

ISO/IEC TR 63306-1:2020-12 (E)

Smart manufacturing standards map (SM2) - Part 1: Framework

Contents	Page
FOREWORD	8
INTRODUCTION	10
1 Scope	11
2 Normative references	11
3 Terms and definitions	11
4 Principle of the Smart Manufacturing Standards Map (SM2)	11
4.1 Framework	11
4.2 SM2 Catalogue	12
4.3 Graphical representations	14
5 Overview of the SM2 Vocabulary	21
5.1 Summary of characteristics and blocks	21
5.2 Values of the characteristics	24
5.3 Qualifier	24
6 Block "Identification"	25
6.1 Composition	25
6.2 Qualifier	25
6.3 Sub-block "Reference"	26
6.3.1 Characteristic "Status"	26
6.3.2 Characteristic "Standard number"	26
6.4 Sub-block "Publication"	26
6.4.1 Characteristic "Edition"	26
6.4.2 Characteristic "Publication date"	26
6.5 Sub-block "Project"	27
6.5.1 Characteristic "Project number"	27
6.5.2 Characteristic "Forecast publication date"	27
6.6 Sub-block "Owner"	27
6.6.1 Characteristic "Organization"	27
6.6.2 Characteristic "Committee number"	27
6.6.3 Characteristic "Committee title"	28
6.7 Sub-block "ICS"	28
6.7.1 Characteristic "International Classification for Standards"	28
6.7.2 Other characteristics	29
6.8 Sub-block "Title"	29
6.8.1 Characteristic "Standard title"	29
6.8.2 Characteristic "Standard short title"	29
7 Block "Object"	30
7.1 Composition	30
7.2 Qualifier	30
7.3 Sub-block "Type of standard"	30
7.3.1 Description	30
7.3.2 Characteristics	30
7.4 Sub-block "Type of object"	32

7.4.1	Description	32
7.4.2	Characteristics	32
7.5	Sub-block "Manufacturing process type"	33
7.5.1	Description	33
7.5.2	Characteristics	34
8	Block "Hierarchy"	34
8.1	Composition	34
8.2	Qualifier	35
8.3	Sub-block "Equipment hierarchy"	35
8.3.1	Description	35
8.3.2	Characteristics	35
8.4	Sub-block "Functional hierarchy"	37
8.4.1	Description	37
8.4.2	Characteristics	37
9	Block "Life cycle"	38
9.1	Composition	38
9.2	Qualifier	39
9.3	Sub-block "Product type life cycle"	39
9.3.1	Description	39
9.3.2	Characteristics	40
9.4	Sub-block "Product instance life cycle"	41
9.4.1	Description	41
9.4.2	Characteristics	41
9.5	Sub-block "Production system life cycle"	41
9.5.1	Description	41
9.5.2	Characteristics	42
10	Block "Interoperability"	42
10.1	General	42
10.2	Composition	43
10.3	Qualifier	43
10.4	Sub-block "Interoperability approach"	43
10.4.1	Description	43
10.4.2	Characteristics	43
10.5	Sub-block "Interoperability concern"	45
10.5.1	Description	45
10.5.2	Characteristics	45
10.6	Sub-block "Interoperability layer"	46
10.6.1	Description	46
10.6.2	Characteristics	46
11	Block "System engineering process"	46
11.1	General	46
11.2	Composition	47
11.3	Qualifier	48
11.4	Sub-block "Agreement processes"	48
11.4.1	Description	48
11.4.2	Characteristics	48
11.5	Sub-block "Organizational project-enabling processes"	49
11.5.1	Description	49
11.5.2	Characteristics	49
11.6	Sub-block "Technical management processes"	49
11.6.1	Description	49
11.6.2	Characteristics	49

11.7	Sub-block "Technical processes"	50
11.7.1	Description	50
11.7.2	Characteristics	50
12	Block "Relevance to SM"	51
12.1	Composition	51
12.2	Qualifier	52
12.3	Characteristic "Relevance level"	52
12.4	Characteristic "Motivation"	52
13	Block "Validation"	52
13.1	Composition	52
13.2	Qualifier	53
13.3	Characteristics specification	53
Annex A	(informative) Compilation of definitions of smart manufacturing	54
A.1	Objective	54
A.2	Definition	54
A.3	Complements to the definition	54
A.4	Vision	55
A.5	Difference from the manufacturing to date	56
A.6	New technologies for smart manufacturing	57
Annex B	(informative) Life cycles	60
B.1	General	60
B.2	Product life cycle	60
B.3	Production system life cycle	62
B.4	Supply chain life cycle	64
B.5	Characteristic "RAMI4.0 Life cycle"	65
B.5.1	Description	65
B.5.2	Possible values	65
B.6	Characteristic "IMSA Life cycle"	66
B.6.1	Description	66
B.6.2	Possible values	66
Annex C	(informative) Hierarchies	67
C.1	General	67
C.2	Characteristic "Equipment hierarchy" of IEC 62264-1 and IEC 61512-1	67
C.2.1	Description	67
C.2.2	Possible values	67
C.3	Characteristic "Functional hierarchy" of IEC 62264-1	68
C.3.1	Description	68
C.3.2	Possible values	68
C.4	Characteristic "SGAM Zones"	69
C.4.1	Description	69
C.4.2	Possible values	69
C.5	Characteristic "RAMI4.0 Hierarchy levels"	70
C.5.1	Description	70
C.5.2	Possible values	70
C.6	Characteristic "IMSA System hierarchy"	71
C.6.1	Description	71
C.6.2	Possible values	71
C.7	Mapping legacy hierarchies on the equipment hierarchy	71

C.8	Mapping on legacy hierarchies on the functional hierarchy	73
Annex D (informative)	Interoperability.....	74
D.1	General	74
D.2	Big Picture characteristic "Interoperability barrier"	74
D.2.1	Description.....	74
D.2.2	Possible values	74
D.2.3	Comments.....	74
D.3	Characteristic "SGAM Interoperability Layers"	76
D.3.1	Description.....	76
D.3.2	Possible values	77
D.4	Characteristic "RAMI4.0 Layer".....	78
D.4.1	Description.....	78
D.4.2	Possible values	78
D.5	Characteristic "IMSA Intelligent characteristics"	80
D.5.1	Description.....	80
D.5.2	Possible values	80
Annex E (informative)	Big Picture history.....	82
Bibliography	85
Figure 1	– Principle of the SM2 Framework	12
Figure 2	– Example of populated SM2 Catalogue	13
Figure 3	– Example mapping of product catalogue data standards.....	15
Figure 4	– Example mapping structure for production system standards	16
Figure 5	– Example chart "Production system cube" with standard numbers	17
Figure 6	– Example chart "Production system cube" with short title	18
Figure 7	– Example 2D chart with standard numbers	19
Figure 8	– Example 2D chart with short title.....	20
Figure 9	– Product type life cycle.....	40
Figure 10	– GERA life cycle phases	42
Figure B.1	– Product type life cycle	60
Figure B.2	– Versions of a product type.....	61
Figure B.3	– Product type improvement.....	61
Figure B.4	– Product instance life time	62
Figure B.5	– Product instance and product type.....	62
Figure B.6	– Production system life cycle	63
Figure B.7	– The user and the external actors	63
Figure B.8	– From the design to maintenance.....	63
Figure B.9	– Spare component discontinued.....	64
Figure B.10	– Supply chain life cycle	64
Figure C.1	– RAMI4.0 Hierarchy	70
Figure D.1	– Grouping into interoperability layers	77
Figure E.1	– Standards landscape.....	82
Figure E.2	– History of the Big Picture project	84

Table 1 – Block "Identification": sub-blocks and characteristics	21
Table 2 – Block "Object": sub-blocks and characteristics	21
Table 3 – Block "Hierarchy": sub-blocks and characteristics	22
Table 4 – Block "Life cycle": sub-blocks and characteristics	22
Table 5 – Block "Interoperability": sub-blocks and characteristics	23
Table 6 – Block "System engineering process": sub-blocks and characteristics	23
Table 7 – Block "Relevance to SM": sub-blocks and characteristics	24
Table 8 – Block "Validation": sub-blocks and characteristics	24
Table 9 – Composition of the block "Identification"	25
Table 10 – Possible values of "Status"	26
Table 11 – Composition of the block "Object"	30
Table 12 – Characteristics of "Type of standard"	31
Table 13 – Characteristics of "Type of object"	32
Table 14 – Characteristics of "Manufacturing process type"	34
Table 15 – Composition of the block "Hierarchy"	35
Table 16 – Characteristics of "Equipment hierarchy"	35
Table 17 – Characteristics of "Functional hierarchy"	38
Table 18 – Composition of the block "Life cycle"	39
Table 19 – Characteristics of "Product type life cycle"	41
Table 20 – Characteristics of "Product instance life cycle"	41
Table 21 – Characteristics of "Production system life cycle"	42
Table 22 – Composition of the block "Interoperability"	43
Table 23 – Characteristics of "Interoperability approach"	44
Table 24 – Characteristics of "Interoperability concern"	45
Table 25 – Characteristics of "Interoperability layer"	46
Table 26 – Composition of the block "System engineering process"	47
Table 27 – Characteristics of "Agreement processes"	48
Table 28 – Characteristics of "Organizational project-enabling processes"	49
Table 29 – Characteristics of "Technical management processes"	50
Table 30 – Characteristics of "Technical processes"	51
Table 31 – Composition of the block "Relevance to SM"	52
Table 32 – Possible values of "Relevance level"	52
Table 33 – Composition of the block "Validation"	53
Table B.1 – Possible values of "RAMI4.0 Life cycle"	65
Table B.2 – Possible values of "IMSA Life cycle"	66
Table C.1 – Possible values of "Equipment hierarchy"	67
Table C.2 – Possible values of "Functional hierarchy"	68
Table C.3 – Possible values of "SGAM Zones"	69
Table C.4 – Possible values of "RAMI4.0 Hierarchy level"	70
Table C.5 – Possible values of "IMSA System hierarchy"	71
Table C.6 – Mapping on legacy hierarchies on the equipment hierarchy	72
Table C.7 – Mapping on legacy hierarchies on the equipment hierarchy	73
Table D.1 – Possible values of "Interoperability barrier"	74

Table D.2 – Interoperability categories defined by GWAC.....	76
Table D.3 – Possible values of "SGAM Interoperability Layers"	77
Table D.4 – Possible values of "RAMI4.0 Layer"	78
Table D.5 – Possible values of "IMSA Intelligent characteristics"	81