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Part 3: Information flows in production planning processes

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Introduction

This draft standard is based on international discussions in which the UK has taken an active part. Your comments on this draft are invited and will assist in the preparation of the consequent standard. Comments submitted will be reviewed by the relevant BSI committee before sending the consensus UK vote and comments to the international secretariat, which will then decide appropriate action on the draft and the comments received.

If the international standard is approved, it is possible the text will be published as an identical British Standard.

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Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	(7)
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/ Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

DRAFT INTERNATIONAL STANDARD

ISO/DIS 18828-3

ISO/TC 184/SC 4

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Automation Systems and Integration — Standardized procedures for production systems engineering —

Part 3: Information flows in production planning processes

Systèmes d'automatisation industrielle et intégration — Procédures normalisées pour l'ingénierie des systèmes de production —

Partie 3: Flux d'informations dans les processus de planification de la production

ICS: 25.040.40

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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The committee responsible for this document is ISO/TC 184, *Automation Systems and Integration*, Subcommittee SC 4, *Industrial data*.

ISO 18828 consists of the following parts, under the general title *Standardized procedures for production systems engineering*

— *Part 2: Reference process for seamless production planning*

— *Part 3: Information flows in production planning processes*

The following parts are under preparation:

— *Part 1: Overview, concepts and integration*

— *Part 4: Key performance indicators (KPIs) in production planning processes*

— *Part 5: Manufacturing change management*

Introduction

Increasing cost pressures in a competitive global environment coupled with constantly growing levels of product and process complexity mean that advanced production planning skills are now a key factor of success for many manufacturing companies. To produce competitively, it is necessary not only to ensure the efficient operation of the production structures but also to be in a position to plan and design these to respond to specific requirements and at a high level of quality. Reduced time-to-market and constantly shortening planning and development times, to mention only two of the major advantages of efficient planning structures, are crucial components of economic success in today's markets. In parallel with product design and prior to the initial start of production (SOP), production planning is a business process having great potential with respect to improving product and process planning. Researching, generating, processing, and transferring information are important aspects of production planning. Depending on the level of maturity of the planning and the respective planning discipline (see Section 4), definable information packages result, which are generated iteratively during planning and are processed further through the overall planning process. The resulting information flows are followed via a reference planning process, thus allowing the specification of information states at defined points during planning. The comparison of actual with target states of information packages that follows, is performed at these defined points.

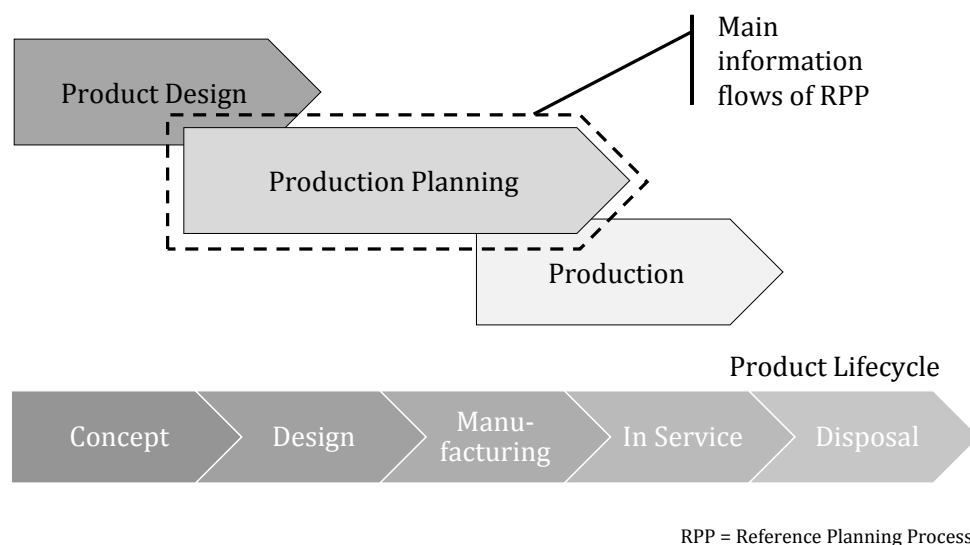


Figure 1 — Main Information flows of the reference planning process (qualitative depiction)

The main information flows in production planning are specified in this part of ISO 18828. They will be examined in the context of the reference planning process (see [Figure 1](#)) described in ISO 18828-2. Also building on the reference planning process and on the information flows, ISO 18828-4 describes key indicators for the transparency and assessment of the planning processes themselves.

Automation Systems and Integration — Standardized procedures for production systems engineering —

Part 3: Information flows in production planning processes

1 Scope

The scope of this standardization is to depict the information flows between the various planning disciplines within production planning.

The following aspects are within the scope of this document:

- General overview of main information flows within the reference planning process
- Basic pattern to describe main information flows
- Detailed description of every main information flow
- State notation structure of main information flows objects
- Detailed descriptions for each information object state
- Proposal of checklists for benchmarking information objects

The following items are out of scope:

- Information flows to intersecting areas including high level planning
- Data models for production planning
- Complete description of all possible information flows/objects within production planning
- Workflow engines for automated production planning
- Production facilities planning/ manufacturing facilities planning (physical plant and equipment); that includes any kind of resource that is not directly related to the manufacturing process
- Value chain (inbound logistics, operations management, outbound logistics, marketing and sales)
- Process simulation/safeguarding

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO / DIS 18828-2:2014, *Automation Systems and Integration — Standardized procedures for production systems engineering — Part 2: Reference process for seamless production planning*

ISO/IEC 19510:2013, *Information technology — Object Management Group Business Process Model and Notation*

3 Terms and Definitions

3.1 Terms defined in ISO 10303-1

This part of ISO 18828 makes use of the following terms defined in ISO 10303-1:

— product

3.2 Terms defined in ISO 15531-1

This part of ISO 18828 makes use of the following terms defined in ISO 15531-1:

— manufacturing

— process

— process planning

— production control

— resource

3.3 Terms defined in ISO 18828-2

This part of ISO 18828 makes use of the following terms defined in ISO / DIS 18828-2:

— Container concept

— Delivery concept

— Operating resources

— Process chain

— Product design process

— Production planning process

— Work system

3.4 Other terms and definitions

For the use of this document the following terms and definitions apply.

3.4.1

Intralogistics

Intralogistics defines both delivery methods and means of transport at the production site as well as a detailed description of the container concept. The delivery methods include buffers and supermarkets (having defined and simulated ranges), transport capacity, and delivery cycles. They are supported by electronic tools such as PDM (product data management) or ERP (enterprise resource planning) systems that map all required resources and the infrastructure. The detailed container concept includes a complete description of all containers used, the container types, the container size, their sequences, and the partition and packaging concepts for parts and assemblies.

3.4.2

Investment planning

Within the scope of investment planning, all costs that determine the investments and overhead for a planning alternative of a production system are calculated in detail. This calculation is carried out bottom-up for all processes and resources (with respect to concrete machines, facilities, etc.). It is supported by calculation templates, additional calculation tools, and digital planning tools featuring extended planning functions.

3.4.3

Layout planning

Layout planning defines various kinds of information that are needed for planning and implementing a production layout. This includes the arrangement and sizing of lines, stations, machines, circulation areas, and road network. An additional component of layout planning is the cost calculation for structural measures and utilities installations for planned facilities.

3.4.4

Operation list

Listing of information that includes flow charts and personnel allocations, required concrete resources (manufacturing, assembly or personnel resources), infrastructure for production and associated required manipulators (operating resources such as cranes and steel constructions). This listing of information is normally stored in digital tools such as MS (Microsoft) Excel or ERP systems.

3.4.5

Planning scenario

Combination of specific planning variants of all planning disciplines

3.4.6

Precedence graph

A graph that displays all required manufacturing and assembly operations and the associated process times and work content for a work system in the correct sequence

3.4.7

Transport concept

The bridging of distance by goods with the aid of means of transport. The main functions of transport are conveyance and the required handling

3.5 Abbreviations and descriptions

For the use of this document, the following abbreviations and descriptions apply.

3.5.1

BPMN

Business Process Model and Notation

3.5.2

CAD

Computer Aided Design

3.5.3

ERP

Enterprise Resource Planning

3.5.4

KPI

Key performance indicator

3.5.5

MIF

Main information flow

3.5.6

MS-Excel

Microsoft-Excel

3.5.7

PDM

Product Data Management

3.5.8

UML

Unified modeling language

3.5.9

VDMA

Verband Deutscher Maschinen- und Anlagenbau (German Mechanical and Plant Engineering Industry Association)

4 Classification of information flows in the reference process

When describing the information flows in production planning it is sensible to restrict it to the most important, fundamental planning disciplines that are found in many manufacturing companies. This structure of the production planning resulting in the reference planning process for seamless production planning is given in ISO 18828-2. Therefore the production planning disciplines manufacturing, assembly, logistics and layout will be used to identify the main information flows (see [Figure 2](#))

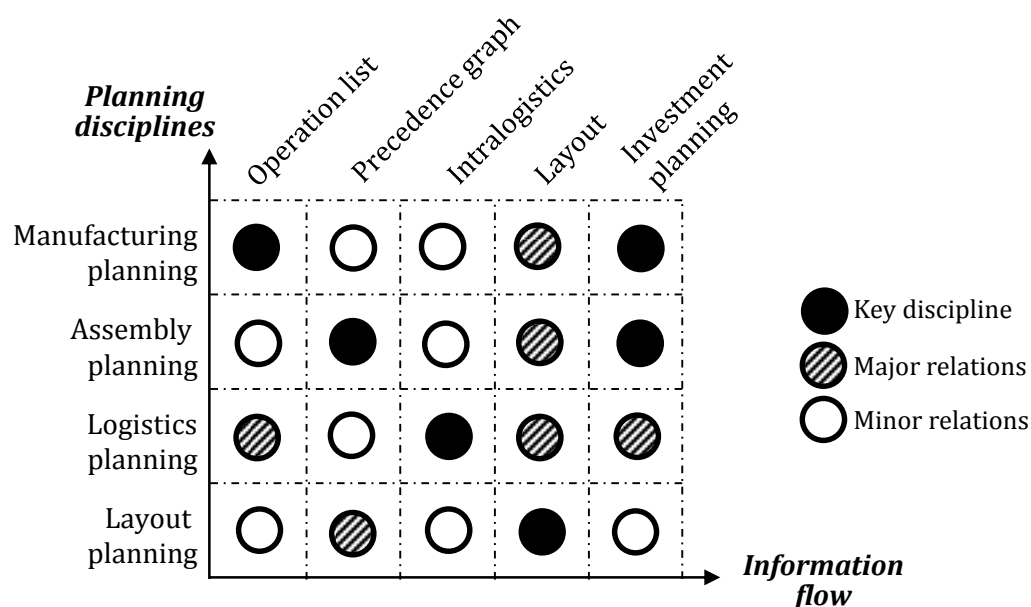


Figure 2 —Main information flows structured by planning discipline

The information flows described in Section 5 originate from the reference planning process. They represent an information-oriented view of the overall planning process and take into account both the planning disciplines and planning phases. ISO 18828-3 provides additional information that focuses on the transparency of the information flows. The process interfaces include the process phases, i.e., conceptual, rough, and detailed planning, in one dimension, and the planning disciplines of manufacturing, assembly, logistics, and layout, in the other.

In addition, the information flows per se can be regarded as individual, isolated information flows.

Five main information flows have been identified and modeled, each of which takes all process interfaces that were derived from the reference planning process. They describe the total information exchange between the accompanying activities and the type of data exchanged. In this respect, they resemble UML (Unified Modeling Language) activity diagrams.

Each information flow has been modeled around a specific flow object. This approach has the benefits of increased transparency of the interactions and data flows for each object. End users who are interested in a specific flow can easily check the entirety of their data and complete this specific flow. Furthermore, software providers also benefit from the object/process-oriented approach. Defining inputs and outputs for each activity enables the rapid derivation of an initial rough information flow. In addition, the function flow indirectly defines user interfaces, existing business and application logic, and applicable programming environments.

Furthermore in [Figure 3](#) a general overview of the networked interactions of the planning phases and planning disciplines is provided with respect to each main information flow. In addition [Figure 3](#) visualizes all required and accompanying activities, relationships, and decisions for each information flow. Software providers are also able to use this information in a work flow process. Besides, they are able to insert specific gateways and events for the main information flows in order to support the end user progressively in a step-by-step manner when completing the information object cycles.

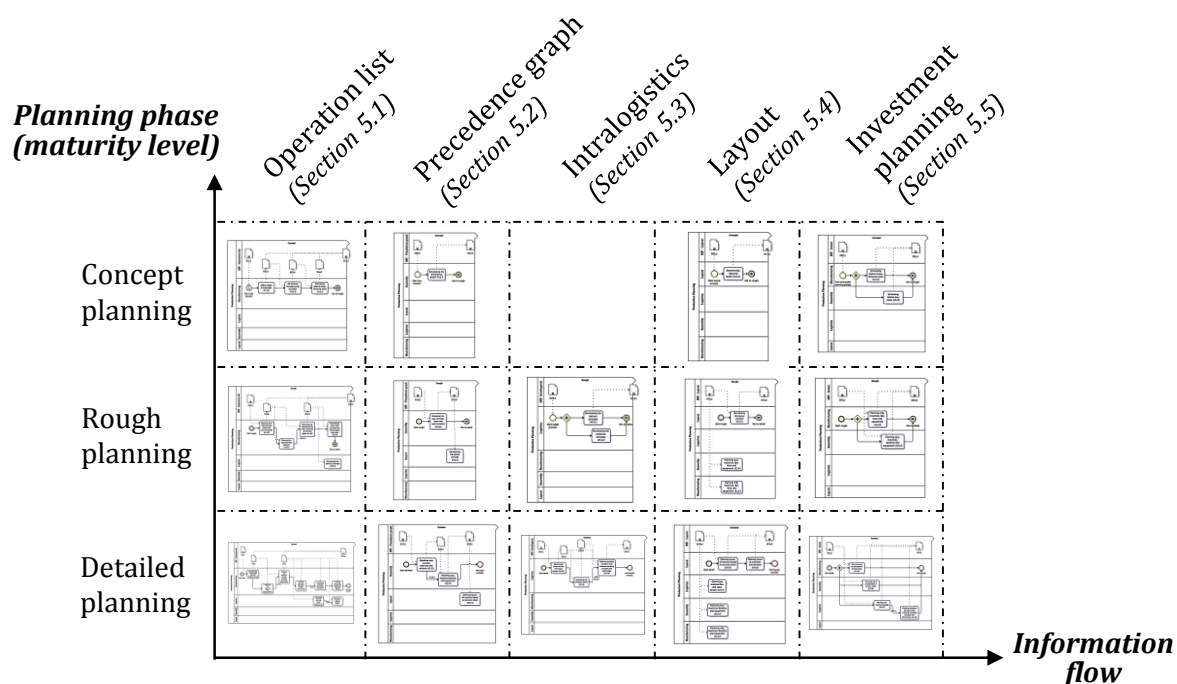


Figure 3 —Main information flows structured by planning phases

In order to graphically depict the interaction between processes and information flows, the 'Business Process Model and Notation' (BPMN) has been selected. The BPMN language uses semantically unique graphical elements for flows, connectors, and artifacts, which are similar to the activity diagrams of the UML. The formal visualization characteristics primarily used in this standard are described in [Annex D](#).

5 Main Information Flows

5.1 Operation list/process plan

The main information flow for an operation list or a process plan includes two information objects. The first object is referred to as 'preliminary information for the operation list' and includes prerequisites for planning. It has only one single state and will not be considered further. The second information object is referred to as an 'operation list' and assumes various states during the course of the planning process. Each state converts data from a previous state and supplements it with additional information or aggregates it into a subsequent state object. With respect to the 'operation list' information object, ten different states have been identified, which are depicted in [Figure 4](#).

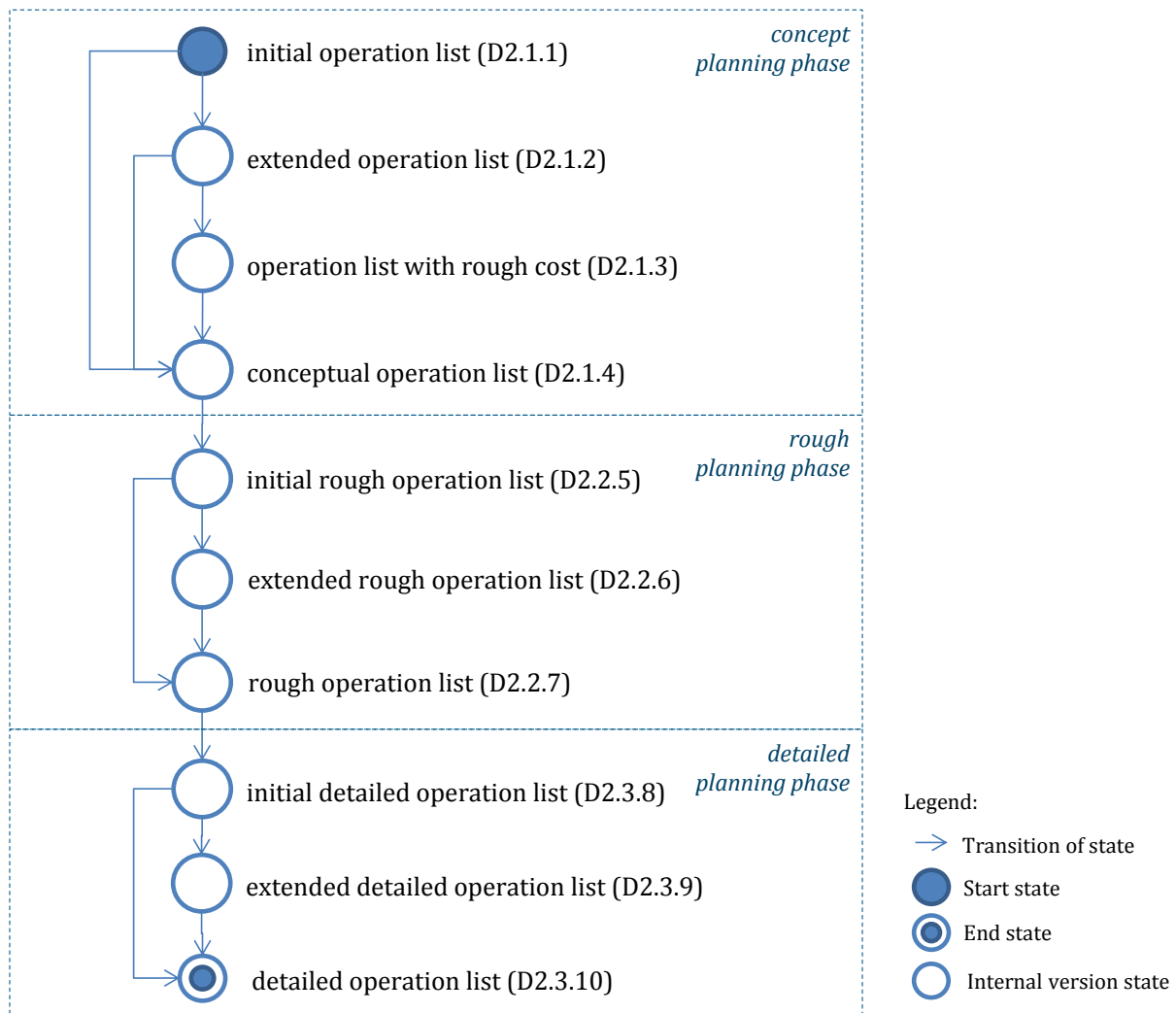


Figure 4 — States of the 'operation list' information object

NOTE The depicted states are described in greater detail in [Annex B](#).

Each state has been provided with a unique identifier, which follows a specific classification scheme. In order to gain an intuitive understanding, it is recommended to read from the right, not the left. The last digit represents the current version number of the information object. The middle digit stands for the current planning phase, while the first digit represents the information object itself. Accordingly, the last digit also contains the information state of the object. The accompanying letter 'D' identifies the type of information, in this case, 'data.'

5.1.1 Concept planning phase

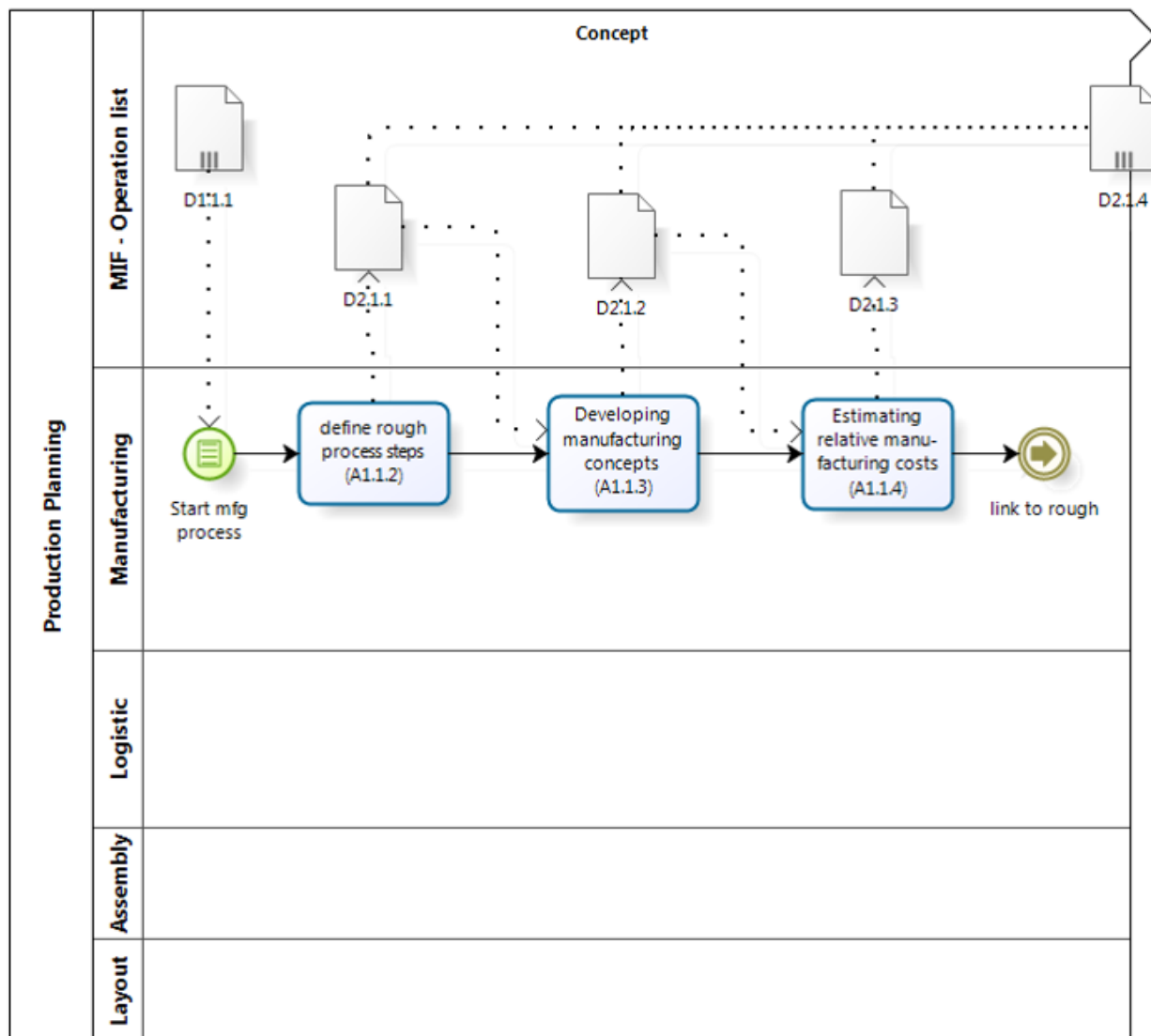


Figure 5 — Concept planning phase of the ‘operation list’ information flow

Based on preliminary information (p. D1.1.1 in [Figure 5](#)) that has been compiled from various relevant sources, the concept planning phase generates an initial conceptual operation list (D2.1.4).

To start the concept planning phase, various preliminary information is required for defining an operation list. It generally includes:

- product information (for example, parts and assemblies)
- number of pieces
- applicable technologies (for example, in a catalog)
- additional brown field information (for example, available resources)
- additional green field information (for example, applicable resources)

— available time database (for example, process times for operations).

These planning prerequisites determine an initial operation list. The information list is the result of a first rough definition of process steps (A1.1.2). The following step of developing manufacturing concepts (A1.1.3) supplements the initial operation list with additional information and results in an extended conceptual operation list (D2.1.3). The estimation of rough manufacturing costs (A1.1.4) based on the data of the conceptual operation list enables adding rough costs to the extended conceptual operation list (D2.1.4).

The last version of the concept planning phase generally includes four to five alternative operation lists for manufacturing a part or an assembly. Furthermore, this version determines process times for each alternative operation list (for example, milling four min., machining three min., etc.), and is passed on to the rough planning phase.

5.1.2 Rough planning phase

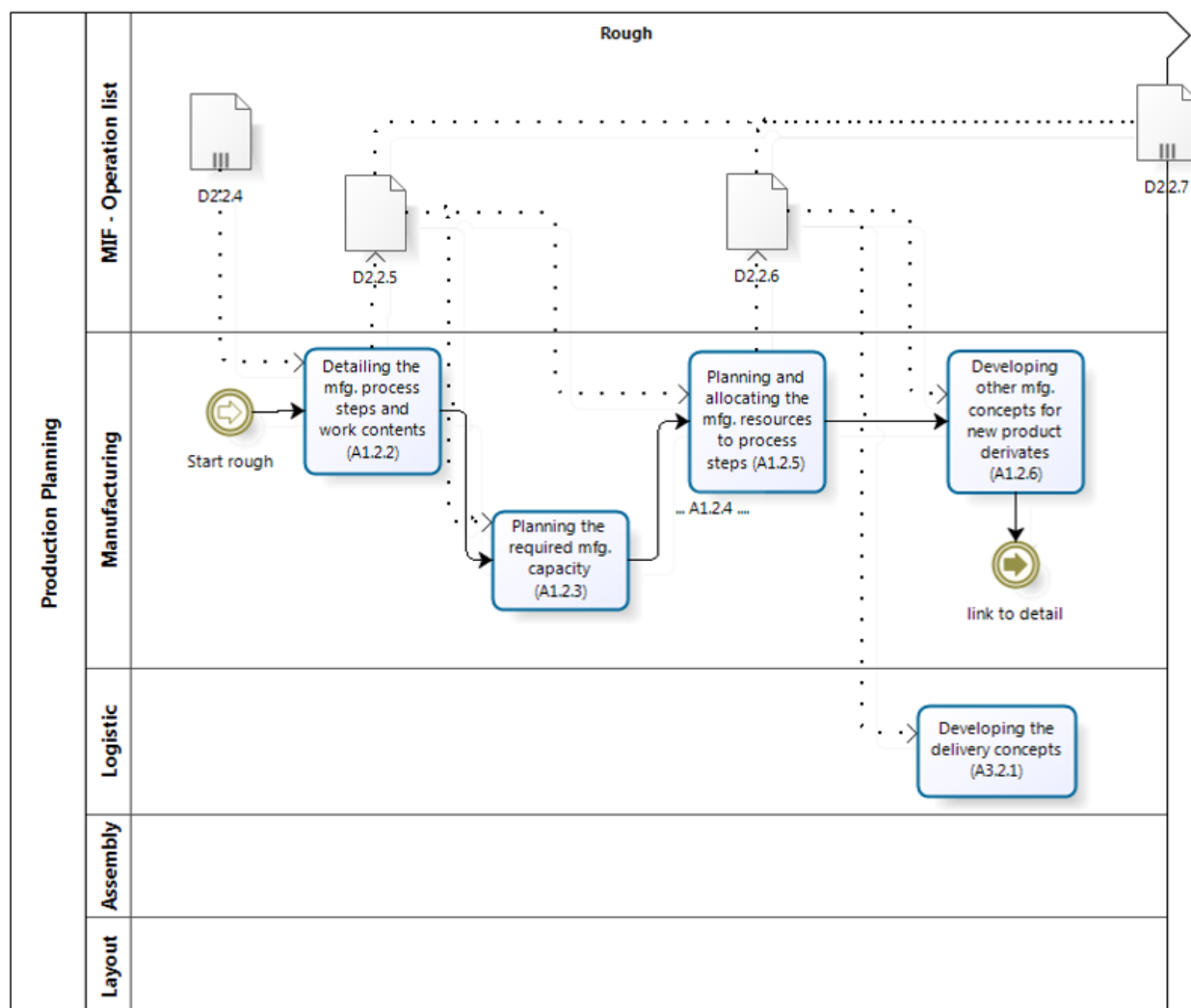


Figure 6 — Rough planning phase of the 'operation list' information flow

During the rough planning phase, the conceptual operation list (D2.2.4 in [Figure 6](#)) is detailed further in accordance with relevant continuing planning process steps and ultimately results in a rough operation list (D2.2.7).

The first process step in the rough planning phase consists of detailing the manufacturing process steps and work content (A1.2.2) and thus converts the conceptual operation list into a rough operation list (D2.2.5). The information in this list is used to estimate the required manufacturing capacity (A1.2.3) and for planning and allocating operating resources (A1.2.5). The rough operation list is developed further into an extended rough operation list (D2.2.6). In addition to further information, this list is used in developing manufacturing concepts for new product variants (A1.2.6) and supply concepts (A3.2.1). All this information is finally aggregated and documented in a rough operation list (D2.2.7).

The rough operation list normally includes various alternative operation lists that, similarly to the conceptual operation list, identify corresponding process times. Depending on these alternative operation lists, the rough operation list defines generic required resources (manufacturing, assembly, personnel resources, etc.). Furthermore, the rough operation list determines the required

infrastructure as well as manipulators and operating resources (for example, cranes and steel constructions). As of this level of detail, the list is often managed in digital form (for example, in standardized MS Excel lists, ERP systems, or specialized planning tools).

5.1.3 Detailed planning phase

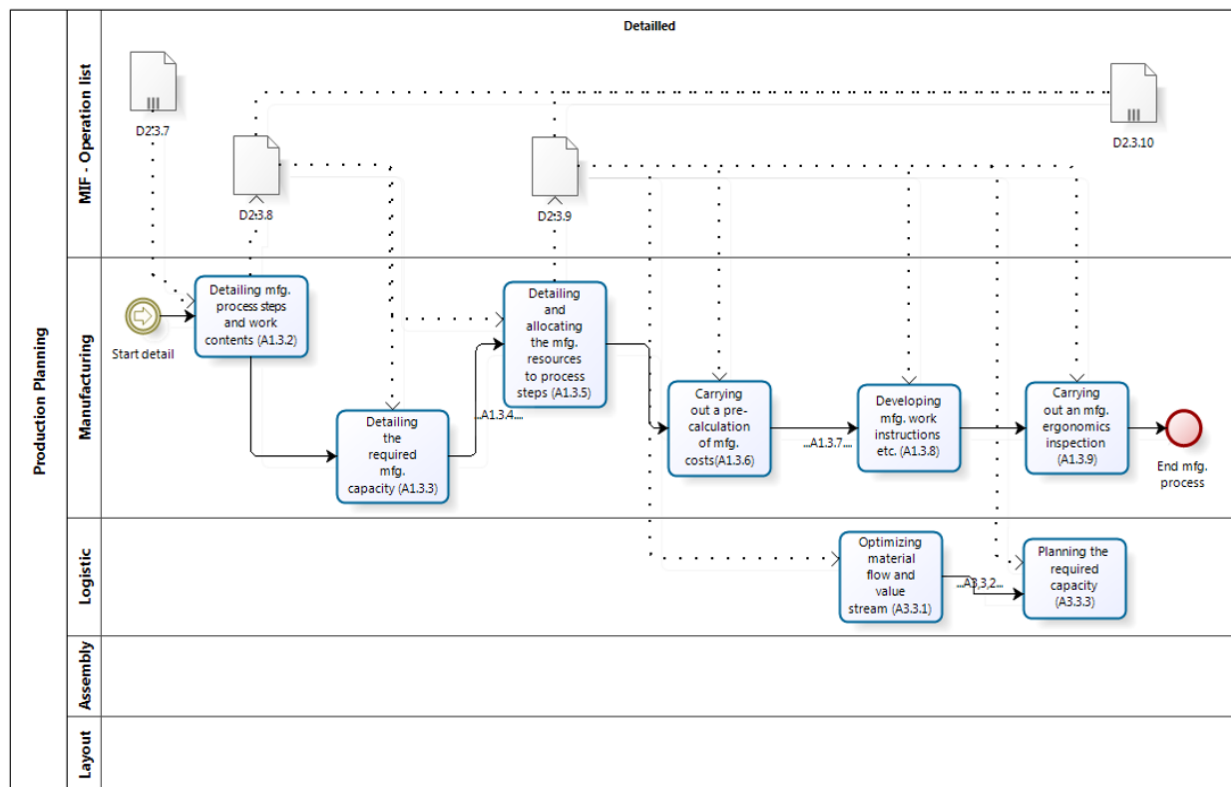


Figure 7 — Detailed planning phase of the ‘operation list’ information object

During the detailed planning phase, the rough operation list (D2.3.7 in [Figure 7](#)) is completely detailed and developed further into an elaborated complete operation list (D2.3.10).

In the detailed planning phase, the rough operation list is used to develop the details of manufacturing process steps and work content (A1.3.2). The rough operation list is converted into an initial detailed operation list (D2.3.8), which is used to determine the required manufacturing capacity (A1.3.3) and for allocating operating resources to process steps (A1.3.5). The aforementioned processes enrich the initial detailed operation list into an extended detailed operation list (D2.3.9). This list is applied in various subsequent planning steps within the scope of manufacturing planning, for example, when performing a preliminary calculation of manufacturing costs (A1.3.6), developing work instructions for manufacturing (A1.3.8), and an initial ergonomic assessment (A1.3.9). Furthermore, the extended detailed operation list is used in logistics planning for optimizing the material flows and the value stream (A3.3.1) and planning the required capacity (A3.3.3).

At the end of the detailed planning phase, all relevant information, consisting of the operation list including schedules, personnel allocations, required concrete resources (operating resources, assembly resources, personnel), the infrastructure, and operating resources (cranes, steel constructions) is collected and stored in a detailed operation list (D2.3.10). The management of the list is generally