INTERNATIONAL STANDARD

ISO 17989-1

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Tractors and machinery for agriculture and forestry — Sustainability —

Part 1: Principles

Tracteurs et matériels agricoles et forestiers — Durabilité —

Partie 1: Principes

Reference number
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Foreword

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

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 23, *Tractors and machinery for agriculture and forestry*.

ISO 17989 consists of the following parts, under the general title *Tractors and machinery for agriculture and forestry — Sustainability*:

— *Part 1: Principles*

Introduction

International concern over human impact on the health of the environment (e.g. acid rain, ozone layer depletion, air, water and soil pollution, ground compaction, soil erosion) and the consumption of the limited natural resources have encouraged organizations that are involved in the design, development and marketing of machinery to give attention to how a machine can impact the environment. Social issues, such as a safe workplace, and economic issues, such as a manufacturing organization considering increasing the number of workers to increase production rates, shall be balanced by organisations. This rise in attention is driven not only by issues relating to social responsibility of manufacturers, but also purchasers of machinery who themselves can have concerns about the impact that their machine has on the environment, as well as legislative bodies that are in positions to mandate certain actions intended to reduce the adverse impact of machinery on the environment. In order to address these concerns, application of the principles of sustainability has been regarded as appropriate strategy.

The sustainability concept was developed in the forestry sector when more and more wood was used as source of energy (before the use of coal started) and has a long tradition in agriculture as agricultural and forestry production are linked to the land.

Today, sustainability standards are used in agriculture with the aim of achieving a fair balance between the three sustainability aspects:

- economic aspects, such as:
  - cost-effectiveness;
  - liquidity;
  - stability / steady economic condition.
- environmental aspects, such as:
  - climate effects;
  - resource consumption;
  - biodiversity;
  - soil protection;
  - water and air pollution.
- social aspects, such as:
  - work and employment (education, training, safety);
  - social involvement.

It is recognized that a product's design and its use over its lifetime can have a significant impact on the quality and sustainability of the environment in which it operates. Taking steps during a product's design and development stage that are aimed at reducing the impacts of the product is an important factor in sustaining the environment. In this sense, designing for sustainability can be seen as a process and set of considerations that are integrated into a product's design and development activities in support of reducing the negative impacts and improving the performance of the product. The design and use of agricultural and forestry machinery, being very closely tied to the environment in the production of food, fibres, fuel and lumber for humans and livestock, is no exception to this objective.

Standards which provide designers and manufacturers of agricultural and forestry machinery with guidelines for the incorporation of sustainability into a machine's design and development are desired and would be useful in advancing the state of the art of sustainability in design in this industry sector, and could provide machinery purchasers with the means of fairly comparing the impacts of competing products.

This part of ISO 17989 is the first of a series of standards that specifies principles related to sustainability and recommends to regard 'sustainability' as a management task to be addressed to the manufacturer. Other parts of this series are planned to address specific product families and to specify approaches related to sustainability in the design and use of products/machines.

Tractors and machinery for agriculture and forestry — Sustainability —

Part 1:
Principles

1 Scope

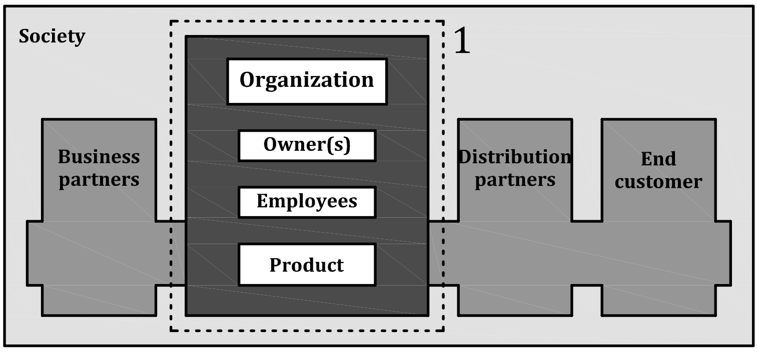
This part of ISO 17989 provides guidelines to assist designers and manufacturers of tractors and machinery for agriculture and forestry to integrate sustainability principles, practices and considerations into their organizations and processes. This part of ISO 17989 is specifically applicable to equipment used in the production of food, fibres, fuel and lumber for humans and livestock.

NOTE This part of ISO 17989 includes three different levels for the application: principles, recommendations and additional information (annexes).

This part of ISO 17989 is addressed to the organization management and provides guidance for considering sustainability aspects relevant for the organization and the product life cycle. It defines the factory gate as the system boundary (Figure 1).

This part of ISO 17989 is not applicable to contractual or regulatory purposes or to registration and certification.

Except when they are closely related to sustainability, this part of ISO 17989 does not address issues of occupational health and safety or operator safety aspects of a machine's design. Designers can find guidance on these issues in other International Standards.



Key

1 system boundary

Figure 1 — System boundary specifying also the scope of ISO 17989-1

2 Terms and definitions

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

2.1
design and development
set of processes that transforms requirements into specified characteristics or into the specification of a product, process or system

Note 1 to entry: The terms "design" and "development" are sometimes used synonymously and sometimes used to define different stages of the overall design and development process.

Note 2 to entry: A qualifier can be applied to indicate the nature of what is being designed and developed (e.g. product design and development or process design and development).

[SOURCE: ISO 9000:2005, definition 3.4.4]

2.2
end-of-life machine
machine that has completed its useful life and is taken out of service for disposal, recycle or reuse

[SOURCE: ISO 10987:2012, definition 3.7]

2.3
energy efficiency
effectiveness of converting energy into useful work

[SOURCE: ISO 10987:2012, definition 3.11]

2.4
environment
surroundings in which an organization or product operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation

[SOURCE: ISO 14001:2004, definition 3.5, modified]

2.5
environmental aspect
element of an organization's activities or products or services that can interact with the environment

[SOURCE: ISO 14001:2004, definition 3.6 modified]

2.6
environmental impact
any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products, or services

[SOURCE: ISO 14001:2004, definition 3.7 modified]

2.7
environmental label
environmental declaration
claim which indicates the environmental aspects of a product or service

[SOURCE: ISO 14020:2000, definition 2.1]

2.8
life cycle
consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal

[SOURCE: ISO 14044:2006, definition 3.1]

2.9
life cycle assessment
compilation and evaluation of impacts over a product's life cycle

Note 1 to entry: The life cycle to be assessed includes raw material selection, manufacturing, transportation, use, maintenance and end-of-life.

2.10
life cycle thinking
consideration of all relevant environmental aspects of a product during the entire product life cycle

2.11
manufacturing organization
organization, corporation, firm, enterprise, authority or institution, or part or combination thereof, whether incorporated or not, public or private, that has its own functions and administration

[SOURCE: ISO 14031:2013, definition 3.20 modified]

2.12
product
machine, attachment or system that performs a specific function and that is placed on the market for sale or distribution or placed into service

Note 1 to entry: A product can be software, hardware or processed material (e.g. lubricant).

2.13
sustainability
balance between social, environmental and economic needs that optimizes the current quality of life without sacrificing future quality of life

[SOURCE: ISO 10987:2012, definition 3.1]

2.14
end customer
synonym for farmer, contractor, product owner or operator

3 Principles

This concept shows that sustainability is characterized by a high degree of complexity which can affect the organization and its processes. The amount and importance of stakeholders, their interests, and their needs clarify that sustainability relates to the organization as a whole. Therefore, sustainability shall be seen as management task.

In order to satisfy this concept, the following principles shall be applied:

— identification of stakeholders and their interests (see 4.1);

— shaping of the organization policy (see 4.2);

— identification of relevant performance indicators (see 4.3);

— installation of the process that allows the optimization of performance (see 4.4);

— information to stakeholders (see 4.5);

— application of assessment procedures (see 4.6).

4 Recommendations for the application of the principles

4.1 Stakeholders and their interests

Stakeholders are to be understood as persons or groups with requests or demands concerning the organization, which are affected by or can influence organization decisions. With respect to their interests, stakeholders can be divided into the following groups:

— Owners and employees are primarily organization-oriented, i.e. their concern centres on long-term successful organization management and development; for additional information, see Annex A.

— Business partners (suppliers), distribution partners (dealers, agents) and end customers are primarily product and after sales oriented, i.e. for them the benefits, advantages and total costs of a product are of particular importance; for additional information, see Annex B.

— Other stakeholders such as analysts/lenders, scientists, politicians/society as well as communities and residents at the locations.

Dialogue with the stakeholders permits the organization to recognize early general trends and developments as well as opportunities and risks. With regard to sustainability, such a dialogue provides the possibility of inventorying, continuously updating and evaluating the topics that are important to stakeholders. Topics evaluated from the stakeholder and organization perspectives tend to display a high level of agreement. The resulting matrix (Figure 2) is the starting point for the development of a sustainability strategy.

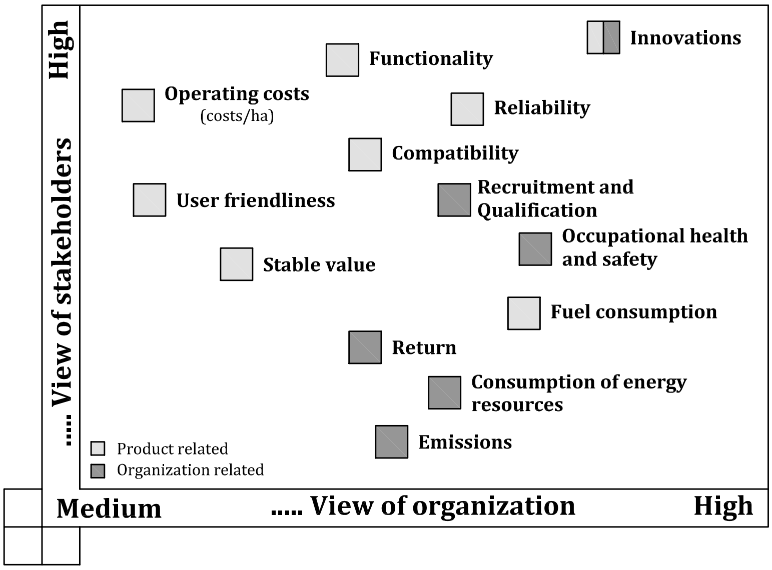


Figure 2 — Topic matrix: Importance of topics from the organization and stakeholder perspectives (example)

4.2 Organization policy

Organization policy defines not only the field of activity and fundamental goals, but also in particular the self-image and values of the organization (corporate culture). Codes of conduct describe interactions both within the organization and with external stakeholders.

Since sustainability affects all internal and external organization matters in the sense of taking into account the interests of all identified stakeholders, organization management shall also assume a position in this regard and adapt the values of the organization. The formulations chosen are less important than whether the convictions and associated messages of management are successfully transmitted.

4.3 Performance indicators

The multidimensional 'sustainability' concept shall be made manageable and comprehensible, so that it can be applied in the organization. Based on the topics identified within the framework of the stakeholder dialogue, specific targets and performance characteristics and indicators are to be determined, to which specific measures can be assigned. Figure 3 shows the derivation of specific targets and performance indicators.

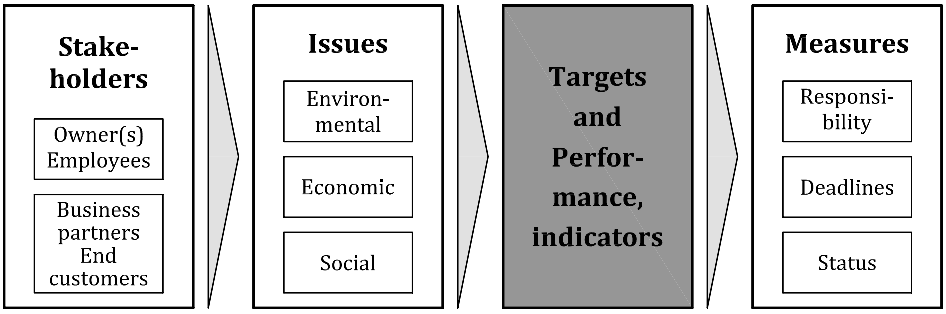


Figure 3 — Derivation of sustainability targets and indicators

According to the principle of sustainability (see Clause 3), the performance indicators should address economic, environmental and social aspects. The performance indicators can deal with the following:

- **Economic performance indicators, e.g.:**
  - Economic performance;
  - Market presence;
  - Indirect economic impacts.
- **Environmental performance indicators, e.g.:**
  - Materials;
  - Energy;
  - Water;
  - Biodiversity;
  - Emissions, effluents and waste;
  - Products and services;
  - Compliance;
  - Transport.
- **Social performance indicators, e.g.:**
  - Labour practices;
  - Human rights;
  - Society;
  - Product responsibility.

With respect to the interests of owners and employees and other stakeholders, the performance indicators should be identified, defined and specified by using two different approaches:

— stakeholder approach (see Annex A);

— life cycle approach (see Annex B).

4.4 Process for optimization of performance

For the optimization of the performance, a continuous improvement process may be implemented within the organization. The structure of this process should correspond to Figure 4.

NOTE The continuous improvement process for quality is shown in ISO 9001.

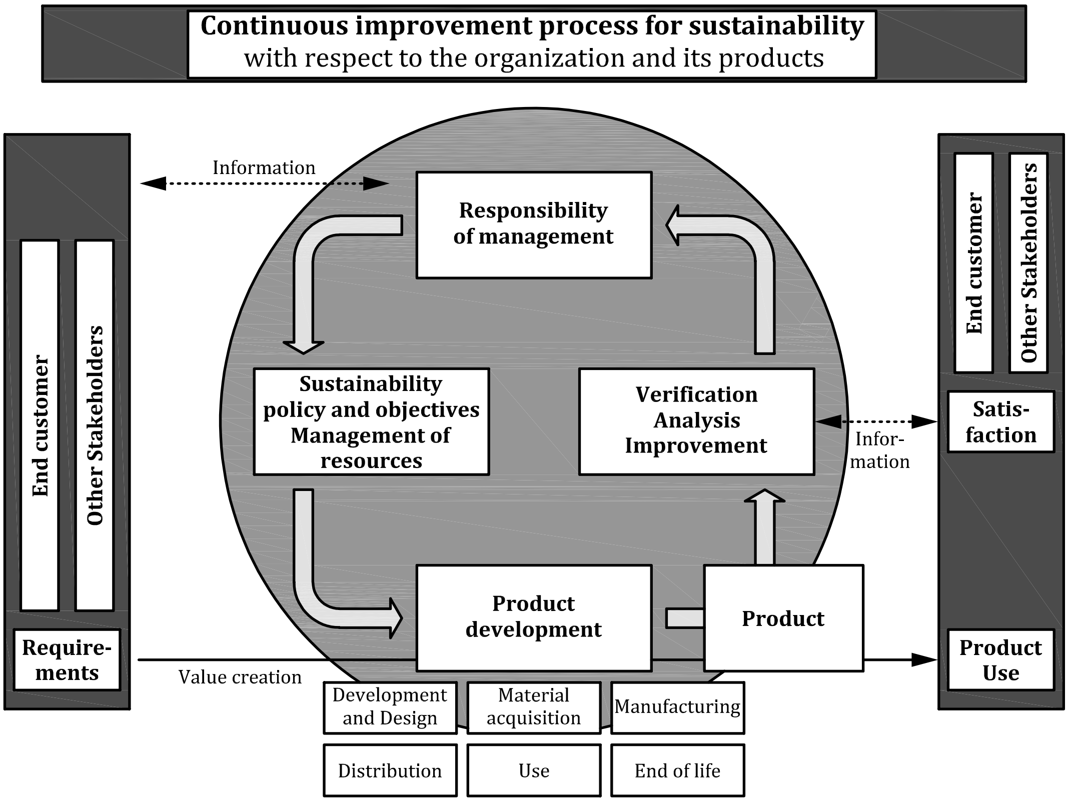


Figure 4 — Continuous improvement process for sustainability

4.5 Information to stakeholders

4.5.1 General

Reporting concerning the sustainability performance of an organization can take place:

— internally, with the objective of promoting employee awareness, motivation and identification, thus keeping the process going; and

— externally, with the objective of informing business and distribution partners, end customers, financial partners, the public and politicians concerning the organization's principles (sense of responsibility, future orientation, etc.) and current sustainability status.

Depending upon the target group and message, various formats can be considered (e.g. website, business reports, press releases and employee information).

4.6 Reports

4.6.1 General

Information on the organization's vision, mission, strategies, operations and products with respect to sustainability can be provided to the public. This information may be included in other documents (for example business reports) or published as separate brochures, leaflets, etc.

4.6.2 Labels and declarations

If provided, the information on labels and declarations should:

— be readable and intelligible; and

— be comprehensible and verifiable;

4.6.3 Additional information

If provided, additional information should be appropriate and sufficient to explain the nature of the claim or data that is being presented by the label or declaration and should:

— provide detailed information on one or more aspects of sustainability; and

— refer to other sources of information.

EXAMPLES Additional information can be explanatory brochures, free telephone numbers, internet sites, or other public access means.

4.7 Assessment

The assessment may be part of the organization's continuous improvement process (see 4.4). Information is provided by ISO 9001.

Annex A
(informative)

Stakeholder approach – Examples for performance indicators

See Table A.1.

Table A.1 — Examples for performance indicators

Stakeholder	Aspect	Performance indicators
Owners	**Economic**	Rate of return, cost-effectiveness, liquidity, steady economic condition, turnover per employee, market shares, expenditures for product development and innovations, …
	Environmental	Consumption of resources such as energy, water, air and raw material, use of hazardous substances, amount and disposal of wastes, avoidance of manufacturing related pollutions, …
	Social	Involvement in local, regional social structures, availability and qualification of staff, working conditions, accidents at work, prestige of the organization and its products, …
Employees	**Economic**	Job security, salary, …
	Environmental	Comfortable and healthy work place and working conditions, …
	Social	Career opportunities, employee engagement, development of competence, methods, tools and processes, training, flexible working times, …

Annex B
(informative)

Life-cycle approach

B.1 General

Life cycle thinking includes consideration of the impacts of a machine through all stages of the product's life.

These stages include:

— conception / development / design;

— material acquisition;

— manufacturing;

— distribution;

— use;

— maintenance;

— end-of-life.

A life cycle assessment (LCA) is useful in identifying the sustainability aspects and potential adverse impacts throughout a product's life cycle from raw material acquisition through production, use and end of life treatment.

LCA can assist all parties involved in the production of an agricultural or forestry product in:

— identifying the significant impacts in all or certain phases of a product's life;

— identifying opportunities to reduce the impacts in certain phases of a product's life;

— identifying the most relevant sustainability indicators of the product's performance;

— identifying those performance indicators that are seen as value added information by product customers, society (general), and that are useful in making a sustainability performance claim or producing an environmental declaration or label.

ISO 14040 and ISO 14044 should be referenced for principles, framework and requirements to be used in preparing and carrying out an LCA for a product.

Examples of how the individual life cycle stages could provide contributions with respect to sustainability are provided in Annex C.

B.2 Principles related to life cycle stages

B.2.1 Efficient use of natural resources

In designing a machine, efforts should be made to reduce the depletion of natural resources where economically and socially possible. This process involves:

— selecting design solutions that serve to improve the efficient use of resources during all stages of the machine's life;

- when LCA verifies better environmental performance giving preference to the use of renewable resources;
- when LCA verifies better environmental performance giving preference to construction materials that can be recovered and recycled during end-of-life treatment of the machine.

B.2.2 Minimization of pollution

Minimization of release to the air, ground or water of substances or materials that are documented as being hazardous, toxic or otherwise harmful to the environment shall be taken into consideration during all life cycle phases of a product. When feasible, such substances or materials should be replaced by other, less harmful substances and materials.

The design should take into consideration:

- reduction or treatment of engine exhaust and other air emissions to levels that are technically and economically feasible and meet the minimum requirements of national and regional regulations where such regulations exist;
- use of materials that can be recycled and reused as an alternative to land disposal or incineration;
- reduction, and possible elimination of the potential for the release of harmful chemical substances during the use, service or disassembly of the machine;
- provision in operator instructions regarding steps that the operator can take to prevent or reduce pollution.

B.2.3 Efficient use

'Use' is an important life cycle stage because this stage can provide the most significant contributions to the sustainability demands the end customer is faced with:

- economic requests such as cost-effective operations;
- environmental requests such as reduction of resource consumption, protection of soil, water, air, flora, fauna and humans;
- social requests such as safe workplaces, quality controlled production of food, energy and fibre.

To increase and to optimize the contribution of the use stage, the following parameters should be considered:

- efficiency of the product (machine, service);
- efficiency of operating the machine;
- efficiency of the (agricultural) process;
- use of renewable fuels and lubricants.

B.2.4 Communication to customers and public

Communication promotes an awareness of sustainability and is useful to purchasers and operators of the product, as well as society (general) that have an interest in understanding how and to what degree the product can impact the environment. Examples of such communication are:

- including, in operator's manuals, information regarding steps the machine operator can take to reduce impact on the environment (e.g. work site operating recommendations; instructions regarding proper disposal of waste lubricants; instructions regarding proper disposal of lead-acid batteries) and operating costs as well as to ensure the safety of the operator and bystanders,

— including, in a product's published specifications, data regarding environmental, economic and safety performance of the product;

— including, with a product, an environmental label or declaration.

B.2.5 Examples for (detailed) performance indicators

See Table B.1.

Table B.1 — Examples for (detailed) performance indicators

Life cycle phase	Aspect	Performance indicator
Development / Design	**Economic**	Development times, hourly rates, taxes, regulations and tariffs, number of patents ...
	Environmental	Degree of efficiency, duration of life, retrofitting, ...
	Social	Labour content, ...
Material acquisition	**Economic**	Costs per unit, taxes, regulations and tariffs ...
	Environmental	Availability, recyclability and hazardousness of materials, ...
	Social	Conditions of employment and work, ...
Manufacturing	**Economic**	Processing times (order / delivery), taxes, regulations and tariffs ...
	Environmental	Consumption of energy and water,, emissions, wastes, ...
	Social	Working conditions, accidents at work, ...
Distribution	**Economic**	Taxes, regulations and tariffs
	Environmental	Packaging, means of transport, ...
	Social	After sales support
Use	**Economic**	Performance, acquisition, running and service costs, taxes, regulations and tariffs ...
	Environmental	Impacts to air, water and soil, ...
	Social	Safety of operator, ...
End-of-life	**Economic**	Residual value, costs for disassembling, taxes, regulations and tariffs ...
	Environmental	Retrofitting, recyclability, hazardous substances, disposal, ...
	Social	

Annex C
(informative)

(Practicable) Examples of how the individual life cycle stages could provide contributions with respect to sustainability

The following examples should show that:

— the consideration of sustainability aspects is possible at all stages;

— process oriented and overall stage thinking create additional benefit;

— simple measures can create benefit;

— the organization benefits from life cycle oriented sustainability thinking.

NOTE 1 The application of the shown examples and other measures depend on various parameters such as the organization size and organization, manufactured products, etc.

NOTE 2 LCA typically does not address the economic or social aspects of a product but the life cycle approach and methodologies described in ISO 14044 can have useful application to these aspects.

NOTE 3 Not all indicators listed in Table C.1 are beneficial for all products and LCA or other considerations are needed to validate improvements.

Table C.1 — (Practicable) Examples how the individual life cycle stages could provide contributions with respect to sustainability

Contributions of prior to the next stage	**Aspect**		
	Environ-mental	**Economic**	**Social**
Contributions of 'development stage' to 'material acquisition stage'			
Preference of standardised components (e.g. screws, etc.)	X	X	X
Use of same parts	X	X	
Preference of standardized materials	X	X	X
Integration of multiple functions into one components (vs. multiple components with single function)		X	
Preference of local suppliers	X		X
Consideration of the whole life-cycle for parts / components to be acquired	X	X	X
Contributions of 'development stage' to 'manufacturing stage'			
Use of existing components / sub-assemblies		X	X
Modular designs		X	
Use of laser technology (instead of nibbling)	X	X	
Use of bevelled material (instead of tubes)	X	X	
Edging instead of welding	X	X	
Dimensioning by using the Finite Elements Method (FEM)		X	
Simulation of kinetic behaviour		X	
Testing of software by simulation		X	
Optimization of tolerances		X	

Table C.1 *(continued)*

Contributions of prior to the next stage		**Aspect**	
	Environ-mental	**Economic**	**Social**
Energy-saving transport	X	X	X
Ergonomic work positions with respect to welding and assembly		X	X
No or less grinding of surfaces		X	X
Complete and clear drawings for ensuring legibility and quality		X	X
Transportability, storage of components without additional frame, palette		X	X
Contributions of 'development stage' to 'distribution stage'			
Machine size, disassembling for transport		X	
High added value (for end customer) and less proportional costs for design and manufacturing		X	
Unique features		X	
Compatibility with tractors and other systems		X	
Contributions of 'development stage' to 'use stage'			
Energy-saving operation/use	X		
Ergonomic operation	X		X
Compatibility with other machines and systems		X	
Durability with respect to weather, ultraviolet light and corrosion conditions (in house parts, supplier parts)	X	X	
Contributions of 'development stage' to 'end-of-life stage'			
Modular designs and disassembling (without special tools)		X	X
Identification/marking of materials	X	X	
Contributions of 'material acquisition stage' to 'development stage'			
Searching for ideas / stimulations at innovative suppliers		X	
Selection of parts, components and materials depending on quality and costs of competitive suppliers		X	
Preference of parts and components with high degree of secondary raw material	X		
Selection of recycled materials	X		
Identification of parts with high durability demands with respect to weather, ultraviolet light and corrosion conditions	X		
Protection of bearings and drives against dust	X		
Friction resistance (if required)	X		
Possibility of repair	X		X
Possibility of re-use as secondary raw material	X		
Preference of local suppliers	X		
Avoidance of hazardous substances	X		X
Contributions of 'material acquisition stage' to 'manufacturing stage'			
Parts, components without additional/special packaging	X	X	X
Recirculation of packaging boxes, transport frames, use of kanban	X	X	
Coordination and collecting of delivery dates	X	X	X
Low warehouse stock		X	

Table C.1 *(continued)*

Contributions of prior to the next stage		**Aspect**	
	Environ-mental	**Economic**	**Social**
Contributions of 'material acquisition stage' to 'distribution stage'			
Selection of suppliers (reliability, delivery reliability, innovative solutions)		X	
Contributions of 'material acquisition stage' to 'use stage'			
Energy-saving parts/components (e.g. pumps, engines, motors)	X	X	
Quality and reliability of parts and components		X	
Contributions of 'material acquisition stage' to 'end-of-life stage'			
Disassembling and recyclability of parts and components	X	X	
Contributions of 'manufacturing stage' to 'development stage'			
Feedback on problems such as fitting accuracy, missing data		X	X
Contributions of 'manufacturing stage' to 'material acquisition stage'			
Information on missing parts		X	
Information on loss of suppliers		X	
Contributions of 'manufacturing stage' to 'distribution stage'			
Information on product quality, completeness of delivery, painting, complete functional and quality check	X	X	
Contributions of 'manufacturing stage' to 'use stage'			
Complete check of compatibility	X	X	
Contributions of 'distribution stage' to 'development stage'			
Comparison with products of competitors, information on customer requests, input for increasing competitiveness	X	X	X
Contributions of 'distribution stage' to 'material acquisition stage'			
Information on loss of suppliers		X	
Contributions of 'distribution stage' to 'manufacturing stage'			
Sequence of machine manufacturing, avoidance of changing the sequence, long-term planning to achieve an even work flow	X	X	X
Quality requirements		X	
Complete use and optimization of (truck) carrying capacity, planning of deliveries	X	X	
Contributions of 'distribution stage' to 'use stage'			
Customer consulting oriented to his needs, customer information and training for machine operation	X	X	X
Contributions of 'distribution stage' to 'end-of-life stage'			
Acceptance of returned machines, support for marketing of used machines	X	X	X
Contributions of 'distribution stage' to 'management / human resources department'			
Trainee advertising, support of trainees		X	X
Contributions of 'development, material acquisition, manufacturing and distribution stage' to 'management / human resources department'			
Working atmosphere, each other support, no workplace bullying, incorporation, education and training, encouragement of gender balance,		X	X

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