FBD_BMODEL

FASHION BIG DATA BUSINESS MODEL

D5.1

Report on data-based services

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1 Executive Summary

The FBD_BModel's technology platform is composed of two interconnected knowledge-based systems (a Cloud Computational Interactive Design System (CC_IDS) and a Supply Chain and Production Management System (SCMPS)). Associated with it are several data-based services to a variety of value chain members and stakeholders. In particular, these are:

- **IDS-ds1:** Classification of body shapes of a specific population.
- **IDS-ds2:** Identification of the individual consumer's needs (consumer profile) in relation to their lifestyle in terms of physical activities, living environments, body size and shape and their physiological features and health status as well as fashion requirements.
- **IDS-ds3:** Recommendation of relevant fashion design solutions (styles, colours, materials) according to the personalized fashion requirements of consumers.
- **IDS-ds4:** Recommendation of relevant functional design solutions (functional performances of materials) according to personalized consumer's requirements on life style.
- **IDS-ds5:** Evaluation of virtual fitting in terms of fashion, fabric hand, thermal comfort and movement performance of designed garments and adjustment of technical parameters according to evaluation results.
- **IDS-ds6:** Creation, management and updating of the design cloud database and design knowledge base.
- **SCMPS-ds1:** Selection of relevant fabric suppliers and materials as well as garment makers in terms of technical parameters, cost, delay, stock, environmental footprint, and transport conditions.
- **SCMPS-ds2:** Testing and certifying functional performance of textile materials from fibres, yarns, fabrics to garments in the fashion textile supply chain.
- **SCMPS-ds3:** Cloud databases services for the certified textile and apparel manufacturers, particularly SMEs.
- **SCMPS-ds4:** Optimization of production planning and scheduling by dynamically organizing tasks into different series (reconfiguration).
- **SCMPS-ds5:** Simulation of production and adjustment of tasks planning according to simulated performance.
- **SCMPS-ds6:** Environmental footprint assessment (Life Cycle Analysis) and certification of products and manufacturing processes.
- **SCMPS-ds7:** On-line pricing, trading and financial transaction services.
- **SCMPS-ds8:** Creation, management and updating of the production knowledge base (rules characterizing relations between design parameters, production parameters and environmental impacts).

In order to describe the data requirements, i.e. the key data associated with each data-based service (IDS-ds1-6 and SCMPS-ds1-8), the generation of a foundational simplified product

datasheet is essential, which will extract both design and production related parameters and compute additional data required to build these data-based services.

The design datasheet is generated by interactions between the consumer and designer on evaluation of the design solution, and consists of data generated through 3 sub-systems of CC_IDS:

- **CCIDS1:** Consumer selection, profile formalization and requirement specification
- **CCIDS2:** Virtual fashion design and product development, and
- **CCIDS3:** Functional characterization.

The production datasheet consists of data generated through 3 sub-systems of SCMPS:

- **SCMPS1:** Fabric Manufacturing
- **SCMPS2:** Garment Manufacturing
- **SCMPS3:** Logistics and Distribution.

The design datasheet consists of 15 data categories, 6, 6, and 3 related to CCIDS 1, 2, and 3 respectively. Overall, 57 input data types and 21 computed output data are associated with it. The production datasheet consists of 27 data categories, 12, 11, and 4 related to SCMPSS 1, 2, and 3 respectively. Overall, 104 input data types and 64 computed output data are associated with it. Following the detailed presentation of the simplified product datasheet, the data-based services associated with FBD_BModel platform are evaluated in terms of their data requirements, data from whom and service to whom. Many of these data-based services show requirement of data from both datasheets, and from multiple sub-systems, and are essential for various value chain members and stakeholders.

This simplified datasheet and data-based service representation, as proposed in this report, will act as a foundation for the creation of a more detailed and normalized product datasheet as the project progresses and the business cases and systems are elaborated further.

In addition, the role of security management of the databases and data-services connected to FBD_BModel's platform has been revisited, along with providing a brief description of the role of different standards, most importantly ISO/IEC JTC 1/SC 27, ISO/IEC JTC 1/SC 31 and ISO/IEC JTC 1/SC 32, for addressing security management issues that can improve the security and mitigate risks associated with FBD_BModel's integrated platform.

2 Deriving the general product data structure

2.1 FBD_BModel's overall model

The FBD_BModel's technology platform is composed of two interconnected knowledge-based systems (a Cloud Computational Interactive Design System (CC_IDS) and a Supply Chain and Production Management System (SCMPS)).

As has been proposed in the project, the **CC_IDS** will

> "promote dynamic interactions between designers, textile material manufacturers, garment producers and remote consumers by means of a cloud materials database, cloud computing, 3D digital garments and human avatars in a virtual world for evaluating and predicting fitting effects, functional performances and comfort perception, in order to generate the most appropriate virtual garments and related technical design solutions (fabrics, garment styles, patterns, colours). CC_IDS will be composed of a design cloud database and two subsystems, i.e. the Functional Textiles CC_IDS and Garment and Fashion CC_IDS. The design cloud database will include all technical data on the selected samples and human data of the target populations, namely the fabric technical parameters and thermal properties, the garment design parameters (design elements, garment styles and patterns, colours), the human models, the corresponding 3D virtual fabrics, virtual garments and virtual garment fitting effects on the human models."

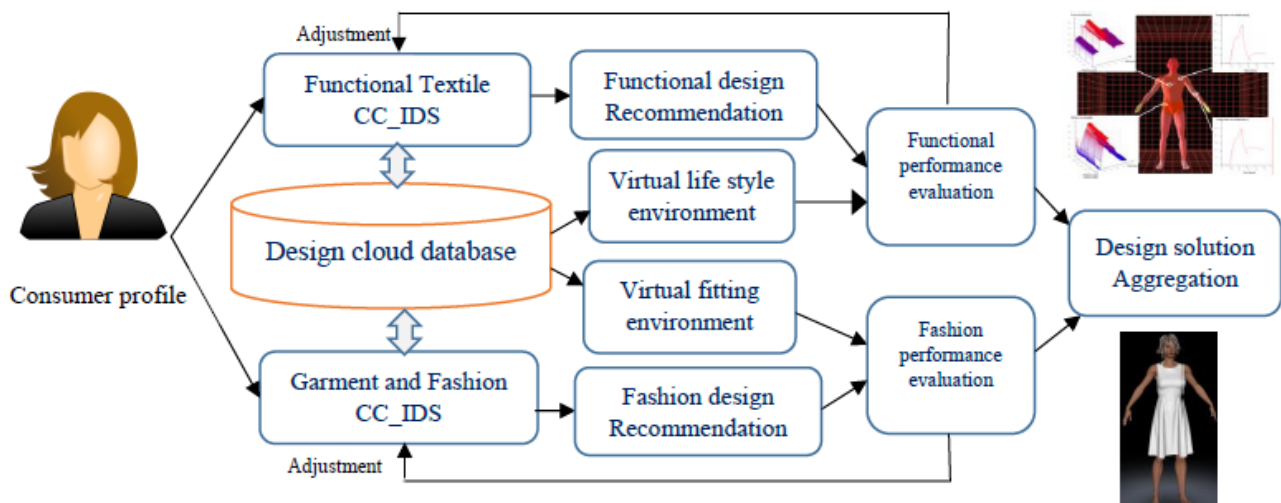Figure 1. represents the overall CC_IDS structure.

Figure 1 CC_IDS structure and development process

On the other hand, the **SCMPS** is based on the flexible customized garment manufacturing and will

> *"permit the classifying and commissioning (of) production orders of small well-targeted products, generated from all personalized design solutions in a specific time interval, and setting-up optimised distributed production planning schemes, in order to provide quick responses and fast delivery to consumers minimizing both stocks for raw materials and finished products and total costs. The proposed production system will be flexible, capable of dealing with different collections simultaneously, satisfying various needs of consumers in terms of fashion style, functionalities, material and colour. The production system will take into account different parameters of the production chain (capacity, default rates, productivity, etc.) but also environmental parameters such as human resources, virtual inventories and supplies, forecasts, ecological impacts, etc. The supply chain structure (design unit, production unit, stock unit, transportation unit, retailing unit) will be carefully designed and dynamically re-configured in order to optimize product delivery cost and timing for selected design solutions."*

Figure 2. represents the overall SCMPS structure.
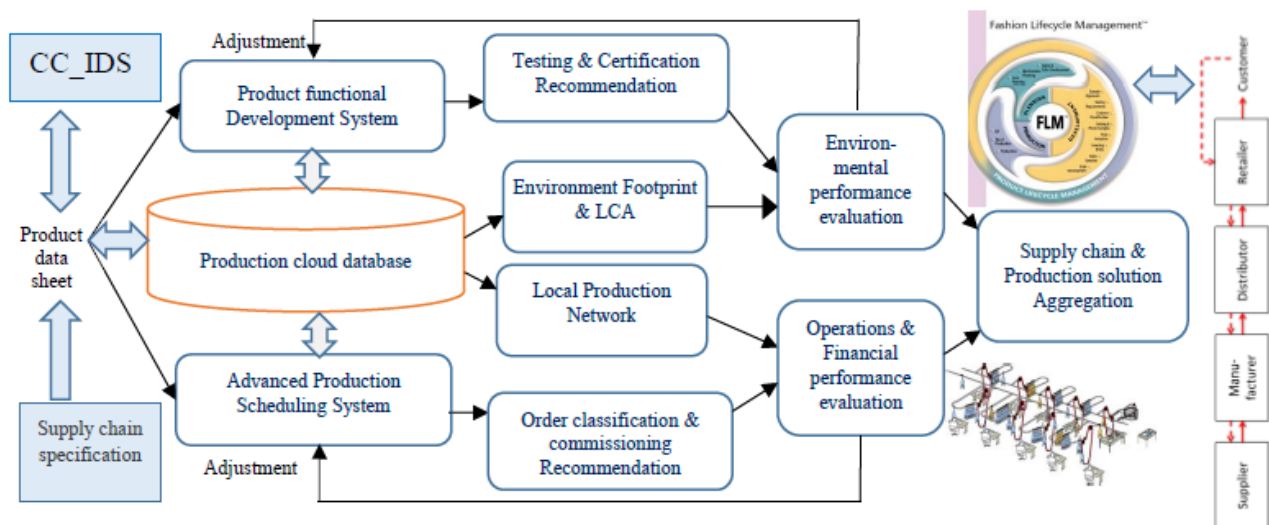
Figure 2 SCMPS structure and development process

2.1.1 Associated CC_IDS data-based services

The CC_IDS is proposed to be composed of two stages: 1) creating a design knowledge base; 2) developing an online design recommendation and a data updating mechanism. This system will consist of a number of databases: (1) metabolisms of human activities; (2) human living environments in relation geographic locations and seasonal weather changes; (3) human anthropological features such as height, size, gender and age; (4) garment design and structural features such as size, fitness and layers in each garment, and the process of how to wear the

garments (e.g. underwear+shirt+jacket+coat); (5) fabric structural and physical properties such as fabric thickness, weights, porosity, surface energy, water vapour permeability, moisture management properties, thermal conductivity, temperature regulating, IR irradiative property and smart heating capacity; (6) fibre structural features and properties such as diameters, surface energy, moisture sorption capacity, thermal conductivity.

Based upon these requirements the proposed data-based services associated with CC_IDS include:

- **IDS-ds1:** Classification of body shapes of a specific population.
- **IDS-ds2:** Identification of the individual consumer's needs (consumer profile) in relation to their lifestyle in terms of physical activities, living environments, body size and shape and their physiological features and health status as well as fashion requirements.
- **IDS-ds3:** Recommendation of relevant fashion design solutions (styles, colours, materials) according to the personalized fashion requirements of consumers.
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- **IDS-ds5:** Evaluation of virtual fitting in terms of fashion, fabric hand, thermal comfort and movement performance of designed garments and adjustment of technical parameters according to evaluation results.
- **IDS-ds6:** Creation, management and updating of the design cloud database and design knowledge base.

2.1.2 Associated SCMPS data-based services

The SCMPS is proposed to be composed of two stages: 1) fabric production; 2) fabric cutting (performed collectively for many grouped orders), and sewing (performed individually per order or collectively according to the size of the production unit). During the production, the main data parameters affecting overall cost, efficiency and environmental sustainability of the production chain will be optimised, such as human resources allocation, material procurement, transportation costs, capacity, default rates, productivity, environmental impacts based on a LCA, etc.

Closely connected to CC_IDS by a normalized product data sheet, SCMPS sets up a common infrastructure permitting to realise the following data-based services:

- **SCMPS-ds1:** Selection of relevant fabric suppliers and materials as well as garment makers in terms of technical parameters, cost, delay, stock, environmental footprint, and transport conditions.
- **SCMPS-ds2:** Testing and certifying functional performance of textile materials from fibres, yarns, fabrics to garments in the fashion textile supply chain.
- **SCMPS-ds3:** Cloud databases services for the certified textile and apparel manufacturers, particularly SMEs.
- **SCMPS-ds4:** Optimization of production planning and scheduling by dynamically organizing tasks into different series (reconfiguration).
- **SCMPS-ds5:** Simulation of production and adjustment of tasks planning according to simulated performance.

- **SCMPS-ds6:** Environmental footprint assessment (Life Cycle Analysis) and certification of products and manufacturing processes.
- **SCMPS-ds7:** On-line pricing, trading and financial transaction services.
- **SCMPS-ds8:** Creation, management and updating of the production knowledge base (rules characterizing relations between design parameters, production parameters and environmental impacts).

3 Simplified product datasheet

In order to describe the data requirements, i.e. the key data associated with each data-based service (IDS-ds1-6 and SCMPS-ds1-8), the generation of a normalized product datasheet is essential. A simplified version of the product datasheet is proposed here, which will act as a foundation for the creation of a more detailed and normalized product datasheet as the project progresses, and the business cases are elaborated further.

The simplified product datasheet is composed of two parts: 1) design datasheet, corresponding to the design solution finally determined by the CC_IDS; and 2) production datasheet, corresponding to the production parameters extracted from the SCMPS cloud database for this design solution and the supply chain specification related to the selected suppliers and other involved professional partners (shown in Figure 3). The design datasheet is generated by interactions between the consumer and designer on evaluation of the design solution. It consists of data generated through 3 sub-systems of CC_IDS:

- **CCIDS1: Consumer selection, profile formalization and requirement specification**
- **CCIDS2: Virtual fashion design and product development, and**
- **CCIDS3: Functional characterization.**

The production cloud database constitutes the kernel of the whole SCMPS. It is composed of the production parameters (capacity, quality, delivery time, processes, raw materials, costs, etc.), and environmental impacts of all registered members of the local production network. The production datasheet consists of data generated through 3 sub-systems of SCMPS:

- **SCMPS1: Fabric Manufacturing**
- **SCMPS2: Garment Manufacturing**
- **SCMPS3: Logistics and Distribution.**
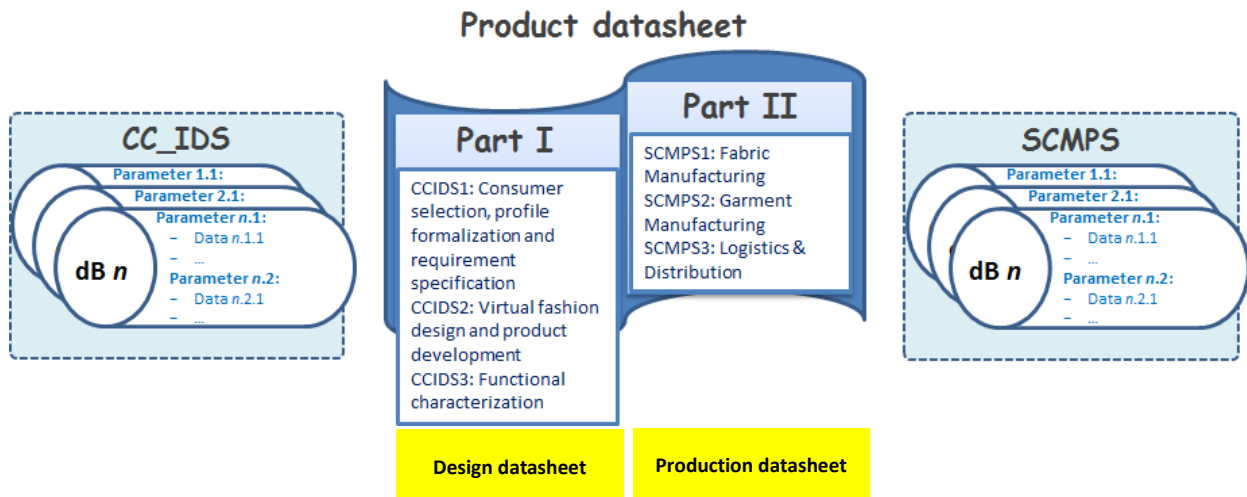
Product datasheet

Figure 3 Simplified product datasheet model

4 Simplified product datasheet Part I: related to CC_IDS

4.1 Consumer selection, profile formalization and requirement specification (CCIDS1)

The CCIDS1 consists of 6 categories of data related to consumer. These are related to:

- Consumer's profile in terms of: (i) demographics and (ii) anthropological measurements,
- Environmental aspects related to consumer's geographical location, and
- Socio-economic aspects of the consumer, in terms of (i) lifestyle, (ii) economic and (iii) psychographic.

Overall, 26 input data types can be identified while only 1 computed data, i.e. visualization of the 3D avatar is created.

4.1.1 Consumer-related parameters (CCIDS1.1)

The consumer-related input parameters are related to (i) demographics and (ii) anthropology, while the output is a 2++D or 3D avatar of the consumer profile inputted. In total there are 7 input data and 1 output data.

Table 1. CCIDS 1.1 input datasheet

CATEGORY	DATA CODE	INPUT DATA TYPE	DATA FORMAT
Demographics	C (in) 1.1.1	Gender	Male/Female
	C (in) 1.1.2	Age	Years
	C (in) 1.1.3	Skin colour	Image
Anthropological	C (in) 1.1.4	Height	metres
	C (in) 1.1.5	Weight	Kgs
	C (in) 1.1.6	Body shape	Image/Text[1]
	C (in) 1.1.7	Other body measurements[2]	metres

Table 2. CCIDS 1.1 output datasheet

CATEGORY	DATA CODE	COMPUTED METADATA	DATA FORMAT
Anthropological	C (out) 1.1.1	3D avatar	Images

4.1.2 Environmental parameters (CCIDS1.2)

The environmental input parameters are related to geographical details of the consumer's location. There are 5 input data.

Table 3. CCIDS 1.2 input datasheet

CATEGORY	DATA CODE	INPUT DATA TYPE	DATA FORMAT
Geographical	C (in) 1.2.1	Location	Place
	C (in) 1.2.2	Weather type	Text[3]
	C (in) 1.2.3	Temperature	°C/°F
	C (in) 1.2.4	Relative Humidity (R.H.)	%
	C (in) 1.2.5	Air velocity	metre/second

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[1] E.g. Inverted triangle, Triangle, Round/Apple, Neat hour-glass, Full hour-glass, Rectangle.
[2] Measurement points, e.g. for jacket include: chest, waist, hip, total front length, shoulder, waist from shoulder, armhole, back to neck length, waist from centre-back to neck length, lower front width.
[3] E.g. Sunny; Raining; Stormy; Snowing

4.1.3 Socio-economic parameters (CCIDS1.3)

The socio-economic input parameters are of three types: (i) lifestyle-related, (ii) economic, and (iii) psychographic. In total there are 14 input data, of which 8 are related to the last category and are based upon consumer's personal preferences or wear experiences after purchase when the product is in-use.

Table 4. CCIDS 1.3 input datasheet

CATEGORY	DATA CODE	INPUT DATA TYPE	DATA FORMAT
Lifestyle	C (in) 1.3.1	Activity type	Text[4]
	C (in) 1.3.2	Body metabolism	Watts/metre^2
	C (in) 1.3.3	Duration	Minutes
	C (in) 1.3.4	Schedule/programme	Text[5]
Economic	C (in) 1.3.5	Income	Euros
	C (in) 1.3.6	Price sensitivity	Number
Psychographic	C (in) 1.3.7	Hand feel	Softness/smoothness/warmness
	C (in) 1.3.8	Wear fitting	Tight fit/just fit/loose fit
	C (in) 1.3.9	Skin comfort	Prickle/rough/cool
	C (in) 1.3.10	Post-purchase evaluation	Text
	C (in) 1.3.11	Fitting performance	Scale[6]
	C (in) 1.3.12	Outlook performance	Scale[6]
	C (in) 1.3.13	Skin comfort performance	Scale[6]
	C (in) 1.3.14	Thermal comfort performance	Scale[6]

4.2 Virtual fashion design and product development (CCIDS2)

The CCIDS2 consists of 6 categories of data related to the product visualization. These are related to:

- Fabric parameters and specifications, and
- Garment parameters and specification.

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[4] E.g. Jogging, running, walking, sitting, sports, etc.
[5] E.g. 1day/week, 3days/week, every day, multiple times a day
[6] E.g. Likert scale (5 = Very good to 1 = Not good)

Overall, 15 input data types can be identified while 4 computed data types are created. The computed output data are related to 2++ or 3D fabric and garment visualizations on avatars.

4.2.1 Fabric parameters (CCIDS2.1)

11 fabric input parameters are identified for CCIDS 2.1. These are primarily related to fabric properties, like fabric coarseness, thickness, weight, porosity. Additionally fibre properties also influence the fabric parameters, e.g. fibre diameter, fibre type, fibre blend ratio. The input images are preferred in simple .jpeg or .png file format. Output fabric visualization is preferred in .obj file (i.e. simple 3D format).

Table 5. CCIDS 2.1 input datasheet

CATEGORY	DATA CODE	INPUT DATA TYPE	DATA FORMAT
Fabric Specification	C (in) 2.1.1	Fabric type and composition	Text[7]
	C (in) 2.1.2	Fabric coarseness[8]	NeC/Nm
	C (in) 2.1.3	Fabric thickness	Millimetres
	C (in) 2.1.4	Fabric weight	gram/metre^2
	C (in) 2.1.5	Fabric design	Image
	C (in) 2.1.6	Fabric colour	Image
	C (in) 2.1.7	Print design	Image
	C (in) 2.1.8	Fibre diameter	micrometre
	C (in) 2.1.9	Fibre type	Text
	C (in) 2.1.10	Fabric porosity	%
	C (in) 2.1.11	Fibre blend ratio	%

Table 6. CCIDS 2.1 output datasheet

CATEGORY	DATA CODE	COMPUTED METADATA	DATA FORMAT
Fabric Specification	C (out) 2.1.1	Fabric visualization	Images

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[7] E.g. Woven/Knitted - Cotton (50%)-Polyester (50%)
[8] Depends on average yarn diameter and fabric count

4.2.2 Garment parameters (CCIDS2.2)

4 garment input parameters and 3 output parameters are identified for CCIDS 2.2. All data types are in image format, where 2D images are preferred in .jpeg or .png files while 3D images in .obj file. UV mapping refers to the 3D modelling process of projecting a 2D image to a 3D model's surface for texture mapping and are in .mtl file format.

Table 7. CCIDS 2.2 input datasheet

CATEGORY	DATA CODE	INPUT DATA TYPE	DATA FORMAT
Garment Specification	C (in) 2.2.1	Garment 2D image	Images
	C (in) 2.2.2	Garment 3D shape	Images
	C (in) 2.2.3	Component image 2D	Images
	C (in) 2.2.4	Component image 3D	Images

Table 8. CCIDS 2.2 output datasheet

CATEGORY	DATA CODE	COMPUTED METADATA	DATA FORMAT
Garment Specification	C (out) 2.2.1	UV mapping	Mesh
	C (out) 2.2.2	Customized garment	Images
	C (out) 2.2.3	Virtual try-on	Images

4.3 Functional characterization (CCIDS3)

The CCIDS3 consists of 3 categories of data related to the product functionalization. These are related to:

- Thermal properties and comfort,
- Tactile properties and comfort, , and
- Pressure properties and comfort.

Overall, 16 input data types can be identified while 16 computed data, i.e. mainly graphical images of product functionalization are created.

4.3.1 Thermal comfort-related parameters (CCIDS3.1)

There are 6 input and output functional or technological properties, respectively, related to thermal comfort. The key input parameters are related to air and water permeability and 3 moisture

management. Output results are related to sensation and feel for consumers, in terms of thermal comfort, moisture sensation, perception of dampness and warmth etc.

Table 9. CCIDS 3.1 input datasheet

CATEGORY	DATA CODE	INPUT DATA TYPE	DATA FORMAT
Functional/technological properties	C (in) 3.1.1	Water contact angle	Degree
	C (in) 3.1.2	Water vapour permeability	gram/metre^2
	C (in) 3.1.3	Air permeability	gram/metre^2
	C (in) 3.1.4	Moisture regain	%
	C (in) 3.1.5	Moisture management properties[9]	
	C (in) 3.1.6	Thermal conductivity	

Table 10. CCIDS 3.1 output datasheet

CATEGORY	DATA CODE	COMPUTED METADATA	DATA FORMAT
Functional/technological properties	C (out) 3.1.1	Body core temperature	^{o}C/^{o}F
	C (out) 3.1.2	Skin temperature	^{o}C/^{o}F
	C (out) 3.1.3	Skin humidity	%
	C (out) 3.1.4	Thermal sensation	Graphic Images over length of wear
	C (out) 3.1.5	Moisture sensation	Graphic Images over RH
	C (out) 3.1.6	Thermal comfort feel	Graphic Images over ^{o}C

4.3.2 Tactile comfort-related parameters (CCIDS3.2)

There are 5 input and 6 output functional or technological properties, respectively, related to tactile comfort. The key input parameters are related to fabric bending, compression, surface roughness, friction and shear. All data can be imported from Fabric Touch Tester. Output results are related to sensation and perception of consumers, in terms of comfort, feel, sensory feel etc.

Table 11. CCIDS 3.2 input datasheet

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[9] From Moisture Management Tester, generally calculated in terms of three performance attributes: absorption rate (%/second), one-way transport capacity, and spreading speed (in Millimetre/second).

CATEGORY	DATA CODE	INPUT DATA TYPE	DATA FORMAT
Functional/technological properties	C (in) 3.2.1	Fabric bending	gram/metre^2
	C (in) 3.2.2	Fabric compression	N.metre
	C (in) 3.2.3	Fabric surface roughness	µmetre
	C (in) 3.2.4	Fabric friction	µ
	C (in) 3.2.5	Fabric shear	N/centimetre

Note: All data can be imported from Fabric Touch Tester.

Table 12. CCIDS 3.2 output datasheet

CATEGORY	DATA CODE	COMPUTED METADATA	DATA FORMAT
Functional/technological properties	C (out) 3.2.1	Primary sensory index	Graphical Images over length of wear
	C (out) 3.2.2	Softness-stiffness	Graphical Images over length of wear
	C (out) 3.2.3	Warmness-coolness	Graphical Images over length of wear
	C (out) 3.2.4	Smoothness-roughness	Graphical Images over length of wear
	C (out) 3.2.5	Skin tactile comfort feel	Graphical Images over length of wear
	C (out) 3.2.6	Hand feel	Graphical Images over length of wear

4.3.3 Pressure comfort-related parameters (CCIDS3.3)

There are 5 input and 6 output functional or technological properties, respectively, related to pressure comfort. The key input parameters are related to fabric tensile and tear strengths, abrasion resistance, and pilling properties. All data can be imported from Fabric Tensile Strength Tester or Tear Strength Tester or Martindale Tester. Output results are related to compression, bending and bending rigidities.

Table 13. CCIDS 3.3 input datasheet

CATEGORY	DATA CODE	INPUT DATA TYPE	DATA FORMAT
Functional/technological properties	C (in) 3.3.1	Tensile strength - warp	DaN/m
	C (in) 3.3.2	Tensile strength - weft	DaN/m
	C (in) 3.3.3	Abrasion resistance	Cycles
	C (in) 3.3.4	Pilling	Cycles
	C (in) 3.3.5	Tear strength	CN

Table 14. CCIDS 3.3 output datasheet

CATEGORY	DATA CODE	COMPUTED METADATA	DATA FORMAT
Functional/technological properties	C (out) 3.3.1	Compression recovery rate	millimetre/kPa
	C (out) 3.3.2	Compression rigidity	$gram/metre^2$
	C (out) 3.3.3	Recovery rigidity	$gram/metre^2$
	C (out) 3.3.4	Bending rigidity	$gram/metre^2$

5 Simplified product datasheet Part II: related to SCMPS

5.1 Fabric manufacturing (SCMPS1)

The SCMPS1 consists of 12 categories of data related to fabric manufacturing stage. These are related to:

- Fabric properties in terms of: (i) structure, and (ii) quality,
- Stage cost/revenue parameters related to both direct and overhead costs, and margin,
- Fabric manufacturing operations, in terms of (i) production strategy, (ii) lead times, (iii) capacity and performance, and (iii) order details, and
- Process lifecycle assessment.

Overall, 45 input data types can be identified while 29 computed data are created.

5.1.1 Fabric-related parameters (SCMPS1.1)

18 input and 5 output parameters are key to SCMPS 1.1. The input parameters are related to: (i) structure of the fabric – woven or knitted, and (ii) quality issues. The computed output data are related to woven fabric weight and coarseness and circular knitted fabric weight and width.

Table 15. SCMPS 1.1 input datasheet

CATEGORY	DATA CODE	INPUT DATA TYPE	DATA FORMAT
Structure (woven)	S (in)1.1.1	Type of warp	Fabrication Name
	S (in)1.1.2	Warp Count	NeC/Nm
	S (in)1.1.3	Type of weft	Fabrication Name
	S (in)1.1.4	Weft count	NeC/Nm
	S (in)1.1.5	Picks per metre	units/metre
	S (in)1.1.6	Ends per metre	units/metre
	S (in)1.1.7	Cuttable width	Metres
Structure (circular knitted - single jersey)	S (in)1.1.8	Type of knitted fabric	Fabrication Name
	S (in)1.1.9	Gauge	needles per English inch E
	S (in)1.1.10	Stitch density	courses per centimetre
	S (in)1.1.11	Stitch density	wales per centimetre
	S (in)1.1.12	Stitch length	Millimetre
Quality	S (in)1.1.13	Dimensional stability to washing (warp & weft)	%
	S (in)1.1.14	Type of faults	
	S (in)1.1.15	Fault percentage	%
	S (in)1.1.16	Maximum fault percentage	%
	S (in)1.1.17	Continuous faults	centimetre
	S (in)1.1.18	Shrinkage	%

Table 16. SCMPS 1.1 output datasheet

CATEGORY	DATA CODE	COMPUTED METADATA	DATA FORMAT
Structure (woven)	S(out)1.1.1	Weight per linear metre	Grams
	S(out)1.1.2	Weight per square metre	Grams
	S(out)1.1.3	Fabric coarseness[10]	NeC/Nm

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[10] This is dependent on average yarn diameter and fabric count.

Structure (circular knitted - single jersey)	S(out)1.1.4	Fabric width[11]	Metres
	S(out)1.1.5	Fabric weight[12]	grams/metre^2

5.1.2 Cost/revenue parameters (SCMPS1.2)

SCMPS 1.2 lists 9 input and 3 output parameters. The input parameters are related to costs and mark-up while the computed output data are profit- and financial performance- related.

Table 17. SCMPS 1.2 input datasheet

CATEGORY	DATA CODE	INPUT DATA TYPE	DATA FORMAT
Direct cost	S (in)1.2.1	Material wholesale cost (inprice for yarns)	Euros/metres
	S (in)1.2.2	Liquidation price	Euros/metres
	S (in)1.2.3	Production cost (i.e. direct labour)	Euros/metres
Overhead cost	S (in)1.2.4	Inventory carrying cost	% (of Direct cost)
	S (in)1.2.5	Administrative expenses I (includes Management, clerical costs)	% (of Direct cost)
	S (in)1.2.6	Administrative expenses II (includes MIS, computer costs)	% (of Direct cost)
	S (in)1.2.7	Quality cost I (includes cost for inspection, rework)	% (of labor cost)
	S (in)1.2.8	Quality cost II (includes cost for scrapping, excess material)	% (of material cost)
Mark-up	S (in)1.2.9	Margin	%

Table 18. SCMPS 1.2 output datasheet

CATEGORY	DATA CODE	COMPUTED METADATA	DATA FORMAT
Profit	S (out)1.2.1	Sales price	Euros/metres
	S (out)1.2.2	Gross Margin	%
	S (out)1.2.3	Sell through	%

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[11] Formula: [3.14*(Machine diameter)*(Gauge)]/[100*Wale density]
[12] Formula: [Wales/cm * Coarses/cm*Stitch length*C]/36*840*Tex

5.1.3 Operations-related parameters (SCMPS1.3)

The operations-related parameters in SCMPS 1.3 relates to: (i) production type, (ii) production lead time, (iii) capacity and performance, and (iv) order data. Here we have considered only Quick Response strategy which is suited to producing small-series in EU. In total there are 18 input parameters and 13 output parameters identified.

Table 19. SCMPS 1.3 input datasheet

CATEGORY	DATA CODE	INPUT DATA TYPE	DATA FORMAT
Production type	S (in)1.3.1	Production Strategy	**Text**[13]
Production Lead time (woven)	S (in)1.3.2	Value-added time[14]	**Minutes**
	S (in)1.3.3	Non value-added time[15]	**Minutes**
	S (in)1.3.4	Picks per minute	**Units/minutes**
	S (in)1.3.5	Picks per metre	**Units/metre**
	S (in)1.3.6	Transfer failure	**%**
	S (in)1.3.7	Efficiency	**%**
Production Lead time (circular knitted - single jersey)	S (in)1.3.8	Number of feeders	
	S (in)1.3.9	Machine Speed	**Revolutions per minute**
	S (in)1.3.10	Efficiency	**%**
Capacity & Performance (only QR strategy)	S (in)1.3.11	Max. capacity available (Weekly)	**Metres**
	S (in)1.3.12	Capacity utilization	**%**
	S (in)1.3.13	On-time delivery	**%**
	S (in)1.3.14	Safety stock - input material (yarn)	**%**
	S (in)1.3.15	Safety stock - fabric	**%**
Order data (considered only QR strategy)	S (in)1.3.16	Production batch size, Economic Order Quantity (EOQ)	**Metres**
	S (in)1.3.17	Minimum Order Quantity (MOQ)/order	**Metres**
	S (in)1.3.18	MOQ/SKU	**Metres**

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[13] CMT or Fullprice
[14] Formula: Running time + Preparation time (beam doffing time + Warping time + Creeling time)
[15] Formula: Headstock changeover time + Repair time

Table 20. SCMPS 1.3 output datasheet

CATEGORY	DATA CODE	COMPUTED METADATA	DATA FORMAT
Production Lead time (woven)	S (out)1.3.1	Throughput rate (warp sheet/min)[16]	Metres/minute
	S (out)1.3.2	Cycle time (Total time)	Minutes
	S (out)1.3.3	Order completion time[17]	Days
Production Lead time (circular knitted - single jersey)	S (out)1.3.4	Throughput rate or machine performance[18]	Metres/hour
	S (out)1.3.5	Cycle time (Total time)	Minutes
	S (out)1.3.6	Order completion time[19]	Days
Capacity & Performance (only QR strategy)	S (out)1.3.7	Average monthly Inventory (yarn)	Metres
	S (out)1.3.8	Average monthly Inventory (fabric)	Metres
	S (out)1.3.9	Inventory turnover	
	S (out)1.3.10	Supply chain flexibility[20]	Days
Order data (considered only QR strategy)	S (out)1.3.11	Order accept rate[21]	%
	S (out)1.3.12	Service level (to client)[22]	%
	S (out)1.3.13	Backorder	%

5.1.4 Lifecycle Assessment parameters (SCMPS1.4)

The lifecycle assessment output parameters in SCMPS 1.4 are twofold. While some parameters relate to energy and material consumption during the processes, the others show the impact of the processes in terms of footprints and waste generation. Overall 8 parameters are identified.

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[16] Measures the loom production as (Picks/minute)/(Picks/metre)

[17] From receiving an order from retailer to delivering it

[18] Measures the production as [Number of feeders * Revolutions / min * 60 * Efficiency] / [No of courses * Coarse density * 100]

[19] From receiving an order from retailer to delivering it

[20] Amount of time taken to respond to an unplanned 20% increase in demand without service or cost penalty

[21] Total number of accepted orders / Total number of received orders

[22] Number of on-time completed order / Number of orders received

Table 21. SCMPS 1.4 output datasheet

CATEGORY	DATA CODE	COMPUTED METADATA	DATA FORMAT
Lifecycle assessment	S (out)1.4.1	Energy consumption	kWh/year
	S (out)1.4.2	Renewable energy consumption	kWh/year
	S (out)1.4.3	Water Consumption	Litres
	S (out)1.4.4	Material consumption	Gram or kilogram
	S (out)1.4.5	Waste water	Litres
	S (out)1.4.6	Climate Change	Kg of $CO_2/N_2O/CH_4$ to air
	S (out)1.4.7	Eutrophication	gram of PO_4
	S (out)1.4.8	Abiotic Depletion	Milligram of Sb

5.2 Garment manufacturing (SCMPS2)

The SCMPS2 consists of 11 categories of data related to garment manufacturing stage. These are related to:

- Garment properties related to general specifications and construction details, and quality aspects,
- Stage cost/revenue parameters related to both direct and overhead costs, and margin,
- Garment manufacturing operations, in terms of (i) production strategy, (ii) lead times, (iii) capacity and performance, and (iii) order details, and
- Process lifecycle assessment.

Overall, 44 input data types can be identified while 26 computed data are created.

5.2.1 Garment-related parameters (SCMPS2.1)

13 input and 2 output parameters are key to SCMPS 2.1. The input parameters are related to: (i) product specification, i.e. type, description of style, size, and added components, along with construction details, and (ii) quality – e.g. fault types and amount, quality dropouts etc. The output data computed are mainly the garment measurements and tolerances which are very crucial to ensure right fitting.

Table 22. SCMPS 2.1 input datasheet

CATEGORY	DATA CODE	INPUT DATA TYPE	DATA FORMAT
Product Specification	S (in)2.1.1	Product group	Text[23]
	S (in)2.1.2	Style description	Fabrication Name
	S (in)2.1.3	Size group	Text[24]
	S (in)2.1.4	Components and trims	Text[25]
	S (in)2.1.5	Construction details (for all garment making operations) - stitching	Stitch class and type
	S (in)2.1.6		Seam class, type, width & length (metres)
	S (in)2.1.7		Thread type & length (metres)
	S (in)2.1.8	Garment weight	Gram/metre^2
Quality	S (in)2.1.9	Type of faults	Text[26]
	S (in)2.1.10	Fault percentage	%
	S (in)2.1.11	Maximum fault percentage	%
	S (in)2.1.12	Spreading fabric waste (incl. End loss, width loss, flaw removal, splicing loss)	Metres
	S (in)2.1.13	Quality dropout rate/AQL (of finished garment) [27]	%

Table 23. SCMPS 2.1 output datasheet

CATEGORY	DATA CODE	COMPUTED METADATA	DATA FORMAT
Product Specification	S (out)2.1.1	Measurement points[28]	Centimetres
	S (out)2.1.2	Tolerances	Centimetres

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[23] E.g. Fashion shirt - Bivolino; Technical sportswear - Azadora; Technical performance underwear - Yamamay; Fashion urban wear – Monobi

[24] E.g. Standard sizes or Customized with alteration details or Made-to-measure

[25] E.g. Thread type, zippers and other accessories, etc.

[26] E.g. Seam slippage, Yarn severance; Stitch breakage

[27] AQL: Acceptance Quality Limit represents the maximum no. of defective units beyond which a batch is rejected

[28] Measurement points, e.g. for jacket include: chest, waist, hip, total front length, shoulder, waist from shoulder, armhole, back to neck length, waist from centre-back to neck length, lower front width

5.2.2 Cost parameters (SCMPS2.2)

SCMPS 2.2 lists 10 input and 5 output parameters. The input parameters are related to costs and mark-up while the computed output data are profit- and financial performance-related.

Table 24. SCMPS 2.2 input datasheet

CATEGORY	DATA CODE	INPUT DATA TYPE	DATA FORMAT
Direct cost	S (in)2.2.1	Material wholesale cost[29]	**Euros/unit**
	S (in)2.2.2	Liquidation price	**Euros/unit**
Overhead cost	S (in)2.2.3	Manufacturing overhead (indirect labour ratio)	**% (of Direct cost)**
	S (in)2.2.4	Inventory carrying cost (of materials)	**% (of Direct cost)**
	S (in)2.2.5	Inventory carrying cost (of FGI/semi-finished - for VMI/QR)	**% (of Direct cost)**
	S (in)2.2.6	Administrative expenses I (includes Management, clerical costs)	**% (of Direct cost)**
	S (in)2.2.7	Administrative expenses II (includes MIS, computer costs)	**% (of Direct cost)**
	S (in)2.2.8	Quality cost I (includes cost for inspection, rework)	**% (of labour cost)**
	S (in)2.2.9	Quality cost II (includes cost for scrapping, excess material)	**% (of material cost)**
Mark-up	S (in)1.2.10	Margin	**%**

Table 25. SCMPS 2.2 output datasheet

CATEGORY	DATA CODE	COMPUTED METADATA	DATA FORMAT
Financial performance	S (out)2.2.1	**Sales price**	**Euros/metres**
	S (out)2.2.2	**Gross Margin**	**%**

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[29] Includes fabric, trims, lining, labels, tags, zippers costs

	S (out)2.2.3	**Production cost**[30]	**Euros/unit**
	S (out)2.2.4	**Sell through**[31]	**%**
	S (out)2.2.5	**Deadstock**[32]	**%**

5.2.3 Operations-related parameters (SCMPS2.3)

The operations-related parameters in SCMPS 2.3 relates to: (i) production type, (ii) production lead time, (iii) capacity and performance, and (iv) order data. Here we have considered only Quick Response strategy which is suited to producing small-series in EU. In total there are 21 input parameters and 11 output parameters identified.

Table 26. SCMPS 2.3 input datasheet

CATEGORY	DATA CODE	INPUT DATA TYPE	DATA FORMAT
Production type	S (in)2.3.1	Production strategy	Text[33]
	S (in)2.3.2	Type of production system (woven)	Text[34]
	S (in)2.3.3	Type of production system (knitted)	Text[35]
	S (in)2.3.4	Type of garment making	Text[36]
Preproduction Lead time	S (in)2.3.5	Value-added preproduction time[37]	Minutes
	S (in)2.3.6	Non value-added time[38]	Minutes
Production Lead time	S (in)2.3.7	Value-added production time	Minutes (∑SAM)
	S (in)2.3.8	Operator Efficiency[39]	%

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[30] Calculated as: Standard Allowed Minutes x Rate x Variance

(Includes direct labour related to marking, spreading, cutting, sewing processes)

[31] % of units sold at full price

[32] How much fabric is left over after the order has been shipped

[33] E.g. CMT or Full-price or Private label

[34] E.g. Bundles system; Unit Production System; Other flexible manufacturing systems

[35] E.g. Circular knitting; Flat knitting – cut and sew; Flat knitting – whole garment

[36] E.g. Stitching; Thermal bonding; Ultrasonic sewing; knitted

[37] Includes Cut-order planning, marker making, cutting for woven products

[38] Includes Spreading time, downtime, Offloading time

[39] Calculated as: (Total minute produced by an operator / Total minute attended) X 100

	S (in)2.3.9	Non value-added time[40]	**Minutes**
Capacity & Performance (only for QR strategy)	S (in)2.3.10	FGI inventory policy	**Text[41]**
	S (in)2.3.11	Marker efficiency/ Fabric utilization (for woven)	**%**
	S (in)2.3.12	Max. capacity available (Weekly)	**units**
	S (in)2.3.13	Sewing capacity utilization[42]	**%**
	S (in)2.3.14	On-time delivery	**%**
	S (in)2.3.15	Safety stock - materials	**%**
	S (in)2.3.16	Work in progress (includes all garment making operations)[43]	**∑WIP**
Order data	S (in)2.3.17	Production batch size, EOQ	**metres**
	S (in)2.3.18	Order frequency	**Per week**
	S (in)2.3.19	Minimum Order Quantity/Order	**metres**
	S (in)2.3.20	Minimum Order Quantity/SKU	**metres**
	S (in)2.3.21	Floor Ready details (e.g. types of labels)	**Text[44]**

Table 27. SCMPS 2.3 output datasheet

CATEGORY	DATA CODE	COMPUTED METADATA	DATA FORMAT
Production Lead time	S (out)2.3.1	**Production time/shift**	**Standard Allowed Minutes/shift**
	S (out)2.3.2	**Throughput time (Productivity)[45]**	**Units/day**
	S (out)2.3.3	**Cycle time (Total time)[46]**	**Minutes**
Capacity & Performance (only for QR strategy)	S (out)2.3.4	**Cutting productivity[47]**	**Units/hour**

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[40] Includes downtime, changeover or retraining time

[41] E.g. Made to stock; Ship to order; Made to order

[42] Calculated as: [Machine run time / Total working time] x 100

[43] Number of units in various stages of production

[44] E.g. Woven, size, price ticket, hangtag

[45] Number of units produced - average output per unit time

[46] Average time it takes to complete one unit - average time parts spend as WIP

[47] Cutting speed x Number of plies

	S (out)2.3.5	Quantity produced per shift	units/shift
	S (out)2.3.6	Inventory turnover (FGI)	
	S (out)2.3.7	Supply chain flexibility[48]	days
Order data	S (out)2.3.8	Order completion time[49]	days
	S (out)2.3.9	Service level (to client)[50]	%
	S (out)2.3.10	Backorder	%
	S (out)2.3.11	Cut to Ship Ratio[51]	

5.2.4 Lifecycle Assessment Data (SCMPS2.4)

The lifecycle assessment output parameters in SCMPS 2.4 are twofold. While some parameters relate to energy and material consumption during the processes, the others show the impact of the processes in terms of footprints and waste generation. Overall 8 parameters are identified.

Table 28. SCMPS 2.4 output datasheet

CATEGORY	DATA CODE	COMPUTED METADATA	DATA FORMAT
Lifecycle assessment	S (out)1.4.1	Energy consumption	kWh/year
	S (out)1.4.2	Renewable energy consumption	kWh/year
	S (out)1.4.3	Water Consumption	Litres
	S (out)1.4.4	Material consumption	Gram or kilogram
	S (out)1.4.5	Waste water	Litres
	S (out)1.4.6	Climate Change	Kg of CO_2/N_2O/CH_4 to air
	S (out)1.4.7	Eutrophication	gram of PO_4
	S (out)1.4.8	Abiotic Depletion	Milligram of Sb

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[48] Amount of time taken to respond to an unplanned 20% increase in demand without service or cost penalty
[49] From receiving an order from retailer to delivering it
[50] Number of on-time completed order / Number of all received order
[51] Number of garments shipped / Number of garments cut

5.3 Logistics and Distribution (SCMPS3)

The SCMPS3 consists of 4 categories of data related to logistics and distribution stage. These are related to:

- Delivery and payment terms and conditions, and inventory management,
- Delivery lead times and capacities,
- Logistics costs, and
- Process lifecycle assessment.

Overall, 15 input data types can be identified while 9 computed data are created.

5.3.1 Operations-related parameters (SCMPS3.1)

The operations-related parameters in SCMPS 2.3 relates to: (i) shipping/delivery mode and payment terms and conditions, and (ii) lead time and capacity. In total there are 9 input parameters and 1 output parameter identified.

Table 29. SCMPS 3.1 input datasheet

CATEGORY	DATA CODE	INPUT DATA TYPE	DATA FORMAT
Terms and conditions	S (in)3.1.1	Delivery terms	Text[52]
	S (in)3.1.2	Delivery method	Text[53]
	S (in)3.1.3	Payment terms	Text[54]
	S (in)3.1.4	Warehouse type (between fabric and garment manufacturers)	Text[55]
	S (in)3.1.5	Warehouse type (between garment manufacturer and retailer)	Text[56]
Lead time and capacities	S (in)3.1.6	Shipping time	Days
	S (in)3.1.7	Delivery batch size, EOQ (FGI)	Units
	S (in)3.1.8	Shipping time	Days
	S (in)3.1.9	Delivery batch size, EOQ (FGI)	Metres

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[52] E.g. CIF; FOB; FOC - See Incoterms

[53] E.g. Truck, train, ship, air

[54] Most common: LC - 10 day, 20 days, 30 days, CAD

[55] E.g. Central warehouse; Distribution centre; Central order processing (COPS); Direct

[56] E.g. Central warehouse; Distribution centre; Central order processing (COPS); Direct

Table 30. SCMPS 3.1 output datasheet

CATEGORY	DATA CODE	COMPUTED METADATA	DATA FORMAT
Lead time and capacities	S (out)3.1.1	Distribution policy, e.g. Ship backorders	% (of initial order volume)

5.3.2 Cost parameters (SCMPS3.2)

The input cost parameters related to SCMPS 3.2 are related to shipping costs, both direct and indirect, and also related to taxes.

Table 31. SCMPS 3.2 input datasheet

CATEGORY	DATA CODE	INPUT DATA TYPE	DATA FORMAT
Cost	S3.2.1	Shipping Overhead	% (of Total fixed shipping cost)
	S3.2.2	Shipping Labour	% (of Total fixed shipping cost)
	S3.2.3	Fabric freight cost	Euros
	S3.2.4	Fixed shipping cost	Euros
	S3.2.5	Variable shipping cost	Euros/unit
	S3.2.6	Toll	%

5.3.3 Lifecycle Assessment Data (SCMPS3.3)

The lifecycle assessment output parameters in SCMPS 3.3 are twofold. While some parameters relate to energy and material consumption during the processes, the others show the impact of the processes in terms of footprints and waste generation. Overall 8 parameters are identified.

Table 32. SCMPS 3.3 output datasheet

CATEGORY	DATA CODE	COMPUTED METADATA	DATA FORMAT
Lifecycle assessment	S (out)1.4.1	Energy consumption	kWh/year
	S (out)1.4.2	Renewable energy consumption	kWh/year
	S (out)1.4.3	Water Consumption	Litres
	S (out)1.4.4	Material consumption	Gram or kilogram

S (out)1.4.5	Waste water	Litres
S (out)1.4.6	Climate Change	Kg of CO_2/N_2O/CH_4 to air
S (out)1.4.7	Eutrophication	gram of PO_4
S (out)1.4.8	Abiotic Depletion	Milligram of Sb

6 Data requirements for data-based services

Following the detailed presentation of the simplified product datasheet, the data-based services associated with FBD_BModel platform are evaluated below in terms of their data requirements, data from whom and service to whom.

Table 33. Defining the proposed data-based services in terms of datasheet

Data services	Data requirements	Data from:	Service to:
CC_IDS			
▪ **IDS-ds1: Classification of body shapes of a specific population.**	CCIDS(in, out)1.1	Consumers	Retailers
▪ **IDS-ds2: Identification of the individual consumer's needs (consumer profile) in relation to their lifestyle in terms of physical activities, living environments, body size and shape and their physiological features and health status as well as fashion requirements.**	CCIDS(in)1.1 CCIDS(in) 1.3 CCIDS(in, out)2.1	Consumers	Consumers, Retailers
▪ **IDS-ds3: Recommendation of relevant fashion design solutions (styles, colours, materials) according to the personalized fashion requirements.**	CCIDS(in)1.1 CCIDS(in) 1.3 CCIDS(in, out)2.1 CCIDS(in)2.2	Consumers	Designers
▪ **IDS-ds4: Recommendation of relevant functional design solutions (functional performances of materials) according to personalized consumer's requirements on life style.**	CCIDS(in, out) 1.3 CCIDS(in, out) 2.1 CCIDS(in, out) 3.1-3.3	Consumers	Designers
▪ **IDS-ds5: Evaluation of virtual fitting in terms of fashion, fabric hand, thermal comfort and movement performance of designed garments and adjustment of technical parameters according to evaluation results.**	CCIDS(in, out)1.1-1.3 CCIDS(in, out)2.1-2.2	Consumers, Manufacturers	Consumers, Designers, Retailers Manufacturers

▪ IDS-ds6: Creation, management and updating of the design cloud database and design knowledge base.	CCIDS(in, out)1.1-1.3 CCIDS(in, out)2.1-2.2 CCIDS(in, out)3.1-3.3 SCMPS(in, out)1.1-1.4 SCMPS(in, out)2.1-2.4 SCMPS(in, out)3.1-3.3	All value chain partners and stakeholders	All value chain partners and stakeholders
SCMPS			
▪ SCMPS-ds1: Selection of relevant fabric suppliers and materials as well as garment makers in terms of technical parameters, cost, delay, stock, environmental footprint,and transport conditions.	SCMPS(in, out)1.1-1.4 SCMPS(in, out)3.1-3.3 CCIDS(in, out)2.1 CCIDS(in, out)3.1 -3.3	Fabric manufacturers	Garment manufacturers, Retailers
	SCMPS(in, out)2.1-2.4 SCMPS(in, out)3.1-3.3 CCIDS(in, out)2.1 CCIDS(in, out)3.1 -3.3	Garment manufacturers	Retailers
▪ SCMPS-ds2: Testing and certifying functional performance of textile materials from fibres, yarns, fabrics to garments in the fashion textile supply chain.	SCMPS(in, out)1.1-1.4 SCMPS(in, out)2.1-2.4 CCIDS(in, out)2.1 CCIDS(in, out)3.1 -3.3	All manufacturers	All manufacturers, Retailers
▪ SCMPS-ds3: Cloud database services for the certified textile and apparel manufacturers, particularly SMEs.	SCMPS(in, out)1.1-1.4 SCMPS(in, out)3.1-3.3 CCIDS(in, out)2.1 CCIDS(in, out)3.1 -3.3	All manufacturers	All manufacturers
▪ SCMPS-ds4: Optimization of production planning and scheduling by dynamically organizing tasks into different series (reconfiguration)	SCMPS(in, out)1.2-1.3 SCMPS(in, out)3.1-3.2	Fabric manufacturers	Fabric manufacturers
	SCMPS(in, out)2.2-2.3 SCMPS(in, out)3.1-3.2	Garment manufacturers	Garment manufacturers
▪ SCMPS-ds5: Simulation of production and adjustment of tasks planning according to simulated performance.	SCMPS(in, out)1.2-1.3 SCMPS(in, out)3.1-3.2	Fabric manufacturers	Fabric manufacturers
	SCMPS(in, out)2.2-2.3 SCMPS(in, out)3.1-3.2	Garment manufacturers	Garment manufacturers
▪ SCMPS-ds6: Environmental footprint assessment (Life Cycle Analysis) and certification of products and manufacturing processes.	SCMPS(out)1.4 SCMPS(out)2.4 SCMPS(out)3.3	All manufacturers	All manufacturers, Retailers

▪ **SCMPS-ds7: On-line pricing, trading and financial transaction services.**	SCMPS(in, out)1.2 SCMPS(in, out)2.2 SCMPS(in)3.2	All manufacturers	All manufacturers, Retailers
▪ **SCMPS-ds8: Creation, management and updating of the production knowledge base (rules characterizing relations between design parameters, production parameters and environmental impacts).**	CCIDS(in, out)1.1-1.3 CCIDS(in, out)2.1-2.2 CCIDS(in, out)3.1-3.3 SCMPS(in, out)1.1-1.4 SCMPS(in, out)2.1-2.4 SCMPS(in, out)3.1-3.3	All value chain partners and stakeholders	All value chain partners and stakeholders

7 Security issues and related standards

Revisiting Figure 1. (CC_IDS structure) and Figure 2. (SCMPS structure) showcasing the general model of FBD_BModel's inter-connected technology platform, it can be concluded that security is a key concern to handle data in a protected way. In this context, data security refers to protective digital integrity and privacy measures that are applied to prevent unauthorized access to networked computers, design and production cloud databases and computational servers that are co-producing input-output data connected to the several data services, proposed in this report. While definition and development of FBD_BModel's cloud data management and protection system along with the security features is within the scope of Task 6.4, it is crucial to highlight here – in context to the description of the various data constituting the datasheet – the role of standards specifying requirements of a security management system particularly dealing with security assurance. A number of existing international standards addressing security management issues can improve the security and mitigate risks associated with FBD_BModel's integrated platform. These are:

- A number of standards (out of currently 181) published by **ISO/IEC JTC 1/SC 27**, i.e. the ISO/IEC 27000 family - Information security management systems within the field of IT security techniques [4; 5]. In a nutshell, these standards suggest generic methods, techniques and guidelines to address both security and privacy aspects, such as:
  - ➢ Management of information and ICT security; in particular information security management systems, security processes, and security controls and services;
  - ➢ Security management support documentation including terminology, guidelines as well as procedures for the registration of security components;
  - ➢ Security evaluation criteria and methodology.

These could lay foundation for defining FBD_BModel's end-to-end security model, data encryption standards, network maintenance rules, to be established in Task 6.4 (cloud data management and protection system).

- A number of standards (out of currently 122 and 79 respectively) published by **ISO/IEC JTC 1/SC 31** [6] and **ISO/IEC JTC 1/SC 32** [7]. In a nutshell, these standards identify and propose data capture techniques and harmonization of data management and interchange, i.e. data formats, data syntax, data structures, data encoding, reference models and frameworks, and technologies for the process of automatic identification and data capture and of associated devices utilized in inter-industry applications and international business interchanges and for mobile applications.

These could lay foundation for not only defining the data exchange reference architecture (formats and procedures) for normalized data for both Task 4.5 (CC_IDS system integration) and Task 5.3 (SCMPS design action-model), but also to define interoperability across devices (mobile device, cloud platform) in task 6.4.

A number of other ISO/IEC standard families, such as those published by **ISO/IEC JTC 1/SC 38** on proposing standardization in the areas of Cloud Computing and Distributed Platforms [7] and/or by **ISO/IEC JTC 1/SC 41** on standardization in the area of Internet of Things (IoT) and related technologies [8] can also be essential as Reference Architectures for determining FBD_BModel's technological platform's context specific architecture.

However, beyond establishing standards for the data security and distributed, inter-connected, data-intensive cyber platform, it is also crucial to secure the physical supply chain of FBD_BModel's industry partners who are engaged in producing competitively in small-series. This could be vital for assuring security and preparedness of the supply chain while evaluating or contracting new supplier for small-series production, allocating orders to certain suppliers/manufacturers, or environmental risks connected to production of certain product. In addition it is important that the *organization establishes and maintains procedures for the ongoing identification and assessment of security threats and security management-related threats and risks, and the identification and implementation of necessary management control measures* [9]. For which, **ISO 28000:2007** specifies the requirements for a security management system, including those aspects critical to security assurance of the supply chain, including transportation, improved supply chain visibility and inventory management.

8 Conclusion

The main results as described in this deliverable report are related to identification of the main input and output data associated with the product datasheet, their categories, input types and formats, that highlights the key contents of the two interconnected knowledge-based systems, CC_IDS and SCMPS of FBD_BModel's technology platform. In addition, the datasheet also defines the data requirements of a series of data-based services associated with the two systems.

We identify that the CC_IDS consists of 3 sub-systems related to: (i) CCIDS1: consumer selection, profile formalization and requirement specification, (ii) CCIDS2: virtual fashion design and product development, and (iii) CCIDS3: functional characterization. On the other hand, the SCMPS consists

of 3 sub-systems related to: (i) SCMPS1: fabric manufacturing, (ii) SCMPS2: garment manufacturing, and (iii) SCMPS3: logistics and distribution.

A simplified product datasheet proposed in the report, is composed of two parts: 1) design datasheet, corresponding to the design solutions offered through CC_IDS, and 2) production datasheet, corresponding to production-related parameters extracted from SCMPS.

The design datasheet consists of 15 data categories, 6, 6, and 3 related to CCIDS 1, 2, and 3 respectively. Overall, 57 input data types and 21 computed output data are associated with it.

The production datasheet consists of 27 data categories, 12, 11, and 4 related to SCMPSS 1, 2, and 3 respectively. Overall, 104 input data types and 64 computed output data are associated with it.

Following the detailed presentation of the simplified product datasheet, the data-based services associated with FBD_BModel platform are evaluated in terms of their data requirements, data from whom and service to whom. Many of these data-based services show requirement of data from both datasheets, and from multiple sub-systems, and are essential for various value chain members and stakeholders.

This simplified datasheet and data-based service representation, as proposed in this report, will act as a foundation for the creation of a more detailed and normalized product datasheet as the project progresses and the business cases and systems are elaborated further.

In addition, the role of security management of the databases and data-services connected to FBD_BModel's platform has been revisited, along with providing a brief description of the role of different standards addressing security management issues that can improve the security and mitigate risks associated with FBD_BModel's integrated platform.

9 References

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