A circular economy approach for lifecycles of products and services

D1.1: Product specification and production scope template including eco-constraints ready for use

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Summary

Task 1.1 is a precursor to Task 1.2 and many other Tasks and Work Packages. The main aim of the Task is to (a) define the products from industry partners in the project (JS, ALIA, ONA and KOS), and (b) to define the boundaries of their production processes. This will enable Task 1.2 to measure the impacts of those products, and further inform other work in the project.

The products chosen by industry partners are: Potatoes and Salad (JS); High bay LED light (KOS); LED table lamp (ONA); curated sausage and curated pork loin (ALIA). The production scope of these chosen products was mapped out in order to understand the environmental impacts, or eco-constraints of the products. This will be used directly in Task 1.2 to calculate impacts.

Understanding the regulatory framework, the available standards to aspire to, and policy direction at national, EU and global levels is important to ensure the work is carried out in the correct context, applied within real life frameworks and guidelines. This thorough piece of work will inform all related Tasks.

Product Design Specifications (PDS) for all chosen products have been created, with a view to creating a framework for product creation in a circular economy context. This approach demonstrates that sustainable design measures start at the planning and design stages, which can ensure, if correct procedure is followed, that the environmental and social impacts of products are reduced.

Task 1.1 recommends for Task 1.2:

1. Enter the products chosen by industry partners for impact analysis
2. Ensure that the boundaries (scoping) of the impact analysis is defined by the production processes defined in Task 1.1
3. Use the eco-constraints list to define the system boundaries for environmental impact analysis
4. Define social impacts boundaries to add to the eco-constraints
5. Ensure the list of regulations, standards and policies informs the work of Task 1.2
6. Using the PDS for each product, suggest how the PDS can be further enhanced to reduce environmental and social impacts once impact analysis and the decision-making tool sub-tasks have been implemented

Table of Contents

List of Tables

Acronyms and abbreviations

Abbreviation	Description
LCA	Life Cycle Assessment
PDS	Product Design Specification
T1.1	Task 1.1
T1.2	Task 1.2
WP	Work Package

1. Introduction and relevance to other Tasks

Task 1.1 (T 1.1), *Product specification and production scoping with eco-constraints*, is the first Task of Work Package (WP) 1, *Co-creation of products/services*. The strand of this WP that is directly relevant to T 1.1 is "*Analyse the environmental, economic and social impacts of production systems, using existing and new methods of analysing impacts."*

This strand of the WP is carried out in two tasks, T 1.1 and Task 1.2 (T 1.2). In essence T 1.1 defines the products and production systems to be analysed, and the boundaries of those systems. T 1.2 develops methods to analyse the environmental and social impacts of those products, carries out the analysis and then makes assessments. It can be seen therefore that T 1.1 and T 1.2 are intrinsically linked.

The outputs from T 1.1 inform directly Tasks 1.2 and 1.5. Outputs from T 1.2 go on to inform much other work in the project, including Task 1.5 (Sustainable Production), WP 2 (Collaborative recycling/reuse), WP 3 (Sustainable consumption) and WP 6 (Demonstrators).

T 1.1 is sub-divided in to three pieces of work:

- Scoping and eco-constraints
- Regulations, standards and policy compliance
- Product Design Specifications

This work is combined to produce Deliverable 1.1:

*"**Product specification and production scope template including eco-constraints ready for use***
Product specification and production processes are scoped, which enable the boundaries to be set for assessing the impacts of products or processes."

Source: CIRC4Life project proposal

2. Scoping and eco-constraints

The Task description specifies the work to be carried out in this heading:

"Set up the product specifications and production scope, with detailed items, such as product performance and production environment, which should include as many items as possible to fully set up the specification and scope

Set up a full set of eco-constraints related to products and production, such as reducing energy consumption and environmental pollution."

Source: CIRC4Life project proposal Task 1.1 description

For the first part of this sub-task the industry partners (JS, KOS, ONA and ALIA) set about defining products and production processes. The decision about which products to analyse is important because these will be the same products that are used throughout subsequent tasks, right through to the Demonstration. The products chosen are presented in Table 0.1.

Partner	Product 1	Product 2 (if applicable)
JS	Potatoes	Salad (lettuce)
KOS	LED high bay lighting	
ONA	LED table lamp	
ALIA	Curated sausage	Curated pork loin

Table 0.1 The analysed products and their manufacturers

The products have been chosen by the industry partners as being major products produced by their company, and ones which can be put forward for improvement in a circular economy context. The choices were also agreed by all other partners in T 1.1. This approach was necessary because the industry partners need to use these products in further work. Immediately the next piece of work is to take those products and assess the production processes. This is to enable analysis of product's impacts (to be carried out in T 1.2) by setting the system boundaries.

To achieve this industry partners were asked to physically map out their production processes. The requirements for this process were:

- Be representative of the true production process, as accurately as possible
- Cover all processes from primary production to end of life, including point of sale, 'use phase' and any waste processes throughout
- Be as comprehensive as possible
- Consider social impacts

Through various drafts of this process, and discussion between partners, the mapping was refined and standardised as much as possible. Given the diverse nature of the food and electronics sectors, complete standardisation is not possible, but the aim was to be as close as possible to allow comparisons and replicability.

The maps from all partners (JS, ALIA, KOS, ONA) are all shown in full in Appendix 1. Production process maps.

The structure of the production processes can take many forms and be categorised in many ways. Through much discussion and many iterations, the following headings were decided on in order to represent the process clearly and group together impacts in both a comprehensive and replicable manner.

- Material inputs
- Manufacturing processes (for electronics) or farming (for food), including:
  - overheads (services, capital items, office, workforce), and
  - biological processes (for vegetable growing and livestock farming)
- Packaging
- Transport
- Point of sale
- Use phase
- End of Life
- Waste is represented at every stage (and summarised as a whole)

The project believes this is a replicable model for all products and services, with just minor modifications required for specific businesses that use the model. This comprehensive approach represents 'cradle to grave', commonly used in LCA studies.

Note that the above list is (and the process maps are represented) in a somewhat linear fashion. However, it must be emphasised that as the circular economy themes are developed for each product, we would expect to see this representation to become much more circular in nature.

Eco-constraints

From the production process mapping process, and discussion around scoping, a list of environmental impacts, or 'eco-constraints' were drawn up. This sets the system boundaries, a common process in any LCA, carbon footprinting, or similar environmental impact analysis.

The list of eco-constraints is also important because it informs work on most tasks in WP's 1, 2 and 6, and Tasks 3.3, 3.4 and 4.4.

The structure of the eco-constraints is consistent with the process mapping categories, as described above.

The full list of eco-constraints is shown in Appendix 2.
Note that the development and assessment implementation for the **social impacts** that are related to these products is a subtask of T 1.2, and will be added on to the list of eco-constraints.

3. Regulations, standards and policy compliance

"Investigate how to comply with sustainability regulations, directives and standards relevant to the products and production, such as WEEE for electrical and electronic products, Regulation (EC) No 834/2007 on organic production and labelling of organic products, and BREF(http://eippcb.jrc.ec.europa.eu/reference/) for cross industrial sectors. The investigation results will be used to form the eco-constraints."

Source: CIRC4Life project proposal Task 1.1 description

The purpose of this piece of work was to ensure that the scoping of processes, and later the impact analysis of products, is done so in the context of existing policies, regulations and standards in the field of product sustainability. These can be mandatory or voluntary standards, at national, EU or international levels.

Partners contributed to an extensive list of some 67 policies, standards, regulations and directives. Their wide ranging expertise ensures that the project is able to capture experience and knowledge from different sectors and geographically from across the EU. Furthermore the list has been checked by policy specialists, CIRC4Life partner CEPS.

The themes of regulations and standards included are summarised here:

- Organic and eco product labelling
- Animal by-products
- Food hygiene
- Animal feeds
- Electronic products
- BAT /BREF standards
- Carbon footprinting and LCA

Policy themes are summarised as:

- Life Cycle Assessment
- Eco-design and Eco-innovativeness
- Environmental technologies
- Waste
- Circular Economy and Economic growth
- Resource efficiency
- Corporate Social Responsibility
- Climate change

The full list of regulations, policies and standards is available in Appendix 3. The list describes a whole host of EU and national regulations and standards that impact upon the manufacture, retail and other phases of supply chains. Policies show the direction of travel for regulations on an EU level, which quite clearly demonstrate a move towards waste reduction, resource efficiency, circular economy, sustainability, greenhouse gas reductions, and a reduction in the use of plastics, particularly single-use.

Partners will consider all the regulations to be adhered to in an EU context. The standards tend to be voluntary but are in many cases seen as best practice. Current and future policy tends to set policy direction and can be considered an indicator trend.

4. Product Design Specifications

"Combine the eco-constraints into the product specification and production scope, which will be followed at the subsequent stages of the product development process.

After completing the product specifications and production scoping, several product concepts and possible production plans will be developed. Those concepts and production plans will then be further evaluated, with the evaluation criteria derived from the specifications and coping, including the eco-constraints. Based on the evaluation results, the best concept and production plan will be selected for further impact analysis to be conducted on ***Task 1.2 and Task 1.5.***

The eco-constraints derived from this task will be followed in the subsequent stages of the production. This way will enable the product sustainable features from the beginning throughout the product creation process."

Source: CIRC4Life project proposal Task 1.1 description

Production Design Specifications (PDS) are standard practice in the development and production of manufactured products. They clearly state the properties of a product, including:

- Size, specifications and materials
- Environmental performance
- Cost
- Lifespan
- Performance
- Maintenance
- Packaging and shipping
- Safety

Using a standard PDS template (Pugh, 1991), the project aims to use this approach to further embed sustainable design and circular economy principles in products.

However, using this approach for primary farm products is more challenging as farming is a biological, not an industrial system. Partners JS and ALIA however used the PDS template and suitably adapted the approach to enable farm products to be 'designed' in this way.

Each industry partner produced a PDS for their products, listed in full in Appendix 4.

Taking this approach enables the eco-constraints to be embedded in to the design process, to ensure that the resulting products have low environmental and social impacts. For example, the LED company, ONA, states that the LED table lamp must be:

- Low energy use
- Repairable, built in a modular fashion
- Built from low impact materials
- Have a lifespan of at least 10 years
- Fully recyclable at end of life

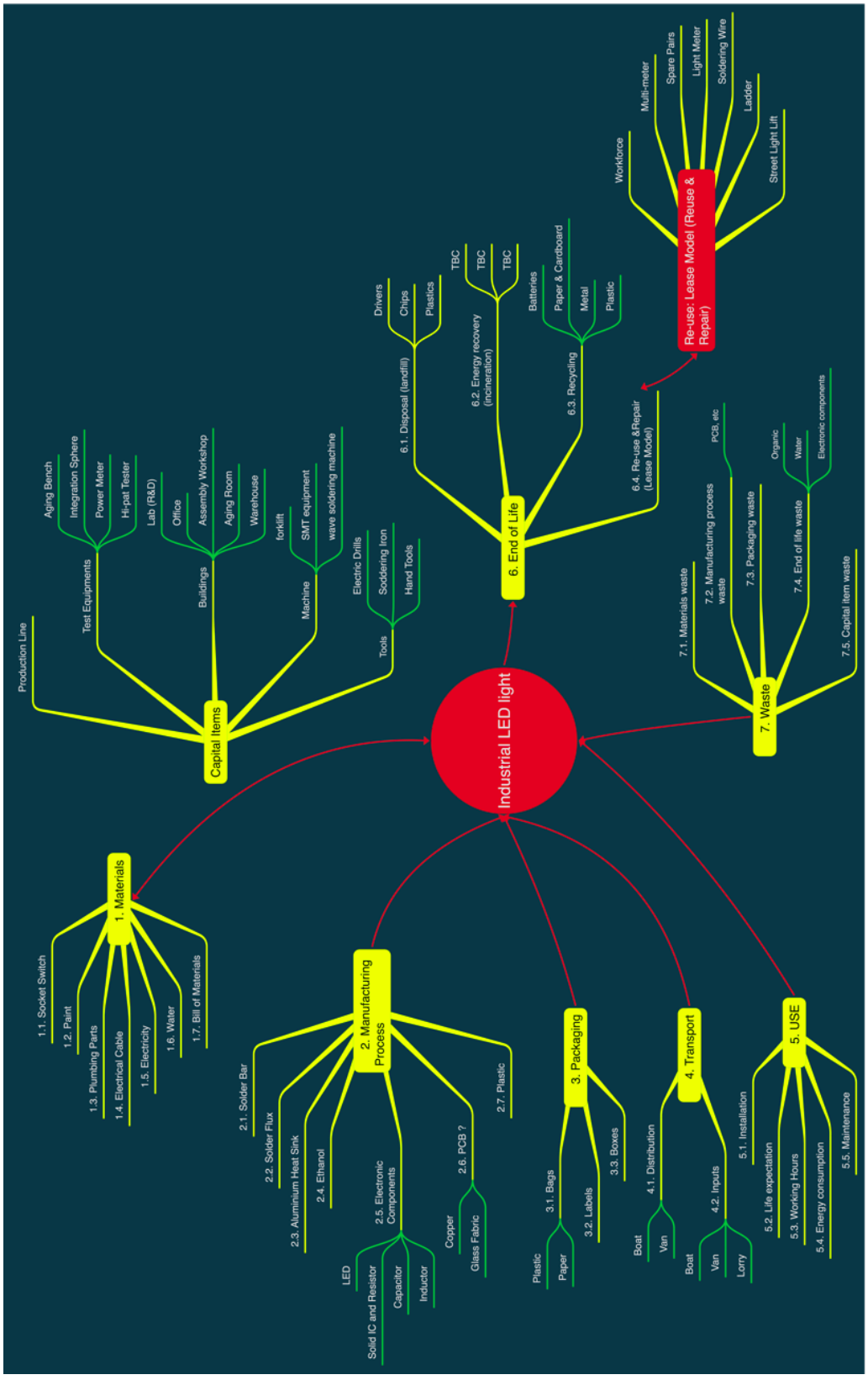
5. Recommendations for Task 1.2

This Task recommends to Task 1.2 the following actions:

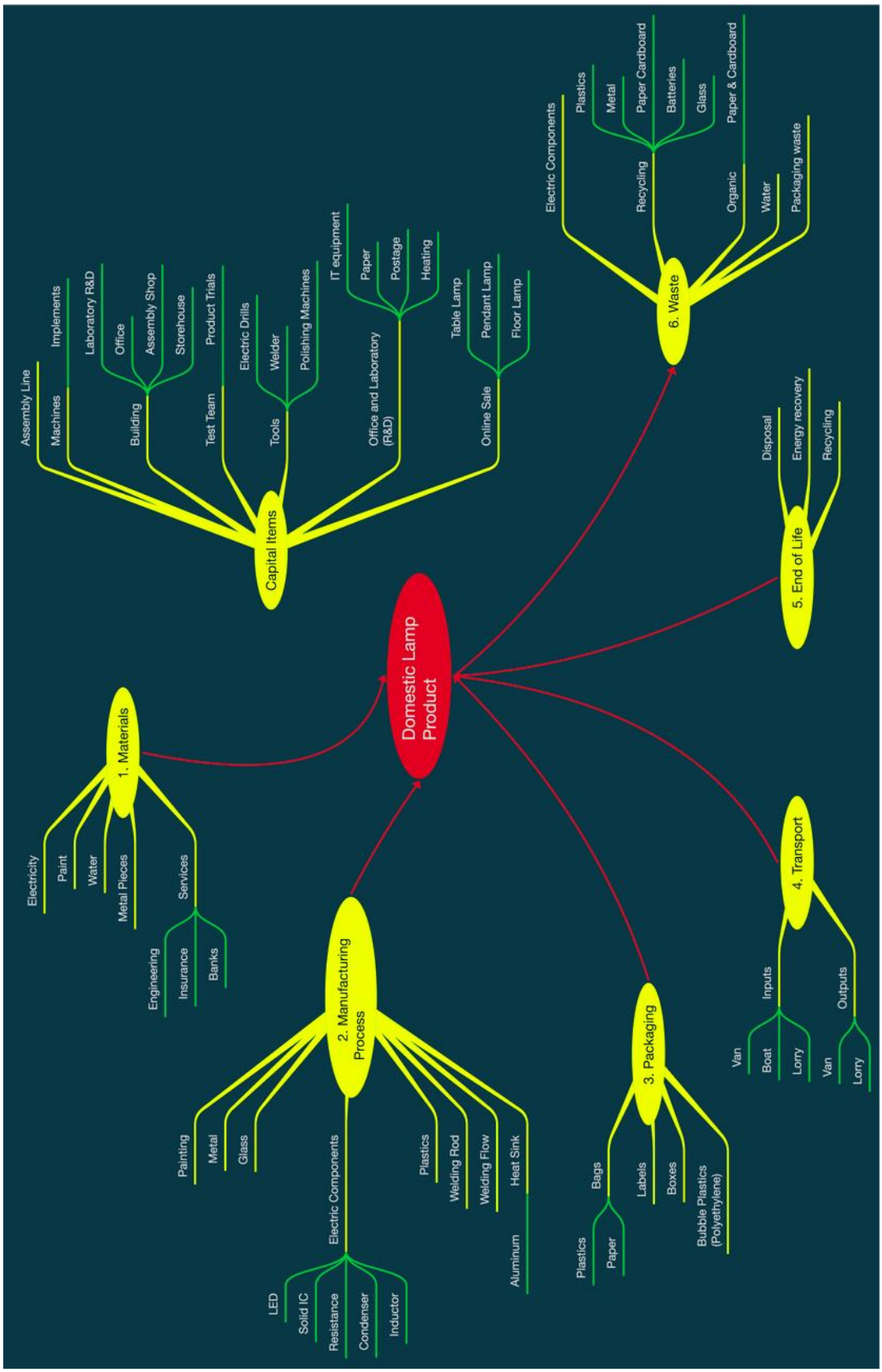
1. Enter the products chosen by industry partners for impact analysis
2. Ensure that the boundaries (scoping) of the impact analysis is defined by the production processes defined in Task 1.1
3. Use the eco-constraints list to define the system boundaries for environmental impact analysis
4. Define social impacts boundaries to add to the eco-constraints
5. Ensure the list of regulations, standards and policies informs the work of Task 1.2
6. Using the PDS for each product, suggest how the PDS can be further enhanced to reduce environmental and social impacts once impact analysis and the decision-making tool sub-tasks have been implemented

Appendix 1. Production process maps

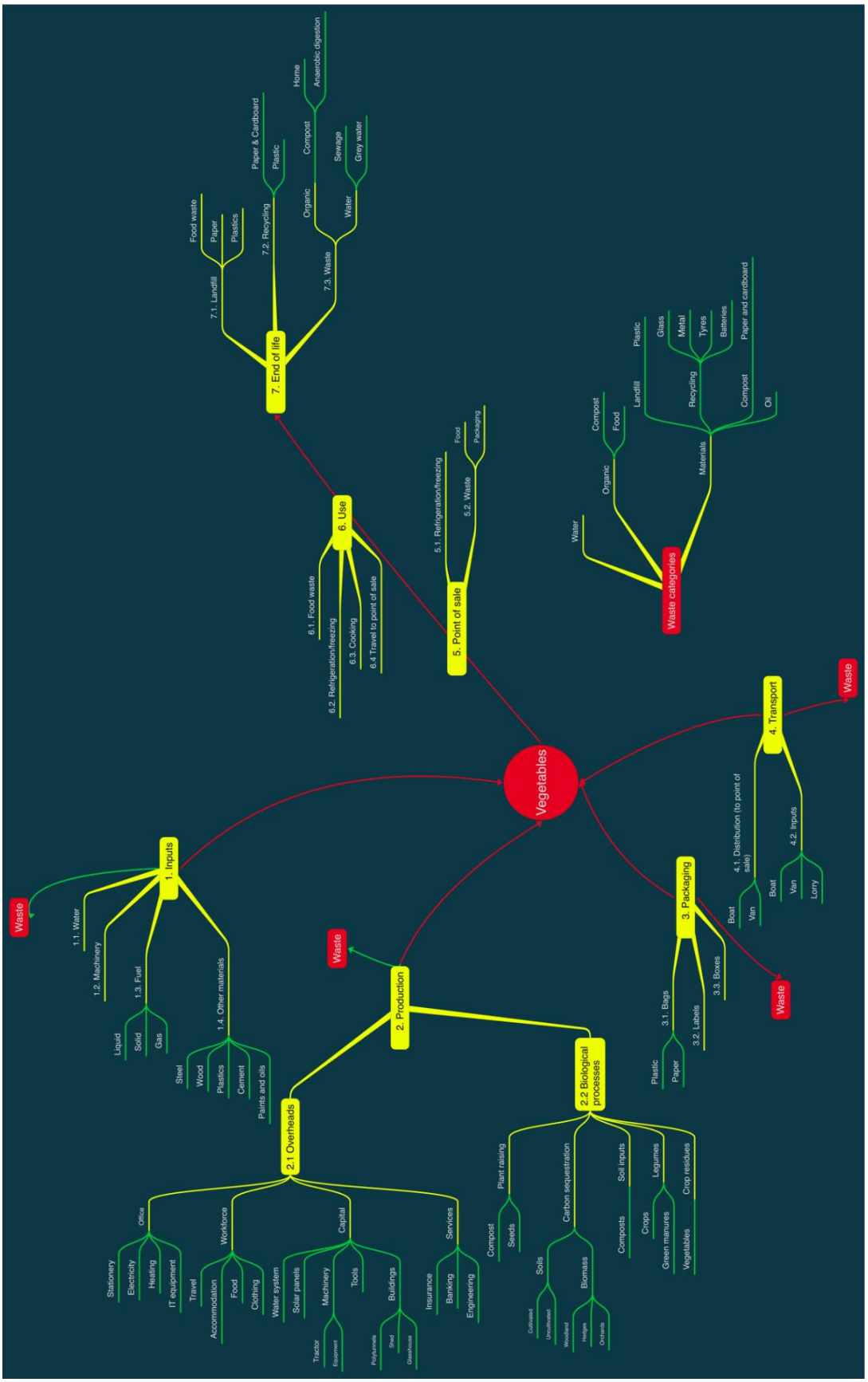
1. Kosnic – industrial LED lighting product



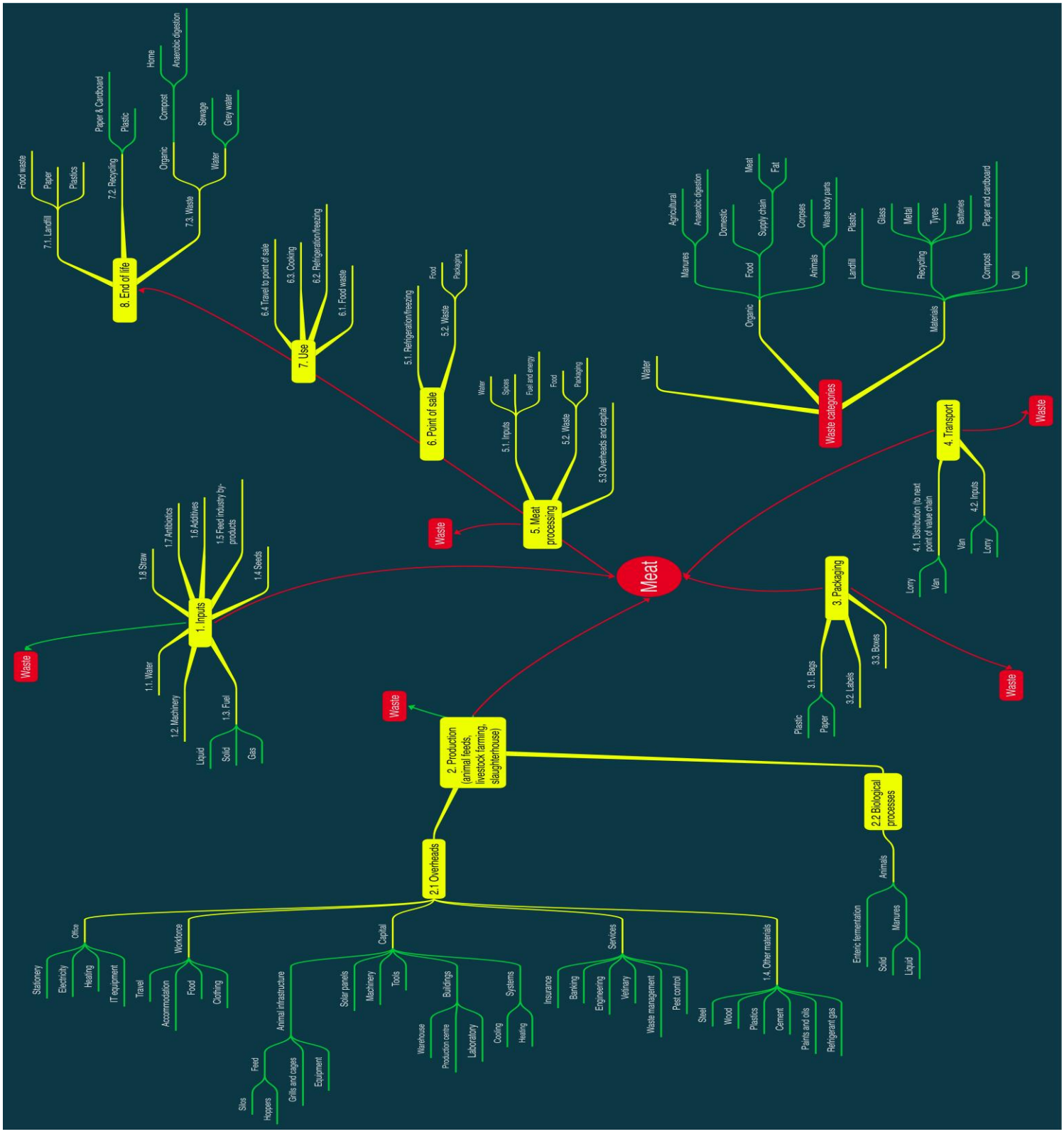
2. Ona – domestic LED table lamp product



3. Jonathan Smith – vegetables



4. Alia - meat products



Appendix 2. Eco-constraints

Environmental impacts or 'eco-constraints'		
Inputs	Raw materials	
	Ingredients/inputs (food)	
	Water	
Manufacturing/processing	Electricity	
	Fuels	
	Consumables	
	Finishes – e.g. paint	
	Components – e.g. electrical	
Biological processes	Livestock	Manures
		Enteric fermentation
	Fertilisers	Organic (manures/composts)
		Inorganic (artificial fertilisers)
	Agrochemicals	
	Carbon sequestration	Soils
		Biomass
	Legumes	Green manures
		Crops
	Land use change	
	Crops	Livestock feed
		Crop residues
Overheads	Capital	Buildings
		Machinery
		Equipment/tools
		Renewable energy
		Water systems
		Tools
		Storage areas/facilities
		Vehicles
		Office
	Services	Insurance
	(contracted in or in house)	Banking
		Labs/analysis
		Vetinary
		Engineering
		Contracting
		Maintenance of buildings and equipment
	Office	Stationery
		Paper
		IT equipment
		Electricity
		Heating
		Website/social media
		Internet
		Phones
	Workforce	Travel – to work
		Travel – on business
		Clothing
		Food
		Equipment
		Accommodation/kitchens/rest areas
Packaging	Labelling/branding	
	Paper and cardboard	
	Plastics	
	Polystyrene	
	Refrigerants	
	Staples	
	Thread/cotton	
Transport & storage	Inputs to process	
	Distribution	
	Refrigeration	
	Refrigeration	
	Heating	
	Atmospheric control	
Use	Consumers	Electricity
		Water
Waste	Mains sewage/septic tank/other	Water
	Recycling/energy-from-waste/landfill	Plastics
		Paper and cardboard
		Glass
		Metal
		Equipment
	Landfill/composting/AD	Food
		Organic – food waste
	Incineration/hydrolysis	Organic – animal corpses
	Composting/on field/slurry lagoon	Organic – livestock manure/slurry
		Vetinary/biohazard
	WEEE	Electrical

Appendix 3. Regulations, policies and standards

Regulations and standards	Name of the regulation/standard	Reference to the sector	Description/assessment
EU regulation	Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092.	Organic farms/ecological agriculture	The regulation sets a general and specific Community framework of the principles of organic production. Standards are in place with regard to plant, livestock, and aquaculture production.
National ecological standards – as a support to the EU legislation	Bioland (Germany)	Organic farms/ecological agriculture	Ecological agriculture, producers - commercial partners -
	Soil Association (UK)	Organic farms/ecological agriculture	Certification of organic farming in UK and other countries
	SKAL (Netherlands)	Organic farms/ecological agriculture	Controls ecological farms in Netherlands
	Naturland (Germany)	Organic agriculture	Certification of organic farming in Germany and other countries.
	KRAV (Sweden)	Organic farms/ecological agriculture	Swedish labelling system for the certification of organic products.
	EKOLAND (Polish)	Ecological agriculture	Within this scheme Polish Association of organic food producers grants certificates to farms that use ecological methods during production.
EU regulation	REGULATION (EC) No 1069/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 laying down health rules as regards animal by-products and derived products not intended for human consumption and repealing Regulation (EC) No 1774/2002 (Animal by-products Regulation).	Animal by-products	The Regulation specifies the operating conditions required for rendering animal by-products not intended for human consumption. It lays down the health and surveillance rules applicable to (amongst others) the collection, transport, storage, handling, processing and use or disposal of animal by-products. It incorporates classification of animal by-products: categories (1,2,3) and consequences for further maintenance with it. The Regulation determines the circumstances under which animal by-products are to be disposed of, in order to prevent the spreading of risks for public and animal health. In addition, that Regulation specifies under which conditions animal by-products may be used for applications in animal feed and for various purposes, such as in cosmetics, medicinal products and technical applications. It also lays down obligations for operators to handle

			animal by-products within establishments and plants which are subject to official controls.
EU regulation	COMMISION REGULATION (EU) No 142/2011 of February 2011 implementing Regulation (EC) No 1069/2009 of the European Parliament and of the Council laying down health rules as regards animal by-products and derived products not intended for human consumption and implementing Council Directive 97/78/EC as regards certain samples and items exempt from veterinary checks at the border under that Directive)	Animal by-products	This Regulation lays down implementing measures: (a) for the public and animal health rules for animal by-products and derived products laid down in Regulation (EC) No 1069/2009. (b) concerning certain samples and items exempt from veterinary checks at border inspection posts as provided for in Article 16(1)(e) and (f) of Directive 97/78/EC.
EU regulation	REGULATION (EC) No 852/2004 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 29 April 2004 on the hygiene of foodstuffs – common basis for the hygienic production of all food including products of animal origin.	Food sector	This Regulation lays down specific rules on the hygiene of food of animal origin for food business operators. These rules supplement those laid down by Regulation (EC) No 852/2004. They shall apply to unprocessed and processed products of animal origin, the activities of feed business operators at all stages, from and including primary production of feed, up to and including, the placing of feed on the market.
EU regulation	REGULATION (EC) No 2073/2005 OF THE EUROPEAN COMMISSION of 15 November 2005 on microbiological criteria for foodstuffs	Food sector	This Regulation lays down the microbiological criteria for certain micro-organisms and the implementing rules to be complied with by food business operators when implementing the general and specific hygiene measures referred to in Article 4 of Regulation (EC) No 852/2004
EU regulation	REGULATION (EC) No 178/2002 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety	Food sector	It establishes common principles and responsibilities, the means to provide a strong science base, efficient organisational arrangements and procedures to underpin decision-making in matters of food and feed safety. It lays down the general principles governing food and feed in general, and food and feed safety in particular, at Community and national level. Article 18 sets general principles for traceability in the food sector.

EU regulation	Regulation (EC) No 183/2005 of the European Parliament and of the Council of 12 January 2005 laying down requirements for feed hygiene (Text with EEA relevance).	Feeding of animals	Lays down general rules on feed hygiene, as well as conditions and arrangements to ensure that processing conditions to minimise and control potential hazards are respected. It also provides that feed business establishments are to be registered with or approved by the competent authority. In addition, feed business operators lower down the feed chain are required to source feed only from registered or approved establishments.
EU regulation	Commission Regulation (EU) 2015/1905 of 22 October 2015 amending Annex II to Regulation (EC) No 183/2005 of the European Parliament and of the Council as regards the dioxin testing of oils, fats and products derived thereof	Feeding of animals	This regulation sets out requirements for feed businesses other than at the level of primary production.
EU regulation	Directive 2002/32/EC on undesirable substances in animal feed	Feeding of animals	The directive applies to all products intended for animal feed, including raw materials for feed, additives and complementary feeding stuffs. It lays down a list of undesirable substances and specifies the limit values for which the presence of these substances in animal feeds is forbidden (Annex I). The list includes substances such as certain heavy metals (like lead and cadmium), dioxin and some pesticides. It is regularly updated in the light of scientific and technical knowledge.
EU regulation	REGULATION (EC) No 1831/2003 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of September 2003 on additives for use in animal nutrition	Feeding of animals	Establishes a Community procedure for authorising the placing on the market and use of feed additives and to lay down rules for the supervision and labelling of feed additives and premixtures in order to provide the basis for the assurance of a high level of protection of human health, animal health and welfare, environment and users' and consumers' interests in relation to feed additives, whilst ensuring the effective functioning of the internal market.

EU regulation	COMMISSION REGULATION (EC) N0 1141/2007 of 1 October 2007 concerning the authorization of 3-phytase (ROVABIO PHY AP and ROVABIO PHY LC) as feed additive	Feeding of animals	Authorizes the mentioned substance as additive
EU regulation	ECODESIGN directive: Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (general, voluntary)	Electronic and electrical products	The Ecodesign Directive was created to provide coherent rules for ecodesign across the EU. The Directive itself is a 'framework directive', so its actual purpose is to lay down the general principles of ecodesign and to define conditions and criteria for setting further, specific, requirements.
EU regulation	RoHs Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment Text with EEA relevance	Electronic and electrical directive products	EU legislation restricting the use of hazardous substances in electrical and electronic equipment (EEE) and promoting the collection and recycling of such equipment. The legislation provides for the creation of collection schemes where consumers return their used waste EEE free of charge. The objective of these schemes is to increase the recycling and/or re-use of such products. The legislation also requires certain hazardous substances (heavy metals such as lead, mercury, cadmium, and hexavalent chromium and flame retardants such as polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE)) to be substituted by safer alternatives.
Directive	WEEE Directive: Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE) Text with EEA relevance	WEEE	The objective of the Directive is to promote re-use, recycling and other forms of recovery of waste electrical and electronic equipment (WEEE) in order to reduce the quantity of such waste to be disposed and to improve the environmental performance of the economic operators involved in the treatment of WEEE. The WEEE Directive sets criteria for the collection, treatment and recovery of waste electrical and electronic equipment.
Regulation	REGULATION (EU) 2017/1369 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 4 July 017 setting a framework for energy	Energy efficiency	This document lays down a framework for energy labelling. The energy label provides information on the consumption of energy and other resources for energy-related products during the use phase. The objectives of

	labelling and repealing Directive 2010/30/		this legislation is to provide better information to consumers, thus enabling informed choices at purchase. The revised framework introduces a product registration database– consisting of a compliance part and a public part– which must be established by January 2019. The revised framework reverts to an "A to G" labelling scale, thus doing away with the additional A+ and higher classes. The label, either in printed or electronic form, includes 7 classes (A-G) from dark green to red.
Regulation	Regulation (EC) No 66/2010 of the European Parliament and of the Council of 25 November 2009 on the EU Ecolabel.	Personal computers, notebooks and tablets, cosmetics, detergents, paints, shoes, furniture, paper products, toilets, tourist accommodation services	It is a voluntary method of environmental performance certification and labelling. Its management is carried out by the European Commission and the national competent bodies. Within the scheme the environmental criteria are developed for specific products groups. the scheme is intended to promote products with a reduced environmental impact during their entire life cycle and to provide consumers with accurate, non-deceptive, science-based information on the environmental impact of products. Its management is carried out by the European Commission and the national competent bodies.
National ecolabelling system	Nordic Swan Ecolabel	Products (goods and services)	Nordic countries ecolabel scheme
National ecolabelling system	Der Blaue Engel	Products (goods and services)	German ecolabel scheme
National ecolabelling system	EkoZnak	Products (goods and services)	Polish ecolabel scheme
National ecolabelling system	Milieukeur	Products (goods and services)	Dutch ecolabel scheme
EU Directive	Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives	Waste	The Directive establishes the legislative framework for the handling of waste. It defines key concepts such as waste, recovery and disposal and puts in place the essential requirements for the management of waste, notably an obligation for an establishment or undertaking carrying out waste management. It also establishes major principles such as an obligation to handle waste in a way that does not have a negative impact on the environment or human halt.

			The Directive encourages to apply the waste hierarchy (prevention, preparing for re-use, recycling, other recovery, disposal) and, in accordance with the polluter-pays principle, a requirement that the costs of disposing of waste must be borne by the holder of waste, by previous holders or by the producers of the product from which the waste came.
EU Directive	The Nitrates Directive of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (91/676/EEC)-	Agriculture	The Directive aims to protect water quality across Europe by preventing nitrates from agricultural sources polluting ground and surface waters and by promoting the use of good farming practices. The Nitrates Directive forms an integral part of the Water Framework Directive and is one of the key instruments in the protection of waters against agricultural pressures.
BREF document	Integrated Pollution Prevention and Control Reference Document on Best Available Techniques in the Food, Drink and Milk Industries, August, 2006	Food, Drink and Milk Industries	BREF documents support implementation of the Directive 2010/75/EU of the European Parliament and the Council on industrial emissions (the Industrial Emissions Directive or IED) - the main EU instrument regulating pollutant emissions from industrial installations.
BREF document	Integrated Pollution Prevention and Control Reference Document on Best Available Techniques in the Slaughterhouses and Animal By-products Industries, May 2006.	Slaughterhouses and Animal By-products Industries (This BREF document is under revision currently)	
BREF document	Intensive Rearing of Poultry or Pigs 2017, this publication is a Science for Policy report by the Joint Research Centre (JRC), the European Commission's science and knowledge service	Poultry or pig industries	
International certification	TCO CERTIFIED	IT products: displays, notebooks, tablets, smartphones, desktops, all-in-one PCs, projectors and headsets.	The system is based on comprehensive social and environmental criteria. The assessment is performed in the full life cycle. Compliance is independently verified, both pre and post certification.
US certification system	EPEAT	IT products	The system provides independent verification of manufacturers' claims. The EPEAT online Registry lists sustainable products from a broad range of

			manufacturers. The system is based on criteria developed through a voluntary consensus process involving multiple stakeholders, including sustainability advocates, manufacturer representatives, purchasing professionals, academics, recycling providers, and policy representatives.
US certification system	Energy Star	Appliances, lighting, computer equipment, electronics, heating and cooling products, windows, and insulation.	The government-backed labelling system for energy efficiency, providing simple, credible, and unbiased information that consumers and businesses rely on to make well-informed decisions.
British Standard (BSI)	PAS 2050. Guidelines for calculating carbon footprint of businesses and/or products and services	Products (goods and services	It is a specification for assessing product life cycle Greenhouse Gas (GHG) emissions, prepared by British Standards Institution (BSI) and co-sponsored by the Carbon Trust and the Department for Environment, Food and Rural Affairs (Defra). It is aimed at organisations, businesses and other stakeholders.
British Standard (BSI)	PAS 2060. Specification for the demonstration of carbon neutrality	. Products, organizations, communities, travel, events, projects and buildings.	This PAS helps organisations demonstrate the carbon neutrality of a specific product, entity or activity. It underpins reliable, credible claims that the subject of such a claim can indeed be considered carbon neutral.
British Standard (BSI) for LCA	BS EN ISO 14040. Environmental management and Life Cycle Assessment – Principles and framework	Products (goods and service)	British standard based on ISO LCA standard
EU methodology	Commission Recommendation of 9 April 2013 on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations, Official Journal of the European Union, L124 Volume 56, ISSN 1997-0766, 4 May 2013.	Products (goods and service) and organisations	EU common methodology for the assessment of products with the use of LCA (consistent with ISO standard)
ISO standards (international)	Environmental management – Life cycle assessment – Principles and framework (ISO 14040:2006). Environmental management - Life cycle assessment –	Products (goods and service)	ISO 14040:2006 describes the principles and framework for LCA including: definition of the goal and scope of the LCA, the life cycle inventory analysis (LCI) phase, the life cycle impact assessment (LCIA) phase, the life cycle interpretation phase, reporting and critical review of

	Requirements and guideline (ISO 14044:2006)		the LCA, limitations of the LCA, the relationship between the LCA phases, and conditions for use of value choices and optional elements. The ICO 14044:2006 provides requirements and guidelines for all the LCA phases.

POLICY	RELEVANT DOCUMENT	DESCRIPTION/ASSESSMENT
Integrated Product Policy (IPP), 2003	Communication from the Commission to the Council and the European Parliament, Integrated Product Policy. Building on Environmental Life-Cycle Thinking, Brussels, 18.6.2003, COM (2003) 302 final.	IPP aims to promote the development of the market for products with high environmental performance. It is addressed at both producers and consumers. An important issue is knowledge about life-cycle analysis and the eco-design. The Communication emphasised the need to apply appropriate incentives for producers that would influence the development of environmental technologies and a system of motivation for consumers, which would cause greater interest in eco-products.
The Eco-innovation Action Plan (Eco-AP), 2011	Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions, Innovation for a sustainable Future - The Eco-innovation Action Plan (Eco-AP) *COM/2011/0899 final	Strategic policy document that aims to catalyse progress towards the transformation of innovative ideas into products and services that help generate growth and tackle the EU's critical societal challenges. It includes a set of targeted actions and measures. The actions are the following: "Use environmental policy and regulation for promoting eco-innovation"; "Support demonstration projects and partnerships for eco innovation"; "Develop new standards boosting ecoinnovation"; "Mobilise financial instruments and support services for SMEs"; "Promote international cooperation"; "Support the development of emerging skills and jobs"; and "Promote eco-innovation though European Innovation Partnerships". Most of these actions have been completed by now. Some of Eco-AP goals have come together in the concept of the circular economy. The Eco-AP include crucial aspects of the circular economy: industrial symbiosis, cradle-to- cradle design and innovative business models.

Green Action Plan for SMEs, 2014	Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions, Green Action Plan fro SMEs Enabling SMEs to turn environmental challenges into business opportunities	This plan aims to help SMEs take advantage of the opportunities offered by the transition to a green economy. It presents ways for SMEs to turn environmental challenges into business opportunities.
A zero-waste programme for Europe, 2014	Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions Towards a circular economy: a zero-waste programme for Europe, /* COM/2014/0398 final */	This document includes a framework programme aimed at supporting design and innovation for circular economy development, unlocking investment in the circular economy and supporting SMEs and consumers.
EU action plan for the Circular Economy, 2015	Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions Closing the loop - An EU action plan for the Circular Economy. Brussels, 2.12.2015 COM (2015) 614 final	Published as part of the Circular Economy Package (see below), the Action Plan includes a series of actions to be carried out by the Commission centred on different thematic areas. In particular, it features actions targeted at all stages of the product's life cycle as well as at five priority sectors that were selected due to their specific value chains, products, environmental footprint or importance for reducing the EU dependency on raw materials: plastics, food waste, critical raw materials, construction and demolition, biomass and bio-based products. The document is aimed at supporting the circular economy in each step of the value chain, from production to consumption, repair and manufacturing, waste management and secondary raw materials that are fed back into the economy
CE package from 2015		In December 2015 the Commission published the Circular Economy Package (which replaced the withdrawn original Package published in 2014) with the goal of expanding the focus of EU waste policy upstream and addressing the full product cycle from production and consumption to waste management and the market for secondary raw materials. The Package included a proposal for new waste legislation as well as the Action Plan for the Circular Economy (see above).

EU strategy for plastics in a Circular Economy, 2018	Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions A European Strategy for Plastics in a Circular Economy, COM/2018/028 final	In the EU Action Plan for the Circular Economy plastics are considered one of the five priority areas to be addressed. The strategy identifies key challenges, including the low reuse and recycling rates of plastic waste, the greenhouse gas emissions associated with plastics production and incineration, and the presence of plastic waste (including microplastics) in oceans. According to this strategy all plastic packaging should be designed to be recyclable or reusable by 2030.
Communication on options to address the interface between chemical, product and waste legislation, 2018	Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions on the implementation of the circular economy package: options to address the interface between chemical, product and waste legislation. Strasbourg, 16.1.2018 COM (2018) 32 final	Communication assesses how the rules on waste, products and chemicals relate to each other.
Monitoring Framework on progress towards a circular economy at EU and national level	Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions on a monitoring framework for the circular economy SWD(2018) 17 final	It is composed of a set of ten key indicators which cover each phase – i.e. production, consumption, waste management and secondary raw materials – as well as economic aspects. 10 indicators grouped according to the four stages of circular economy: production and consumption, waste management, secondary raw materials and competitiveness and innovation. It shows progress towards circular economy in the EU and its Member States.
The Europe 2020 Strategy	A strategy for smart, sustainable and inclusive growth, /* COM/2010/2020 final */	In 2010 the European Union launched its Europe 2020 strategy to put the EU economy on a sustainable trajectory. The transformational changes proposed in the strategy are underpinned by five headline targets and three priority themes, namely smart growth, sustainable growth and inclusive growth. The strategy is used as a reference framework for activities at EU and at national and regional levels. The document sets 3 priorities: • smart growth – developing an economy based on knowledge and innovation. • Sustainable growth – promoting a more • resource efficient, greener and more competitive economy. • Inclusive growth – fostering a high-employment economy

		delivering economic, social and territorial cohesion.
Innovation Union initiative, 2010	Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Region Europe 2020 Flagship Initiative Innovation Union SEC (2010) 1161, COM (2010) 546 final	The major objective of the Innovation Union flagship initiative is to facilitate the transformation of innovative ideas into products and services that help generate growth and tackle the EU's critical societal challenges. It is one of the flagships identified in the Europe 2020 strategy. Initiative includes actions aimed to tackle both the supply and demand side elements of the innovation eco-system: the public sector, businesses, academia and finance. It assigned responsibilities and actions among the actors with the ability to shape the framework conditions for innovation, from the European Commission to Member States and Regional Governments, as well as other relevant stakeholders. There is a link with the EU Eco-innovation Action Plan which aims to ensure that efforts to improve the market penetration of environmental industries extend beyond exploring the possibilities of technology but address all aspects of eco-innovation .
A resource-efficient Europe – Flagship initiative, 2011	Communication: "A resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy" (COM (2011)23)	The flagship initiative for a "resource-efficient Europe" supports the shift towards a resource-efficient, low carbon economy and provides a long-term framework for actions in policy areas such as climate change, energy, transport, industry, raw materials, agriculture, fisheries, biodiversity and regional development. Its objectives include helping to decouple economic growth from the use of resources, supporting the shift towards a low carbon economy, increasing the use of renewable energy sources, modernising the transport sector and promoting energy efficiency. One of the key proposals under this initiative is the "Roadmap to a Resource Efficient Europe", which aims to transform the EU economy into a sustainable one by 2050. The roadmap identifies the economic sectors that consume the most

		resources, and suggests tools and indicators to improve resource efficiency.
A resource-efficient Europe – Flagship initiative, 2011	Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions Roadmap to a Resource Efficient Europe, /* COM/2011/0571 final */	Outlines how we can transform Europe's economy into a sustainable one by 2050. It proposes ways to increase resource productivity and decouple economic growth from resource use and its environmental impact. It illustrates how policies interrelate and build on each other.
A Thematic Strategy on the prevention and recycling of waste, 2005	Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and The Committee of the Regions - Taking sustainable use of resources forward - A Thematic Strategy on the prevention and recycling of waste {SEC (2005) 1681} {SEC (2005) 1682} /* COM/2005/0666 final *	The Thematic Strategy on the Prevention and Recycling of Waste sets long-term goal for the EU countries to become a recycling society that seeks to avoid waste and uses waste as a resource. It identifies key actions to modify the legal framework and to promote waste prevention, reuse and recycling, with waste disposal only as last resort.
Thematic Strategy on the Sustainable Use of Natural Resources, 2005	Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions - Thematic Strategy on the sustainable use of natural resources {SEC (2005) 1683} {SEC(2005) 1684} /* COM/2005/0670 final *	The goal of the strategy is to reduce the negative impact on the environment caused by the use of resources. The strategy refers to the concept of separating the interdependence of economic growth from the growth of consumption of natural resources and environmental impact (decoupling) and is based on the use of product life-cycle analysis.
Strategy for CSR, 2011	Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions A renewed EU strategy 2011-14 for Corporate Social Responsibility	According to this strategy companies voluntarily declare that social and ecological issues are taken into account in their commercial activities and relations with other parties. CSR can contribute to the implementation of the principles of sustainable development, while increasing the European potential of innovation and European competitiveness and thus can contribute to the creation of new jobs
EU climate action	Targets to reduce levels of greenhouse gas emissions, increase energy efficiency and amounts of renewable energy installed across the EU. Targets at 2020, 2030 and 2050. Links to the Paris Agreement on Climate Change.	https://ec.europa.eu/clima/citizens/eu_en

Appendix 4. Product design specifications

JS - Product Design Specifications for salad

1) **Characteristics**
   - The salad must be clean, fresh and have at least five different lettuce varieties in, including a mix of colours, shapes and sizes. The size of each leaf must be no longer than 10cm.
   - It must be produced organically and grown only on the farm of Scilly Organics.
2) **Environment**
   - The farm will not use any pesticides, herbicides or artificial fertilisers. Biodiversity will be managed in a positive way. Soil management will build organic matter and biodiversity.
   - Water use will be minimised during production.
   - Energy use will be minimised, and energy source will be renewable electricity.
   - Soil management should minimise erosion, improve soil structure, build soil carbon and increase biodiversity.
   - Water use should be minimised. The only water used shall be rainwater.
   - Material use should be minimised. Priority should be given to longer lasting and fully recyclable materials.
   - Recycled paper will be used in office and pack house.
   - Pest and disease management should take a holistic and non-chemical approach, whilst ensuring that the crops produced are healthy and marketable.
   - Crops and varieties chosen should be appropriate for the climate in which they are grown, ensuring no extra energy is required to produce them.
3) **Life in Service (Performance)**
   - As a fresh product, the salad will be consumed before the shelf life
   - Satisfaction rates with quality of product is expected to exceed 98%
4) **Target Product Cost**
   - The salad should cost no more than £14.00 (€ 15,70) per kg
5) **Packaging**
   - The salad will be sold in two different sizes, weighing 150g and 500g respectively
   - Packaging for salad should be fully recyclable, and be biodegradable and compostable where possible.
   - Transit packaging will all be reused from local businesses, including cardboard and polystyrene
6) **Quantity**
   - The farm will produce around 750kg of salad per year
7) **Production facility**
   - The farm has been operating for 15 years and produces a range of around 40 different products. It is fully enabled to produce salad products according to these specifications.
8) **Customer**
   - The customer preferences are shown at the beginning, the PDS is based on those preferences.
9) **Shelf Life**
   - The salad should be able to last for at least four days in good condition when refrigerated.
10) **Timescales**
   - The time to produce the salad will be eight to ten weeks (in spring and summer months).
11) **Testing**
   - The salad will be checked for quality at harvesting and packing stages.
12) **Safety**

- Food hygiene regulations will be strictly adhered to during the growing, harvesting and packing of the product

ALIA – Product Design Specifications for meat products

1) Performance

The different stages of growth and fattening of the animals must be defined by the following periods of time:

- Birth to end of weaning of piglets – 21 days.
- End of weaning to fattening transition – 42 days.
- Fattening – 118 days

The weight of the pig at the end of the three must be between 110-115 kg.

2) Animal welfare

An occupation of animals in each cage allowing the free movement of animals must be allowed.
The temperature must be regulated so that it complies with the comfort conditions of the animals.
It should be chosen the specific breeding species in the farm according to the climatic conditions of different periods of the year and animal needs.

3) Prevention of pests and diseases

Preventive treatments by the use of natural products should be prioritized instead the use of antibiotics. This includes stocking rates, housing conditions, diet and probiotics.

4) Life in service (performance)

The animals must go to the slaughterhouse in a period of time between 5 and 6 months, and a weight of 110-115 kg.

5) Target Product Cost

The farm must not spend more than a certain amount of money 1,05 €/kg of pig

6) Shipping

The transport must be carried out in an adapted truck for animal transport and must be as sustainable as possible in terms of CO_2 emissions.

7) Quantity

A total of 25 batches will be produced (equivalent to 25 pigs).

8) Manufacturing Facility

- The energy sources should be as low carbon as possible and energy efficient.
- The tools used in the process must be reusable (silos, cages, water troughs)

9) Size and weight

The objective is that the animals go to slaughterhouse with an age 6 months and a weight 110-115 kg.

10) Materials

- The water used should be reused or recycled as much as possible.
- The animal feed must have sustainable characteristics (using other industries' by-products as ingredients, using formulations that reduce nitrogen and phosphorous content in animals'

manure, including probiotics that reduce antibiotics need, favouring the selection ingredients with low environmental impact).
- The use of antibiotics should be minimised.
- Minimisation of organic waste through systems such as hydrolysis of corpses, minimisation of manures through diet, and management through agriculture use.
- Minimisation of inorganic waste through use of bulk raw materials instead of packaged ones as much as possible (with silos storages).
- Increase in recycling rates and in the use of slurry for further uses in agriculture or energy recovery.
- Materials not related to the main activity (as office material) must be acquired with sustainability criteria.

11) Product life span

Breeding must be completed in 5-6 months

12) Customer

The elaboration of the products will be based on the preferences and criteria of clients regarding environmental features (packaging, ingredients origin, etc.) through big data analysis.

13) Timescales
- The formulation time should be around one month.
- The quality test (weight control) must be carried out every week time.
- The LCA and the living labs to know the opinion of the clients will be made in a period of time equal to one month.

14) Testing

For the testing of the products LCA's will be carried out. In the living labs it will be checked if the design of the product is related to the thoughts of the consumers.
Quality tests will be carried out. These tests will be carried out for all the production batches (6 batches that are equivalent to 6 pigs). If the results are positive, it will be carried out in the same proportion as for the rest of the products. In addition, the quality test will be compared with similar products.

ONA – Product Design Specifications for table lamp

1) Performance
- The light must be able to light a small room (4 by 5 meters) if necessarily.
- The light must be able to be dimmed, as some people want a less bright light than others.
- The light (LED) will not get too hot while using it.

There will be an energy indication depending of which type of bulb the lamp will have, see right:

2) Environment
- The lamp should be used in any household temperatures without losing the ability to perform properly.
- Use low environmental impact materials and manufacturing processes.

3) Life in Service (Performance)

The lamp should be able to be used for eight hours a day, seven days a week, without problems.

4) Maintenance

- The lamp will need to change the bulb and clean it from dust.
- To apply eco-design methods, such as modular design, design for easy repair and upgrade, design for disassembly, design for reuse.

5) Target Product Cost

The price for product will oscillate between 300 and 450 € per piece.

6) Shipping

The lamp will be able to be shipped every way (pallet, truck, bus).

7) Packing

- The lamp will be wrapped in bubble plastic and put inside a cardboard box
- There will be a short technical description to help the consumer recycle the different parts of the lamp

8) Quantity

The first strip will be approximately 35 pieces.

9) Manufacturing Facility

The company has been making domestic lamps before and the machinery can be used again. Only the molds will need to be made again for the new design of the product. All the other tools and machines will be re-used.

10) Size

Approximate size between height 20 and 48 cm, width to be determined.

11) Weight

The product should use as few components as possible, whilst maintaining the required quality.

12) Aesthetics, Appearance and Finish

- Design and implement systems (related with the product) that facilitate components and luminaries' recovery for re-use, re-manufacture and recycle.
- Apply eco-design methods, such as modular design, design for easy repair and upgrade, design for disassembly, design for reuse.

13) Materials

- Use the minimum type of materials, which facilities the sorting of components for reuse and recycling when the product reaches its end of service life.
- Use low environmental impact materials and manufacturing processes.

14) Product life span

The product should be durable, and components should have easy access for repair.

15) Customer

- The elaboration of the products will be based on the preferences of the end consumers.
- Design and implement systems (related with the product) that facilitate components and luminaires' recovery for re-use, re-manufacture and recycle.

- Avoid: The use of special tools for disassembly, non-detachable joints (welded or glued joints), labels attached the product, finishes in materials, and toxic materials.

16) Timescales

- The formulation time must be around 8 weeks.
- The LCA and the Living Labs (carried on to know the opinions of the end consumers) will be done in one month.
- A more specific time of delivery etc will be known once the product is decided etc.

17) Testing

- The design of the lamp will be tested to ensure the type of certification and safety. This will align with relevant standards for electronic products (see Appendix 3).
- There will be testing during the design face with the LCA program.

18) Safety

- Keep away from young children since there is use of electronics.
- The lamp will have the indication of which type of protection against electric shocks it has. This will align with relevant standards for electronic products (see Appendix 3).

KOS – Design specifications for High bay LED lights

Introduction

The product to be developed is an Industrial high-power LED luminaire, known as the LED High Bay. This particular luminaire is installed in an industrial environment with a height between 5 to 13 meters. Comparing with the traditional industrial luminaire that uses HID lamps, the LED high bay uses 50% or less of energy with average life 3-5 times longer.

In particular, this product should include following features.

- A modular LED industrial High Bay, with main building clocks can easily configured to suit customer's need.
- Each functional module, in particular the LED drivers can be replaced with minimum effort. Allowing majority of the fitting parts can be reused.
- Highest possible lumen efficiency with current technology. Maximise saving on energy cost
- Additional functional module such as sensors and emergency module.
- Minimise overall environmental impact

1) Operation Environment

This product is designed to be used in an industrial environment, such as warehouse, factory, workshop etc., where it could be humid, semi enclosed, dusty etc. Therefore, the protection level of the product is required as below:

- Impact Protection: >IK8
- Ingress Protection: >IP54

2) Cost

In the current market situation, the retail price (price to be paid by end user) should be:

- Standard Model: £300 - £500 based on the power and lumen output.

- Additional emergency module: around £150
- Additional motion sensor: around £80

3) Lifespan

The average life of this product as a complete unit that includes LED engine and driver is 50,000 hours, Where the LED module's average life is expected to be 100,000 hours, and the average life of the LED driver is 50,000hours

4) Maintenance

For an installation site, annual check should be carried out. The failed parts/luminaire should be replaced. The expected failure rate is as below

- LED driver: <1% year1; <5% within year 3; <10% within year 5; <30% within Year 10
- LED Engine: <0.5% year1; <2% within year 3; <5% within year 5; <15% within Year 10

5) Packaging & Shipping

Carton Boxes should be used for the complete luminaire and replacement parts. Protection insert will be used where necessary, however the materials used must be recyclable.
Weight of a single package should not exceed 25Kg for manual handling.
The packaging should pass the following drop test:

- A sample packaged product is dropped (must be free fall) from a height of 70cm to a hard floor on three different sides. After the test the product should be in a sellable condition.
- The packaging should be suitable for shipping using standard courier services (such as UPS, DHL & TNT etc.).

6) **Safety**

The product must meet the EU safety regulations outlined in the section below, "regulations and standards".

7) Functional and performance requirement

This section details the technical specifications required. It provides sufficient information that allows the design engineers to complete the product development without ambiguities.

- **Luminaire Body**

Strong central structure allowing functional modules to be fixed to. It should also include built in junction box with 4-section push-wire connectors allow wiring of external cable. The each of the 4 sections should have 2 or more entries. Waterproof (>IP65) entry should be provided for each of the driver module. All modules (LED engine, Driver etc.) can connected and detached from luminaire with minimum effort, yet maintaining good structural integrity.
Protection: Class I, >IK8
Material: Press forming sheet metal (stainless steel)
Fixing: suspended mounting ring.

- **Driver Module**

Each driver is provided for each LED engine
Housing: IP65 waterproof, means of easy connection to the Luminaire body
Dimming: 1-10W dimmable as standard
Type: isolated
Flicker: Non-flicker
Wattage: 40W

- **LED Engine**

This is a replaceable LED Engine including LED chips, PCB board and heat sink.
LED Chips: Highest efficient LED chip. (Possibly 3030 1W)
Optic Lens: 30, 60, 90 degree.
CCT: 4000/5000/6500K
CRI: >80
Watt: 40W / module
Lumen: >6000lm /Module
PCB board: Aluminium 1.5mm
Heat Sink: Extrusion Aluminium
Where possible we should further enhance the module design concept so that the LED PCB and lens can be easily detached and replaced should there be any failure.

- **Emergency Module**

Lithium battery based Emergency module that can be attached to the Luminaire body and connected with minimum effort.
Output Wattage: 10W
Output Lumen: >1500lm
Time: >3hrs (initial emergency time should >hrs)
Function: Selftest as standard
Indicator: Red/Green. The light should be strong enough, so it is visible from distance of 9m.

- **Sensor Module**

Microwave sensor with integrated light sensor that can detect movement 16m Away. The sensor module can be easily installed and connected with minimum effort. Allow remote control and setting. Ideally it should also contain mater/slave operation mode and daylight harvesting function. This module will be purchased externally.

- **Sustainability considerations**

Minimise the waste, this means when components fail, only the necessary parts are replaced this mean structural part, cables and even heat sink that have no limit on life time should remain as much as possible.

  - Avoid high power consumption manufacturing processes, which means injection mounding, die casting etc.
  - Minimise non-recyclable material (plastic).
  - Minimise packing materials, and use recyclable materials where possible.
  - Minimise Packing size, allowing more product being shipped in a container.
  - The product should not use any SVHC materials per REACH regulation.

The applied standards and regulations for developing the Kosnic industrial lighting product include:
LOW Voltage Directive 2014/35/EU

Referenced standards:
EN 60598-1:2015(Luminaires. General requirements and tests)
EN 60598-2-5:2012(Luminaires. Particular requirements. Floodlights)
EN 62493:2015(Assessment of lighting equipment related to human exposure to electromagnetic fields)

EN 62031:2008+A1:2013+A2:2015(LED modules for general lighting. Safety specifications)
EN 62471:2008(Photobiological safety of lamps and lamp systems)
Electro Magnetic Compatibility Directive 2014/30/EU
Referenced standards:
EN 55015:2013+A1:2015(Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment)
EN 61547:2009(Equipment for general lighting purposes. EMC immunity requirements)
EN 61000-3-2:2014(Electromagnetic compatibility (EMC). Limits. Limits for harmonic current emissions (equipment input current = 16 A per phase))
EN 61000-3-3:2013(Electromagnetic compatibility (EMC). Limits. Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current = 16 A per phase and not subject to conditional connection)
Restriction of Hazardous Substances Directive 2011/65/EU
Energy-related Products Directive 2009/125/EC
REACH--Registration, Evaluation, Authorization, and Restriction of Chemicals) restriction of SVHC (Substances of Very High Concern) in (EC) 1907/2006

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