life dimension and Structure dimension. BPSPM is an iterative collaborative multidisciplinary approach to derive, develop, evaluate and select balanced value innovations of the versioning and variation of products and services during the life cycle on perspectives of the strategic marketing, project management, engineering design and operations management.

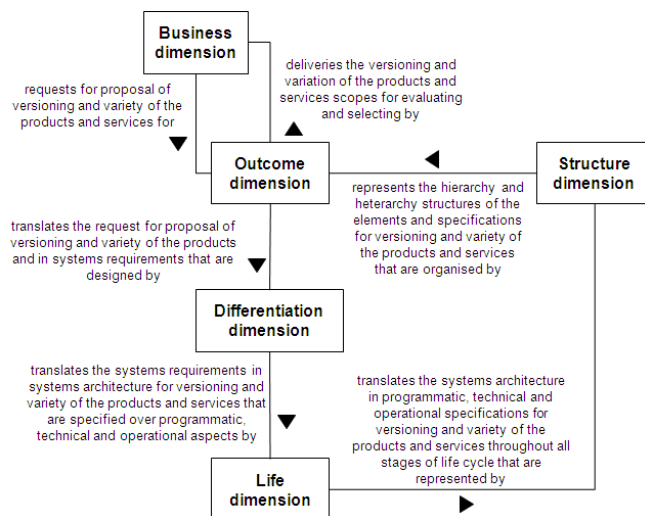


Figure 1 –Business-Product-Service Portfolio Management (BPSPM) modeled with SysML.

The diagram in Figure 1 shows the structure view for Business-Product-Service Portfolio Management (BPSPM). “Business dimension” requests for proposal of versioning and variety of the products and services for “Outcome dimension”. “Outcome dimension” delivers the versioning and variety of the products and services scopes for evaluating and selecting by “Business dimension”. “Outcome dimension” translates the request for proposal of versioning and variety of the products and services in systems requirements that are designed by “Differentiation dimension”. “Differentiation dimension” translates the systems requirements in systems architecture

for versioning and variety of the products and services that are specified over programmatic, technical and operational aspects by “Life dimension”. “Life dimension” translates the systems architecture in programmatic, technical and operational specifications for versioning and variety of the products and services throughout all stages of life cycle that are represented by “Structure dimension”. “Structure dimension” represents the hierarchy and heterarchy structures of the elements of systems architecture and specifications for versioning and variety of the products and services throughout all stages of life cycle that are organised by “Outcome dimension”.

2. Business Dimension

Business dimension deals of the activities of relationship between global market and company. Business dimension applies the concepts of Strategic Marketing and Business Portfolio with two main objectives, being identify the opportunities for Outcome dimension and, evaluating and selecting of versioning and variety of the products and service scopes proposed by Outcome dimension. Business dimension aims apply a strategy based in value innovation and not in competition. [1] The identified opportunity must be available in manner of mission statement considering the main constraints of the programmatic, technical and operational aspects. Following the main approaches for understanding user and costumer needs: surveys and focus groups, latent needs, lead-users, customer-developers, competitive analysis of competing products, industry experts or consultants, extrapolating trends, building scenarios, market experimentation, and others. [3]

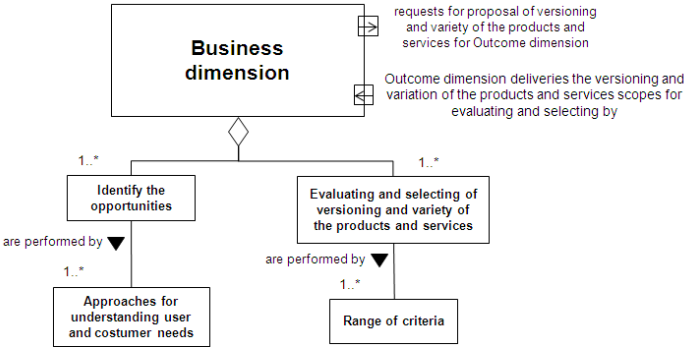


Figure 2 – Business dimension modeled with SysML.

Portfolio management process is defined as a dynamic decision-making process, for evaluating, selecting, request adequacy, approval or cancel of versioning and variety of the products and services scopes. In order to have a successful portfolio management process, it is important to take care of the three goals, being value maximization, balancing the portfolio and creating alignment with business strategy. [1] A range of criteria are used to screen projects prior to development. An early study found financial criteria to be the most common, the most widely used being Net Present Value/Internal Rate of Return having the highest usage, followed by cost-benefit and payback period. However, most firms use a range of additional criteria: ranking, profiles, simulated outcomes, strategic clusters, interactive, and others. [3]

The diagram in Figure 2 shows the structure view for “Business dimension”. The “Business dimension” is made up of one or more “Identify the opportunities” and one or more “Evaluating and selecting of versioning and variety of the products and services”. The “Identify the opportunities” are performed by one or more “Approaches for understanding user and costumer needs”. “Evaluating and selecting of versioning and variety of the products and services” are performed by one or more “Range of criteria”. Diagram shows that the “Business dimension” has two flow ports: “Business dimension” port requests for proposal of versioning and variety of the products and services for “Outcome dimension”; and “Outcome dimension” port deliveries the versioning and variation of the products and services scopes for evaluating and selecting by “Business dimension”.

3. Outcome Dimension

Outcome dimension deals the activities of relationship between the providing company and stakeholders, representing a product-oriented and a service-oriented view respectively. Outcome dimension performs the stakeholders and requirements analysis for the products, services and their performing organisations concurrently. Outcome dimension also organise the elements and specifications for versioning and variety of the products and services throughout all stages of life cycle in manner of scope. Outcome dimension applies the Systems Concurrent Engineering approach with the Engineering Service concepts. The Systems Concurrent Engineering approach is a modeling framework that integrates the product and their performing organizations [7].

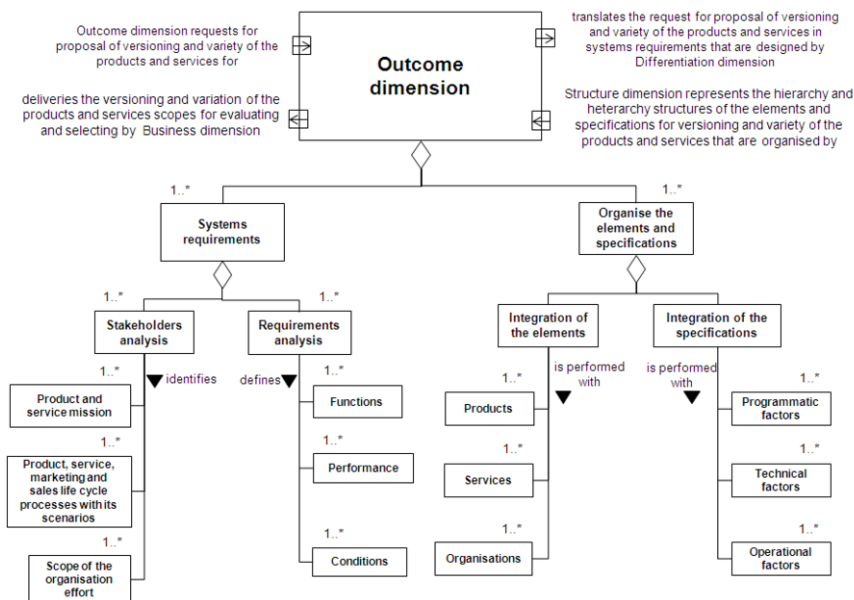


Figure 3 – Outcome dimension modeled with SysML.

Stakeholders analysis available the stakeholders requirements and measures of effectiveness (MOES) for requirements analysis. Requirements analysis available the

measure of performance (MOP) and technical performance measures (TPM) [8]. From the hierarchy and heterarchy structures of the elements and specifications for versioning and variety of the products and services throughout all stages of life cycle the Outcome dimension organise the product, service and organisation elements and the programmatic, technical and operational specifications in manner of scopes considering the main objectives of the mission statement.

The diagram in Figure 3 shows the structure view for “Outcome dimension”. The “Outcome dimension” is made up of one or more “Systems requirements” and one or more “Organise the elements and specifications”. The “Systems requirements” is made up of one or more “Stakeholders analysis” and one or more “Requirements analysis”. “Stakeholders analysis” identifies one or more “Product and service mission”, one or more “Product, service, marketing and sales life cycle processes with its scenarios”, and one or more “Scope of the organisation effort”. “Requirements analysis” defines one or more “Functions”, one or more “Performance”, and one or more “Conditions”. The “Organise the elements and specifications” is made up of one or more “Integration of the elements” and one or more “Integration of the specifications”. “Integration of the elements” is performed with one or more “Product”, one or more “Service”, and one or more “Organisation”. “Integration of the specifications” is performed with one or more “Programmatic factors”, one or more “Technical factors”, and one or more “Operational factors”. Diagram shows that the “Outcome dimension” has four flow ports: “Business dimension” port requests for proposal of versioning and variety of the products and services for “Outcome dimension”; “Outcome dimension” port translates the request for proposal of versioning and variety of the products and services in systems requirements that are designed by “Differentiation dimension”; “Structure dimension” port represents the hierarchy and heterarchy structures of the elements and specifications for versioning and variety of the products and services that are organised by “Outcome dimension”; and “Outcome dimension” port deliveries the versioning and variation of the products and services scopes for evaluating and selecting by “Business dimension”.

4. Differentiation Dimension

Differentiation dimension deals the design of versioning and variety of the products and services. Differentiation dimension aims to provide the design of a range of products and services that are based on a core of company competences. Differentiation can generate new profits and growth in two distinct manners, being versioning that offering new products and services and the variety that offering variations of the products and services for a version that will satisfy the systems requirements [9]. Differentiation dimension performs the functional and implementation analysis of versioning and variety of the products and services and their performing organisations concurrently. Differentiation dimension performs the design for versioning and variety of the products, services and organisation elements that must be available in manner of systems architecture.

Functional analysis identifies the functional context for product and service at each life cycle process scenario and for organization at each life cycle process scenario within the scope of the development effort [7]. Implementation analysis identifies the implementation context for product and service at each life cycle process scenario and for organization at each life cycle process scenario within the scope of the development

effort. Physical connections between the system and the environment elements define the physical external interface requirements. [8]

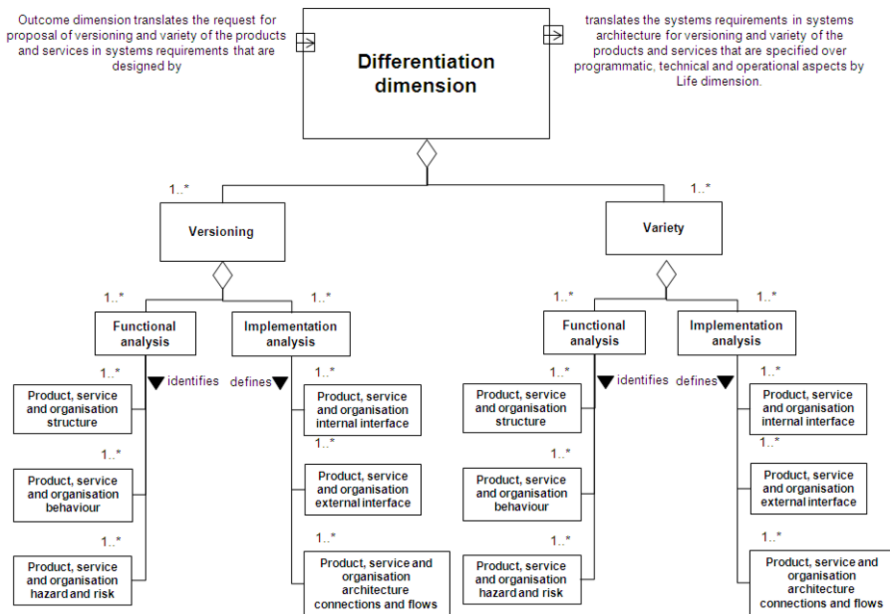


Figure 4 –Differentiation dimension modeled with SysML.

The diagram in Figure 4 shows the structure view for "Differentiation dimension". The "Differentiation dimension" is made up of one or more "Versioning" and one or more "Variety". The "Versioning" is made up of one or more "Functional analysis" and one or more "Implementation analysis". "Functional analysis" identifies one or more "Product, service and organisation structure", one or more "Product, service and organisation behaviour", and one or more "Product, service and organisation hazard and risk". "Implementation analysis" identifies one or more "Product, service and organisation internal interfaces", one or more "Product, service and organisation external interfaces", and one or more "Product, service and organisation architecture connections and flows". The "Variety" is made up of one or more "Functional analysis" and one or more "Implementation analysis". "Functional analysis" identifies one or more "Product, service and organisation structure", one or more "Product, service and organisation behaviour", and one or more "Product, service and organisation hazard and risk". "Implementation analysis" identifies one or more "Product, service and organisation internal interfaces", one or more "Product, service and organisation external interfaces", and one or more "Product, service and organisation architecture connections and flows". Diagram shows that the "Differentiation dimension" has two flow ports: "Outcome dimension" port translates the request for proposal of versioning and variety of the products and services in systems requirements that are designed by "Differentiation dimension"; and "Differentiation dimension" translates the systems requirements in systems architecture for versioning and variety of the products and services that are specified over programmatic, technical and operational aspects by "Life dimension".

5. Life Dimension

Life dimension deals the programmatic, technical and operational specifications for versioning and variety of the products and services throughout all stages of life cycle. Life dimension regards the product and service life cycle (concept, development, production, utilization, support and retirement) and the marketing and sales life cycle (development, introduction, growth, maturity and decline) for products, services and their performing organisations concurrently. [10]

Programmatic specifications are related with the management of the cost, schedule, quality, risk, configuration and interfaces or others issues determined by Business dimension. Technical specifications are related with the development capacity of the company analysing the human abilities and competencies, domain of the technologies and the available facilities. Operational specifications are related with the production capacity of the company and its partners, marketing campaigns, sales and logistics channels, and communications channels with customers and providers.

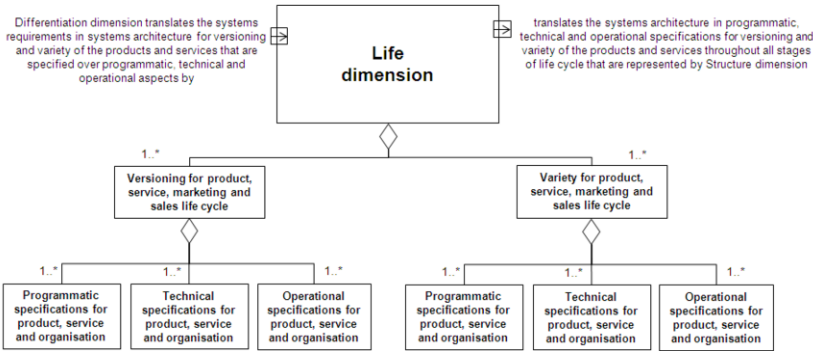


Figure 5 –Life dimension modeled with SysML.

The diagram in Figure 5 shows the structure view for “Life dimension”. The “Life dimension” is made up of one or more “Versioning for product, service, marketing and sales life cycle” and one or more “Variety for product, service, marketing and sales life cycle”. The “Versioning for product, service, marketing and sales life cycle” is made up of one or more “Programmatic specifications for product, service and organisation”, one or more “Technical specifications for product, service and organisation” and one or more “Operational specifications for product, service and organisation”. The “Variety for product, service, marketing and sales life cycle” is made up of one or more “Programmatic specifications for product, service and organisation”, one or more “Technical specifications for product, service and organisation” and one or more “Operational specifications for product, service and organisation”. Diagram shows that the “Life dimension” has two flow ports: “Differentiation dimension” translates the systems requirements in systems architecture for versioning and variety of the products and services that are specified over programmatic, technical and operational aspects by “Life dimension”, and “Life dimension” translates the systems architecture in programmatic, technical and operational specifications for versioning and variety of the products and services throughout all stages of life cycle that are represented by “Structure dimension”.

6. Structure Dimension

Structure dimension represents the programmatic, technical and operational specifications and the elements of systems architecture for versioning and variety of the products and services throughout all stages of life cycle in manner of the hierarchy and heterarchy structures. Structure dimension available the realization for the implementation architecture and attributes, the implementation requirements and lower level system requirements.

Hierarchy structure defines how the programmatic, technical and operational specifications and the elements of systems architecture are structured in a layered pyramidal structure. The layers of the hierarchy correspond to the end products and services breakdown structure. The performing organizations for that end products and services are in the same building block, and consequently, the same layer of that products and services [7]. Heterarchy structure defines how the collaborative and multidisciplinary teams are structured in a layered concurrent structure. The layers of the heterarchy correspond to the end products and services breakdown structure. The performing organizations for that end products and services are in the same building block, and consequently, the same layer of that products and services.

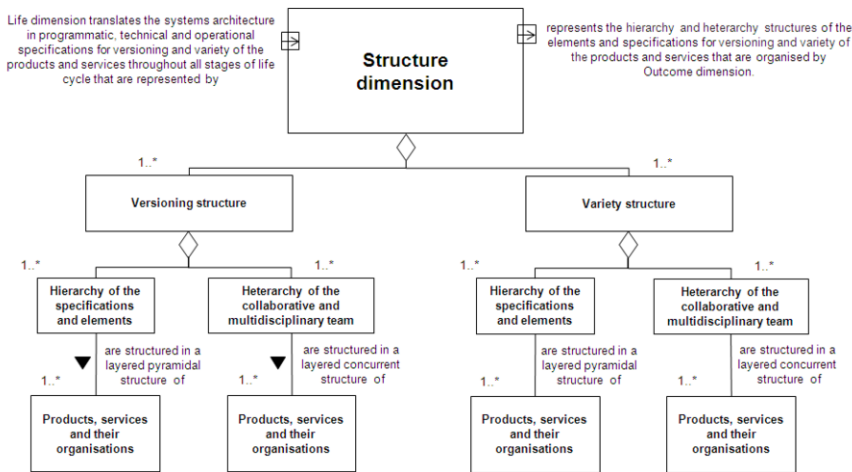


Figure 6 – Structure dimension modeled with SysML.

The diagram in Figure 6 shows structure view for the “Structure dimension” that is made up of one or more “Versioning structure” and one or more “Variety structure”. The “Versioning structure” is made up of one or more “Hierarchy of the specifications and elements” and one or more “Heterarchy of the collaborative and multidisciplinary team”. “Hierarchy of the specifications and elements” are structured in a layered pyramidal structure of the “products, services and their organisations”. “Heterarchy of the collaborative and multidisciplinary team” are structured in a layered concurrent structure of the “products, services and their organisations”. The “Variety structure” is made up of one or more “Hierarchy of the specifications and elements” and one or more “Heterarchy of the collaborative and multidisciplinary team”. “Hierarchy of the specifications and elements” are structured in a layered pyramidal structure of the “products, services and their organisations”. “Heterarchy of the collaborative and multidisciplinary team” are structured in a layered concurrent structure of the “products,

services and their organisations". The diagram also shows that the "Structure dimension" has two flow ports: "Life dimension" translates the systems architecture in programmatic, technical and operational specifications for versioning and variety of the products and services throughout all stages of life cycle that are represented by "Structure dimension", and "Structure dimension" represents the hierarchy and heterarchy structures of the elements and specifications for versioning and variety of the products and services that are organised by "Outcome dimension".

7. Conclusions

Business-Product-Service Portfolio Management (BPSPM) can be used to attend the identified opportunities: a framework that encompassing concurrently the versioning and variety of products and services development; as Product-Service Systems approach; and as approach for concurrent development the versioning and variation of products and services over perspectives of the strategic marketing, project management, engineering design and operations management. The SysML structural diagrams allowed a visualization of high abstraction of the activities of relationship between global market and company, of relationship between the providing company and stakeholders, the specifications for versioning and variety of the products and services, the representation of specifications and the elements of systems architecture for versioning and variety of the products and services throughout all stages of life cycle in manner of the hierarchy and heterarchy structures. Further steps of this work are to demonstrate how to move from the MBSCE modeled by SysML to a given application domain.

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