Technical Report

ISO/TR 59031

Circular economy — Performance-based approach — Analysis of case studies

Economie circulaire — Approche basée sur la performance — Analyse de cas pratiques

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Contents

Page

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 document 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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 323, *Circular economy*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

0.1 Background

The global economy is “linear” as it is mainly based on extraction, production, use and disposal. This linear economy leads to resource depletion, biodiversity loss, waste and harmful losses and releases, all of which collectively are causing serious damage to the capacity of the planet to continue to provide for the needs of future generations.[7] Moreover, several planetary boundaries have already been reached or exceeded.

There is an increased understanding that a transition towards an economy that is more circular, based on a circular use of resources, can contribute to meeting current and future human needs (welfare, housing, nutrition, healthcare, mobility, etc.). Transitioning towards a circular economy can also contribute to the creation and sharing of more value within society and interested parties, while natural resources are managed to be replenished and renewed and in a sustainable way, securing the quality and resilience of ecosystems.

Organizations recognize many potential reasons to engage in a circular economy (e.g. delivering more ambitious and sustainable solutions; improved relationships with interested parties; more effective and efficient ways to fulfil voluntary commitments or legal requirements; engaging in climate change mitigation or adaptation; managing resource scarcity risks, increasing resilience in the environmental, social and economic systems), while contributing to satisfying human needs.

The ISO 59000 family of standards (see Figure 1) is designed to harmonize the understanding of the circular economy and to support its implementation and measurement. It also considers organizations, such as government, industry and non-profit, in contributing to the achievement of the United Nations (UN) Agenda 2030 for Sustainable Development.[8]

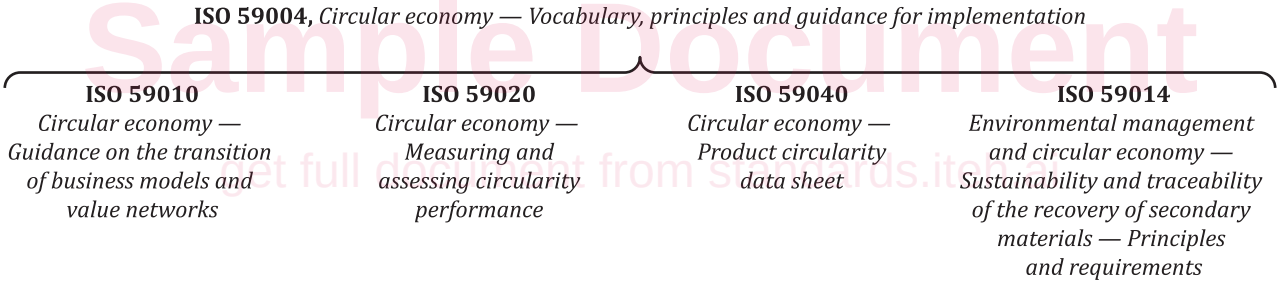

Figure 1 — ISO 59000 family of standards

0.2 Relationship between ISO 59004, ISO 59010 and ISO 59020

ISO 59004, ISO 59010 and ISO 59020 are interconnected, as shown in Figure 2, and support organizations in implementing a transition towards a circular economy.

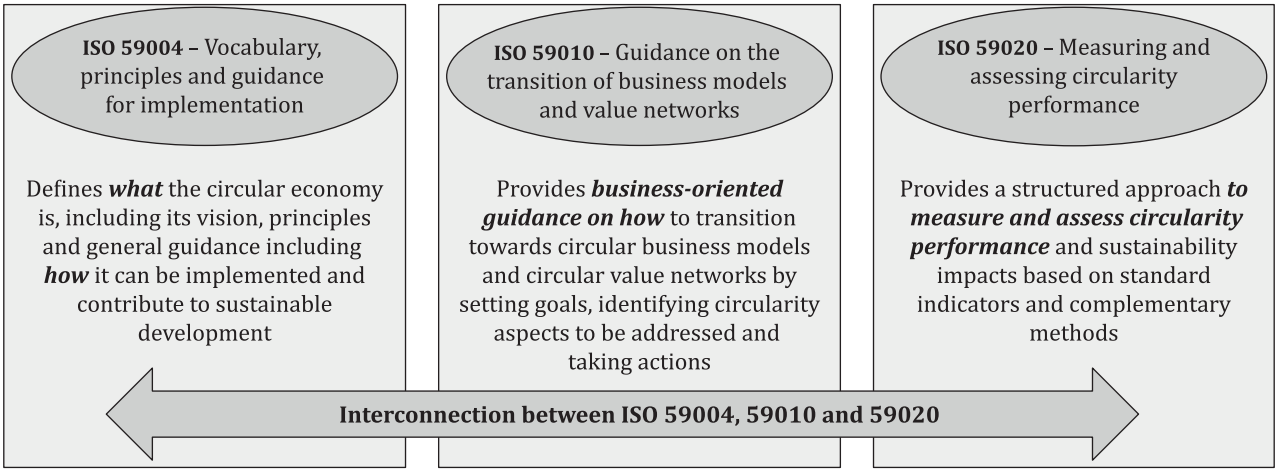

Figure 2 — Relationship between ISO 59004, ISO 59010 and ISO 59020

0.3 Introduction to performance-based approaches

Performance-based approaches, such as functional economy, service economy and product-as-a-service (PaaS) system, are currently acknowledged as being relevant for helping organizations to face the challenges in developing circular-economy-related approaches. Such business models can enable and strengthen their economic viability while simultaneously improving their environmental and societal impacts.

Indeed, in a performance-based approach, the revenue stream of an organization or group of organizations is less dependent on the amount of product or "service unit" delivered and more related to the real impact or outcome of their activities on the customers or beneficiaries. These impacts can be economic and/or social and/or environmental. The performance-based approach has the potential to contribute to the decoupling of economic development from the negative impacts of resource use.

EXAMPLE A car is one of several possible solutions to meet the mobility need of travelling from point A to point B, which is the desired outcome.

Performance-based approaches within a circular economy are currently well documented from a theoretical point of view; however, there seems to be a lack of operational reference for their implementation. Many organizations therefore state that while such approaches are interesting, they are not applicable to their business model and they would require a dramatic transition in their business model, which would threaten their existence in the short term (even if their situation in the long term can be improved). Providing examples of transitions to a performance-based economic model across a range of businesses and companies can bring valuable insight and aid new organizations and economic players to transition to a circular economy (regardless of their size or status). To ensure that this document is a useful tool for promoting changes in business models, the barriers that impede the adoption of a performance-based approach are detailed.

For consistency with the scope of ISO 59010, which covers specific issues of circular economy, this document does not aim to illustrate the many actions, measures and strategies for the implementation of a circular economy within an organization. Instead, it addresses a key question involving the decoupling of revenues from the use of material resources. Decoupling is critical as it reduces the impact of the "rebound-effect" in which reducing the environmental impact of a product has limited effect because one way or another the organization needs to sell more products to grow or survive, which can negate the benefits of circular economy initiatives on resource preservation.

This question of growth is central in this document: it shows how some organizations have managed (at least partially) to make PaaS consistent with sustainable financial results and the preservation of material or intangible resources. In these examples, there are no environmental or social constraints to abide to for mutual development of these three aspects of sustainable development. Of course, achieving synergy from these three aspects demands significant redesigning of all the aspects of an economic model (how to produce value in new ways, ensuring these are valued by customers and, hence, financially rewarding, how the new business models affect work within the organizations, and the relationships between the various stakeholders and the significant time investment needed prior to implementation). This document

complements ISO 59010, which provides a guidance on circular-economy-compliant business models, in particular the service economy cited in this document.

When the sale of performance is considered, the question of assessment is essential. The assessment covers, for instance, not only environmental impacts such as carbon dioxide (CO_2) emissions, but also other aspects such as resource conservation, wellness and intangible resource or value development (e.g. attractiveness of a territory for upcoming investment, reinforcement of relationship between partners for new projects). While a product–service system business model has the potential to improve environmental performance or decrease the environmental impact, the superiority is not always guaranteed (e.g. user mis-behaviour). There is no accepted approach for quantifying this superiority at present. The outputs of using ISO 59020, which centres on the issue of metrics and assessment of circular economy, are essential. This document highlights to what extent they are or can be relevant for the assessment of the contracted performance in each case.

Circular economy — Performance-based approach — Analysis of case studies

1 Scope

This document provides an analysis of various case studies for the implementation of specific aspects of the circular economy in organizations, regardless of their status. This document specifically focuses on performance-based approaches such as functional economy, service economy, product-as-a-service (PaaS) and other performance-based approaches.

This document mainly describes a selection of use cases of operational implementation of such performance-based approaches as observed in different organizations. It stresses the challenging context faced by concerned organizations in changing their economic and business models. This document depicts cultural, organizational and industrial changes induced by the move of business models toward a performance-based approach. It emphasizes to what extent the total economic value can increase and how this is converted into revenue streams for the concerned organizations.

This document does not apply to the implementation of any circular economy domain of actions (circular design, recycling; responsible purchase policy, etc.), but focuses on the systemic level of development of economic models based on the commercialization of various performance aspects.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
performance-based approach
economic models relying on the sales of solutions with the aim to ensure usage intensity, useful effects or results to be achieved

Note 1 to entry: Solutions are a combination of services and products that cannot be separated.

3.2
reuse,verb
use a product or its component parts after their initial use, for the same purpose for which they were originally designed

Note 1 to entry: Utilization intended by the original design can involve either single-use or multiple-uses by the initial user or customer over time.

Note 2 to entry: Minor treatment (e.g. cleaning) of the product can be needed by the user to allow for reuse.

Note 3 to entry: In some cases, resources, such as water, are considered as a product, in which case, the purpose of "original design" is not applicable.

[SOURCE: ISO 59004:2024, 3.5.17]

3.3
economic system
system by which a society organizes and allocates resources

Note 1 to entry: The economic system can vary depending upon the geographic region or governmental jurisdiction.

Note 2 to entry: This can include the regulation of resources and the production, use and disposal of these resources.

[SOURCE: ISO 59004:2024, 3.1.2]

3.4
business model
organization's chosen system of interconnected and interdependent decisions and activities that determines how it creates, delivers and captures value over the short, medium and long term

Note 1 to entry: A business model is more than the organization's processes and the solutions it provides.

Note 2 to entry: A business model is a subset of value-creation models wherein the chosen system determines how the organization creates, delivers and captures economic value.

[SOURCE: BSI 8001:2017, 2.8, modified — "solutions" replaces "products or the services" in Note 1 to entry.]

3.5
functional economy
economic model that optimizes the use of solutions and, thus, the management of existing wealth (products, knowledge and nature)

Note 1 to entry: This model fosters usage rather than ownership.

Note 2 to entry: The economic objective of the functional economy is to create the highest possible use value for the longest possible time while consuming as few material resources and energy as possible.

Note 3 to entry: The functional economy is therefore considerably more sustainable, or dematerialized, than the present economy, which is focused on production as its principal means to create wealth and material flow.

3.6
product-as-a-service
PaaS
business model (3.4) that allows customers to purchase the performance of a product rather than the product

Note 1 to entry: This model can offer environmental and economic benefits to all the parties along the value chain by reducing manufacturing and intensifying use.

Note 2 to entry: At the end of the life of the product, the service provider has the responsibility for the *reuse* (3.2), recycle, regeneration or disposal of the product.

4 General information

4.1 Objective

This document shares examples of various globally distributed organizations that have developed circular economy practices involving a performance-based approach.

This document can be a resource for an organization:

— from the same sector as that of the case study depicted in this document (sectorial analogy);

— facing a similar barrier in moving from a traditional linear economy approach as seen in the example case study (problems of analogy);

— considering a business model similar to a case study in this document (business model analogy, e.g. PaaS, sharing platform).

This document provides relevant examples for consideration when shifting from a sales-based or ownership-based business model to a circular performance-based one.

4.2 Selection of cases

Many cases were submitted for investigation. The selection of the use cases for further consideration for use in this document was based on several factors that allowed selection of examples to illustrate performance-based approaches:

— the extent to which the considered solution relies on the sale of a delivered performance or set of outputs and outcomes;

— the scope and the documentation of the economic, environmental and social impacts (whether direct or as external effects) that were taken into account;

— the extent to which intangible effects (including customer satisfaction) of the deployment of the considered solution are taken into account and documented;

— the consideration of one or several aspects of a performance-based approach that contribute to a circular economy (e.g. a sharing economy, remanufacturing strategies, product extension life strategies);

— the demonstration of mechanical and/or service cycles that are compliant with the principles of a circular economy;

— the ability to scale-up or replicate the considered solution in the same sector or in another field;

— the accuracy of the environmental analysis underlying the deployment of the considered solution. e.g. use of life cycle analysis, accounting for greenhouse gas (GHG) emissions balance in a relevant scope (with a preference for analysis in Scope 2 or Scope 3 rather than Scope 1).

From these considerations, cases selected for more extensive investigation and selection for reporting were chosen as detailed in 6.1.2.

4.3 How to use this document

This document provides relevant examples of performance-based approaches developed by different types of organizations: companies, business associations and start-ups. Each example shows the main barriers determined by the transition from a traditional linear approach and how these can be overcome. Each example presents the concept of the proposed solution before describing the progress of its delivery. Each description of the case study emphasizes the change in the use of products to enable economic revenue generation and articulates the service element contribution towards effective performance provision. As a conclusion, the case study description underlines the extent to which the initial shortcomings of a linear approach are overcome through the change in business towards a performance-approach.

The case study description also shows how the described approach can be adapted to other situations and the conditions under which this can be considered.

This document can be used to provide the means to identify critical issues when an organization moves towards a performance-based approach. This includes consideration of:

— technical and service cycles;

— quantitative assessments, especially environmental and social impacts (external effects) and cost-benefit analysis, focusing on life cycle simulation (LCS) approaches (when they exist) and GHG emission assessment through life cycle assessment (LCA);

— qualitative assessment and its use, especially regarding consideration of intangible effects;

— the type of performance-based approach considered (product–service system, remanufacturing and life-extension strategies, sharing economy platforms, etc.);

— replicability, and scale-up opportunities and conditions.

Moreover, each case study provides an overall overview on why a performance-based approach is relevant from a global point of view and what is important to implement a performance-based approach of a circular model, beyond a list of criteria to abide by.

Some of the cases do not focus on or provide for end-of-life treatment (largely because of a lack of information provided). These aspects can be considered in a performance-based approach and in a circular economy.

5 Analysis of cases

5.1 Process to collect and analyse cases

Following a widely distributed invitation from ISO/TC 323 during 2020, and a second call with a special focus on developing countries launched in early 2021, a total of 121 cases were submitted for analysis (see Table 1).

In order to have an impartial analysis, two experts from countries different than the submitted case studies analysed each case. The main criterion was the existence of a performance-based approach. The selected cases were those that provided the clearest evidence of a performance-based approach. In total, seven cases were selected to be reported in this document, based on information given and the expert analysis.

Table 1 — Cases received

Country	Cases received
Benin	1
Bolivia	3
Brazil	2
Cameroon	1
Chile	4
Columbia	1
France	6
Germany	1
Indonesia	1
Iran	1
Italy	24
Japan	46
Kenya	2
Mauritius	1
Serbia	1
Spain	18
Sweden	2
Switzerland	1
Uganda	1
Uruguay	4
Total	**121**

5.2 Approaches taken in the use cases

5.2.1 General

The selection of cases represents the different aspects of the performance-based circular economy approach. Some cases come from small companies, and others from large companies, but all have based all or part of their business model on an approach that focuses on the sale of the performance of the products rather than on the products themselves. In this way, the link between the manufacture of products and the profitability of the company is broken.

Firstly, it is a question of selling a subscription to the performance of use (mobility, light, industrial stripping, protection of transported and stored products, etc.). The cases presented by these companies never talk about selling products.

Secondly, these companies have recurring income that strengthens their financial stability and strengthens their resilience in the event of economic accidents.

Finally, these companies participate in the fight against global warming and in achieving the Sustainable Development Goals by reducing their demand for materials and energy through the reuse, reparability and controlled recycling of products used for the realization of a performance-based business model.

Some of the companies started directly with a performance-based approach business model and others created or transformed a business unit into a performance-based approach business model (see the information for each use case).

All the data stated for each use case are considered true at the time of collecting the information from the respective institutions and represent a picture of the moment when the data were collected.

5.2.2 Related aspects of the performance-based approach in the cases

Each case is an example of a business model that is based on selling the performance of the product rather than selling the product itself. In all business models, products are at the heart of the service.

This means that the company will first conduct a circular design of the service it wants to provide, then it will use the service's circular design to conduct a good circular design and finally it will provide the specification of the products in relation to the service's circular design.

NOTE The cases are consistent with the principles and definition of circular economy as defined in ISO 59004. Several of the cases received were not included in this document because they were not consistent with these principles. In particular, some examples of recycling without any systemic thought were excluded for this reason.

5.2.3 Circular design

Each of these cases have their own challenges. Some of them have used circular design, while others (regarding the cost and the size of the company) try to do their best to provide what comes closest to a circular design.

Circular design is used to deliver the best performance while minimizing negative impacts during the whole life cycle, in accordance with the best available technology (BAT) and best available methodology (BAM).

The focus of circular design is on curtailing a loss of value that is embedded in raw materials and products, by keeping them circulating in closed loops. These loops, such as reuse, repair, remanufacture, return, refurbishment and recycling, extend the product's life cycle and improve the resource productivity.

In accordance with extended producer responsibility (EPR), circular design methodology is performed by each one of the economic subjects that is introducing a raw material into the market.

The key lies in how a product or material is designed and how different requirements are balanced. The product design phase affects both product life and product performance along the entire supply chain/value chain.

This does not rest solely on the designer's shoulders since economic entities are required to implement all available methodologies to guarantee the entire supply chain up to the reuse of the product itself and the materials that compose it.

5.2.4 Extended producer responsibility

EPR is a policy approach under which producers are given a significant responsibility (financial and/or physical) for the treatment or disposal of post-consumer products.

Part of the cases presented here are from EPR regulations. Companies often state that it was the arrival of these EPR regulations that triggered the reflections on the change of business model.

EPR is not a mandatory element in the implementation of a circular economy business model, but some of the cases shown here infer that each time this proposal has been implemented, it has accelerated the transition from industrialized business models to the circular economy.

A representation of different types of performance-based approaches for addressing EPR challenges is given in Figure 3.

In business models that rely on a mix of products and services, step one (on the left in Figure 3) is just selling products with some services linked to it (maintenance, consultancy, etc.). The second step is to rent or lease the products and the last step is to sell the use of products; the result provided by products and service is closely linked.

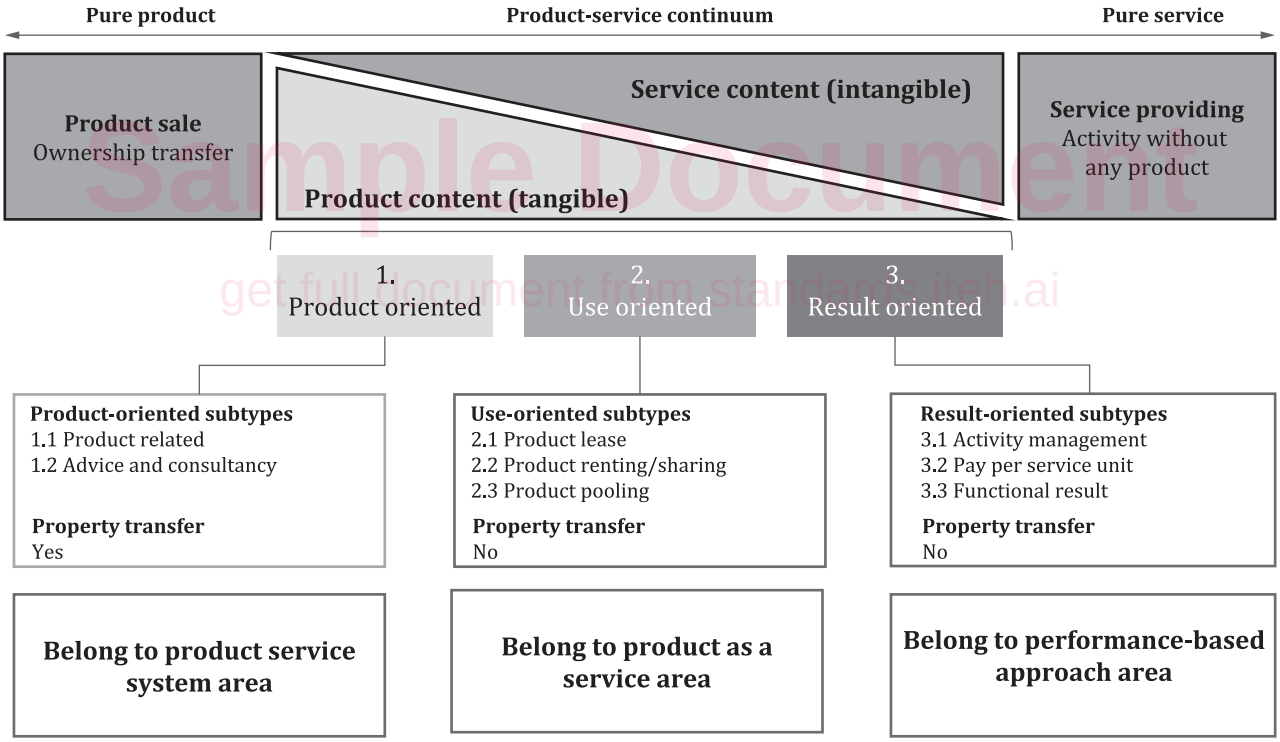

Figure 3 — Different types of performance-based approach for addressing EPR challenges

6 Case studies

6.1 Overview of cases

6.1.1 Items for describing each case

The template for the presentation of the case studies was composed of the following information:

— Proponent of the case.

— Basic information: Location, industry and size of the organization.

— Agreement to share the necessary information for analysing the case.

— Proposed documents: List of the documents presented.

— Reasons to include the case in this document.

— A short description about the organization and actions in circular economy areas.

— Linear economy:

  — Current problem to be solved: The challenge raised by the environmental sustainability of the initial linear economic model of the considered organizations along the supply chain and eventually up to the final customer. The linear problem was identified with the following dimensions: local, regional (where) or global/international.

— Circular economy:

  — Proposed solution: Describing how the initial "linear value offer" has been, is going to be or can be shifted towards a more "circular and performance-oriented" solution with respect to the problem to be solved. It can be justified through an LCA and a five-year plan, as the proposed solution will demonstrate the environmental advantages with particular references to CO_2 equivalent energy consumption, packaging waste reduction, economic advantages, social positive impacts, etc. With respect to the organizations that are involved with the problem to be solved, the proposed solution:

    — showed the economical comparison between linear and circular solutions;

    — showed the financial parameters of the circular business model that are relevant to the proposed solution.

  — How the solution works: Explains how the proposed circular performance-oriented service has been conceptualized and implemented, how it is achieved, how economic, social and environmental impacts are considered and dealt with, and what are the advantages for final customers and third parties.

— Conclusion: Explaining to what extent the initial sustainability challenge has been overcome and in which other business sectors the solution can be implemented. It also underlined to what extent the business model of the organization has become more economically sustainable: it is the opportunity to prove that there can be no trade-off between "handling social and environmental challenges" and "ensuring the economic viability of the organization and/or supply chain". On the contrary, doing one can reinforce the second. It is also important to underscore the crucial role of intangible aspects (competences and skills, relevance of work organization and planning, of players, and of mutual trust) in the increase in value (as a complement to the unavoidable use of material resources) of the organizations' offer.

NOTE To some cases, some information was not given by companies or not identified by experts in the data collection process in time to have them published in this document.