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2026-11

Mass customization value chain management —

Part 1: Framework

Management de la chaîne de valeur de la personnalisation de masse —

Partie 1: Cadre

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Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Abbreviated terms **2**
5 Mass customization value chain management overview **3**
6 Framework model **4**
6.1 General description of the framework model 4
6.2 Framework model domain 5
7 Functional model **7**
7.1 Functional model notation 7
7.2 General description of functional model 8
7.3 Interaction 9
7.4 R&D 10
7.5 Marketing and sales 12
7.6 Sourcing and planning 13
7.7 Production 14
7.8 Logistics 15
7.9 Service 17
7.10 QHSE management 18
7.11 Data management 18
8 Information flow of mass customization **18**
Annex A (informative) **Mass customization value chain management — Consumer electronics industry** **21**
Annex B (informative) **Mass customization value chain management — Iron and steel industry** **27**
Annex C (informative) **Mass customization value chain management — Electrical industry** **29**
Annex D (informative) **Mass customization value chain management — Reverse customization** **32**
Annex E (informative) **Mass customization value chain management — Automotive industry** **35**
Bibliography **37**

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Foreword

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This document was prepared by Technical Committee ISO/TC 184, *Automation systems and integration*, Subcommittee SC 5, *Interoperability, integration, and architectures for enterprise systems and automation applications*.

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This first edition cancels and replaces the first edition (ISO/PAS 24644-1:2023), which has been technically revised.

The main changes are as follows:

— In Clause 7, Quality, Health, Safety, and Environment (QHSE) and data management have been added.

— In Clause 8, the intelligent interaction engine node has been added.

— Annex E has been added.

A list of all parts in the ISO 24644 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Alongside the generalization and popularization of Internet technologies, Internet of Things (IoT), flexible manufacturing technologies and modern logistics, individualized customization services have become embedded into all industrial and service sectors. Users can, by means of Internet platforms, determine and customize their own products according to their own demands. Mass customization is becoming a new mode in the manufacturing industry, and value chains will ultimately be driven by the users. Cooperation among enterprises is required by using quick-response Internet platforms to provide a wide range of products and services in small lots to satisfy the users with various individualized demands.

From the user's perspective, when they directly interact with enterprises for customized products, they also wish to participate in the creation process of their individualized product and to obtain or receive information about the progress of the product.

From the enterprise perspective, mass customization will assist enterprises in realizing the real-time and accurate understanding of the user's demands. Customized products increase the premium value of products for enterprises. Through accurately estimating *a priori* information from customized product demand and requirements from the users, enterprises can reduce or eliminate inventory-related costs by appropriately conducting large-scale procurement or production.

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Mass customization value chain management —

Part 1: Framework

1 Scope

This document specifies a framework for mass customization value chain management, including the framework model, functions and information flow of mass customization. This document does not describe interoperability at a system level or interoperability throughout the life cycle in detail.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

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3.1
domain, noun
functional area

[SOURCE: ISO 24097-1:2017 [1], 3.1.2, modified — “in a policy assertion” has been deleted from the definition. The EXAMPLE has been deleted.]

3.2
information flow, noun
transfer of information from an information-source-object to an information-destination-object

[SOURCE: ISO/IEC 16500-1:1999 [2], 3.30]

3.3
interaction, noun
exchange of information between a user and a system via the human-system interface to achieve the intended goal

[SOURCE: EN ISO 11064-5:2008 [3], 3.20, modified — the admitted term "dialogue" has been deleted.]

3.4
mass customization, noun
production mode that provides customized products and services according to the individualized demands of users with the cost and efficiency in mass production

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3.5
user experience, noun
person's perceptions and responses resulting from the use and/or anticipated use of a product, system or service

[SOURCE: ISO/IEC 30071-1:2019 [4], 3.1.6, modified — Notes 1 and 2 to entry have been deleted.]

3.6
value-added service, noun
service that is offered in addition to the core service in question thus creating additional value

[SOURCE: ISO 17573-2:2025 [5], 3.238]

3.7
value chain, noun
range of activities or parties that create or receive value in the form of products or services

[SOURCE: ISO 22948:2020 [6], 3.2.11]

3.8
product scheme, noun
product solutions designed according to user customization demands

3.9
social community, noun
collective organization where people with common interests, goals or values come together socially

Note 1 to entry: A social community can represent physical communities based on geographic areas, or online communities such as social networking groups.

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3.10
computer-aided X, noun
CAX, noun
comprehensive term for various computer-aided technologies such as CAD, CAM, CAE, CAPP, CIM, CAS, CAT, CAI, etc.

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3.11
intelligent interaction engine, noun
software integrating with enterprise systems, supporting information exchange between users and enterprise systems to meet user needs or complete the intended task

4 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

APS	Advanced planning and scheduling
BOM	Bill of material
B2B	Business to business
CAX	Computer aided X
CBL	Collaboration layer
CTL	Control layer
CP	Configuration partner
CRM	Customer relationship management

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CTO	Concept-to-order
DTS	Delivery-to-service
EML	Equipment layer
EPL	Enterprise layer
ERP	Enterprise resource planning
EVI	Early vendor involvement
FIFO	First-in-first-out
MRP	Material requirements planning
OTD	Order-to-delivery
PLM	Product lifecycle management
QHSE	Quality, health, safety, and environment
TMS	Transportation management system
WMS	Warehouse management system
WSL	Workshop layer

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5 Mass customization value chain management overview

For mass customization value chain management, the value activities of mass customization can be divided into domains from the perspective of life cycle and system, and the contents of each activity and the information transmitted between activities should be clearly defined. The framework of mass customization value chain management consists of an activity interaction model, activity definitions, and identification of general information flows. This document falls in the constructs of function view, according to the definition of enterprise activity and function view in ISO 19439:2006 [7] .

NOTE 1 ISO 19439 specifies that the function view is required to represent the business processes of the enterprise domain, their functionality, behaviour, inputs and outputs. The function view is required to describe the assembly of single processing steps as a collection of processes (business processes and enterprise activities) structured as a network of activities reflecting their logical connection and interdependencies.

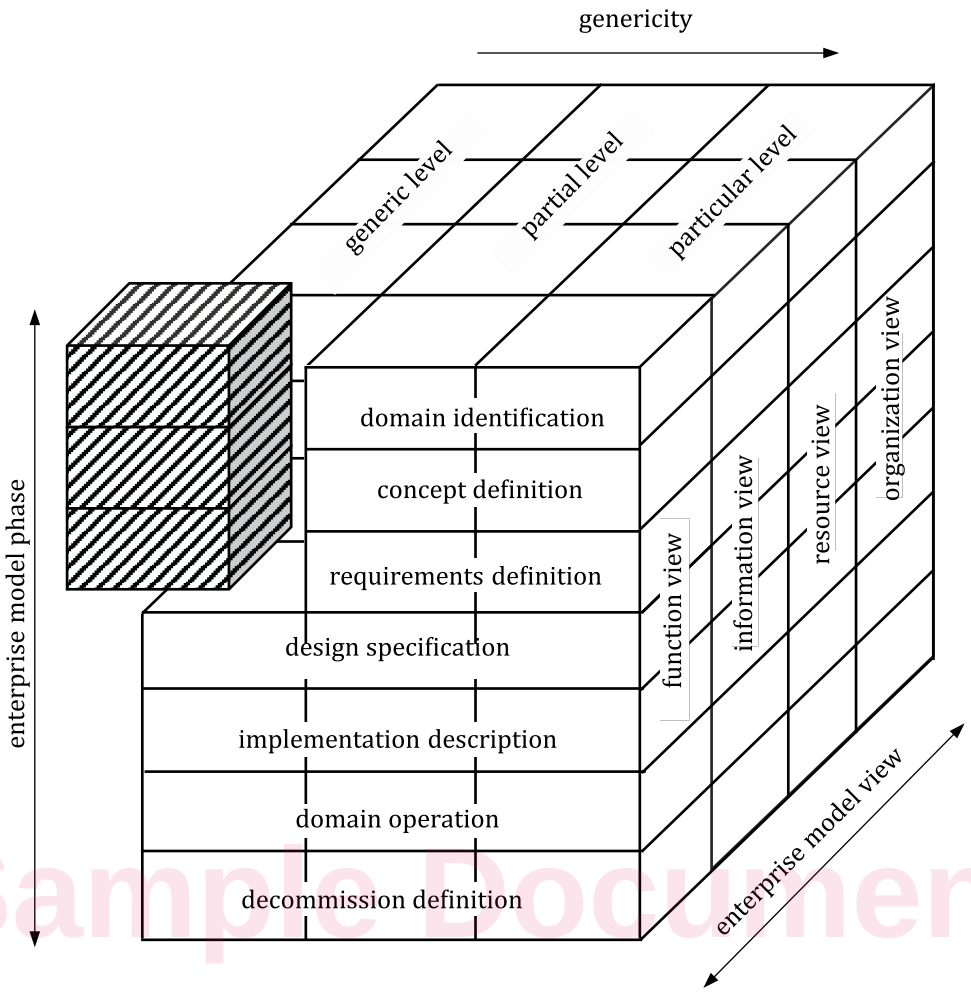
NOTE 2 ISO 19439 specifies that enterprise activity is all, or part, of process functionality that consists of elementary tasks performed in the enterprise that consume inputs and allocate time and resources to produce outputs.

With the definitions and concepts of enterprise activity and function view, the framework is generated referring to the enterprise modelling concepts defined in ISO 19439:2006 [7], which fulfils the requirement of ISO 15704:2019 [8] 5.3.3 and 6.5.1.3. Specifically, the framework corresponds with the domain identification, concept definitions and requirements definition of the function view at the generic level as shown in the dashed area of Figure 1. The modelling concepts are reused in ISO 19440:2020 [9], which builds on ISO 19439:2006 [7], to identify and specify constructs necessary for users that model enterprises.

NOTE 3 Figure 1 is excerpted from ISO 19439:2006 [7], and it is Figure 5 in ISO 19439:2006 [7].

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Figure 1 — Overview of the framework for enterprise modelling

6 Framework model

6.1 General description of the framework model

The framework model of mass customization consists of two dimensions, namely system level and life cycle. The vertical axis in Figure 2 presents the system level, which includes equipment layer (EML), control layer (CTL), workshop layer (WSL), enterprise layer (EPL) and collaboration layer (CBL) based on IEC 62264-1:2013 [10]. The horizontal axis in Figure 2 covers the whole life cycle of a product, which includes seven activities: interaction, research and development (R&D), marketing and sales, sourcing and planning, production, logistics and service.

System level in Figure 2 is divided into five layers according to the organizational structure related to enterprise production activities, in which:

— Equipment layer (EML) is applied by an enterprise to realize the actual physical process, and perceive and operate it by means of sensor, instrument, machine, device, and other methods;

— Control layer (CTL) is used for handling information, and realizing the monitoring and controlling physical process within an enterprise;

— Workshop layer (WSL) is applicable for realizing production management within a factory or a workshop;

— Enterprise layer (EPL) aims to realize enterprise oriented business management; and

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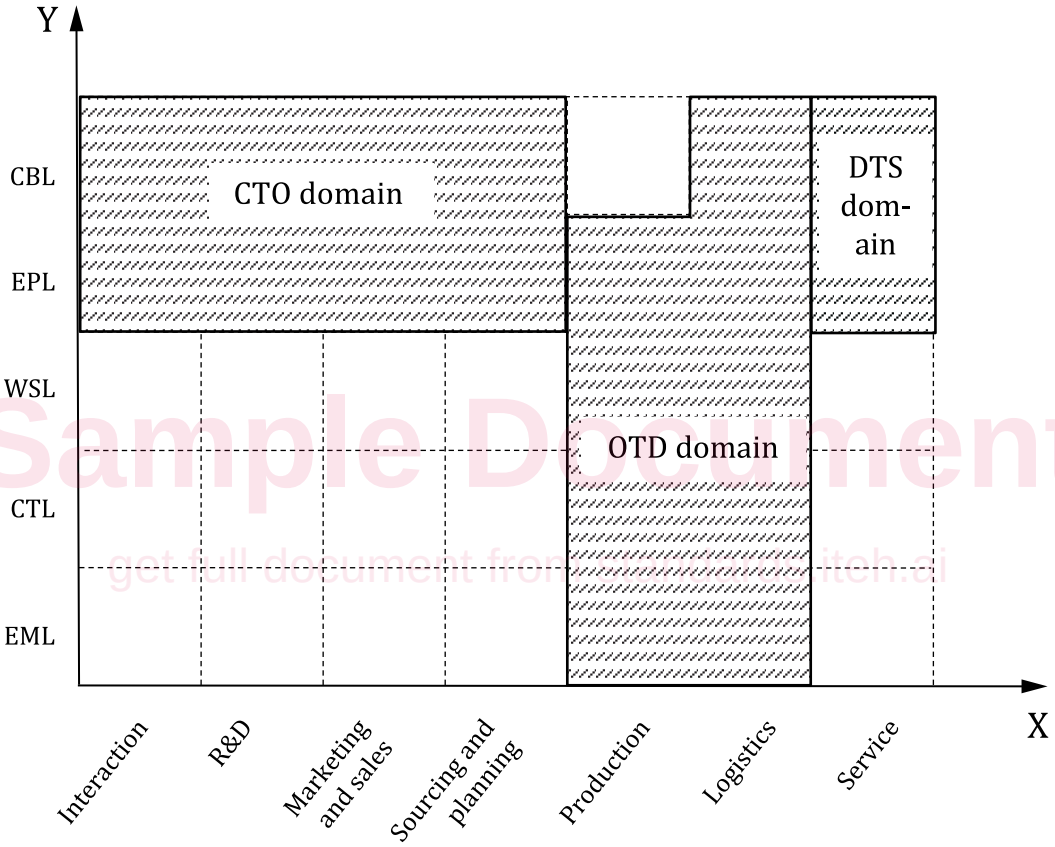
— Collaboration layer (CBL) is applied to realizing the interconnectivity and sharing of internal and external information in an enterprise and the business coordination between enterprises.

Mass customization domains include concept-to-order (CTO) domain, order-to-delivery (OTD) domain, and delivery-to-service (DTS) domain.

As shown in Figure 2, the CTO domain covers four activities from the life cycle, i.e., interaction, R&D, marketing and sales, and sourcing and planning, and it contains WSL and CBL from the system level.

The OTD domain includes the production activity and logistic activity. In the production activity, it covers the EML, CTL, WSL and EPL. In the logistics activity, it includes all five system layers.

The DTS domain covers the service activity from the life cycle, and contains the EPL and CBL from the system level.



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Key

domain

Figure 2 — Mass customization domains

6.2 Framework model domain

In the CTO domain, user demands should be focused on, product schemes are the output of the interaction and R&D activities. User orders are generated through the marketing and sales activity. Enterprises arrange a master production schedule according to the product scheme and the user orders, and find suitable suppliers through the sourcing and planning activity to ensure commodity supply. The contents of a user order include user basic information, customization information, expected delivery date and place, product model, payment information, etc.

NOTE In this document, commodity includes raw material and purchasing parts from suppliers.

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In the interaction activity, enterprises collect user demands, and interact with users and ecosystem partners, conduct user demands analysis and screening, and output customized demands. The interaction methods include user interface, network (e.g. users' interactions with enterprises via surfing the Internet by using the platforms), social networking (e.g., users' interaction with enterprises through the social media), web, apps, etc.

In the R&D activity, enterprises conduct customized demands classification, assessment and transformation, and output product solutions after simulation verification. If customized demands cannot be achieved, enterprises should provide timely feedback to users.

In the marketing and sales activity, enterprises conduct product positioning and pricing, and this activity should obtain user orders through precision marketing.

In the sourcing and planning activity, enterprises find suitable material suppliers for source searching demands and procurement demands.

In the OTD domain, factories conduct the production activity to produce customized products, and deliver them to users through the logistics activity.

In the production activity, factories arrange a detailed production plan according to the master production schedule and material status (including material in stock or its expected arrival time), and workshops shall execute manufacturing according to the detailed production plan.

In the logistics activity, enterprises arrange reasonable a delivery route and deliver the customized products to the designated place at the appointed time through logistics management.

In the DTS domain, enterprises obtain user experience information through the service activity, and the analysis of conduct online or offline diagnosis to get the status information of products, and this activity should provide after-sales and value-added services for users. Enterprises should promote the recycling of customized products.

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The user experience information and new demands obtained from the DTS domain get the fed back to the CTO domain and OTD domain to promote product optimization and iteration.

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Figure 3 depicts mass customization domains, elements and functions, and information flow showing the interaction between the users and domains, pictorially summarizing the dynamics of the CTO, OTD, and DTS domains.

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