

# JRC SCIENCE FOR POLICY REPORT

## The Voluntary Agreement for Imaging Equipment: assessment of admissibility criteria for self-regulation

Bernad-Beltrán, D.

Alfieri, A.

2022

This publication is a Science for Policy report by the Joint Research Centre (JRC), the European Commission's science and knowledge service. It aims to provide evidence-based scientific support to the European policymaking process. The scientific output expressed does not imply a policy position of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use that might be made of this publication. For information on the methodology and quality underlying the data used in this publication for which the source is neither Eurostat nor other Commission services, users should contact the referenced source. The designations employed and the presentation of material on the maps do not imply the expression of any opinion whatsoever on the part of the European Union concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Contact information

Email: JRC-B5-IMAGING-EQUIPMENT@EC.EUROPA.EU

EU Science Hub

<https://ec.europa.eu/jrc>

JRC129299

EUR 31093 EN

PDF

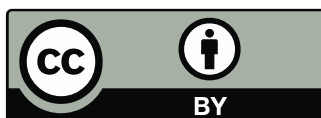
ISBN 978-92-76-53091-6

ISSN 1831-9424

doi:10.2760/452358

Luxembourg: Publications Office of the European Union, 2022

© European Union, 2022



The reuse policy of the European Commission is implemented by the Commission Decision 2011/833/EU of 12 December 2011 on the reuse of Commission documents (OJ L 330, 14.12.2011, p. 39). Except otherwise noted, the reuse of this document is authorised under the Creative Commons Attribution 4.0 International (CC BY 4.0) licence (<https://creativecommons.org/licenses/by/4.0/>). This means that reuse is allowed provided appropriate credit is given and any changes are indicated. For any use or reproduction of photos or other material that is not owned by the EU, permission must be sought directly from the copyright holders.

All content © European Union, 2022

How to cite this report: Bernad-Beltrán, D., Alfieri, F. *The Voluntary Agreement for Imaging Equipment: assessment of admissibility criteria for self-regulation*. EUR 31093 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-53091-6, doi:10.2760/452358, JRC129299.

# Contents

Executive summary.....	3
1 Introduction.....	4
2 Relevant EU policy and regulation.....	5
2.1 The Ecodesign Directive .....	5
2.2 The Circular Economy Action Plan.....	6
2.3 The Waste Framework Directive.....	6
2.4 The Waste Electrical and Electronic Equipment Directive .....	7
2.5 Guidelines for self-regulation.....	7
3 Description of product group and market .....	8
3.1 Imaging equipment products.....	8
3.2 Consumables .....	8
3.3 The market of imaging equipment and consumables .....	9
4 Environmental issues in the imaging equipment sector .....	13
4.1 Environmental hotspots .....	13
4.2 Replacement of printers before technical lifetime .....	15
4.3 Cartridge design and circularity.....	18
5 The current Voluntary Agreement (VA) and the new proposal.....	23
5.1 The current Voluntary Agreement for imaging equipment (VA 2015).....	23
5.2 Description of the proposal for a Voluntary Agreement (VA 2021).....	27
5.3 Comparison between the VA 2015 and the VA 2021 .....	33
6 Assessment of VA 2021.....	39
6.1 Analysis of aspects in the VA that require further analysis.....	39
6.2 Introduction, Objectives & Scope .....	40
6.3 Energy efficiency .....	42
6.4 Resource efficiency.....	43
6.5 Information requirements.....	52
6.6 Cartridge commitments .....	53
6.7 Verification, Reporting and Organizational aspects .....	69
6.8 Other aspects not included in VA .....	71
6.9 Summary of assessment.....	75
6.10 Request for amendments in the VA .....	77
6.11 EVAP counterproposal and JRC re-assessment .....	78
7 Conclusions and recommendations.....	82
References.....	83
List of abbreviations and definitions .....	86
List of figures .....	88
List of tables.....	89



## Abstract

Self-regulatory initiatives under the Ecodesign Directive, including voluntary agreements offered as unilateral commitments by industry, can enable quick progress due to rapid and cost-effective implementation, and allows for flexible and appropriate adaptations to technological options and market sensitivities. These initiatives need to fulfil the admissibility criteria of the Ecodesign Directive such as openness of participation, added value, representativeness, quantified and staged objectives, involvement of civil society, monitoring and reporting, cost-effectiveness of administering a self-regulatory initiative and sustainability.

In April 2021, a new Voluntary Agreement (VA) was proposed for imaging equipment. This report is the final science-for-policy-report in support of the European Commission's assessment of admissibility of the Voluntary Agreement for Imaging Equipment, with respect to the admissibility criteria of the Ecodesign Directive. In order to produce this assessment JRC has carried out an extensive literature review and stakeholder consultation, collecting feedback from a variety of relevant stakeholders in this sector.

Based on these elements collected, it was concluded that the VA proposal is not likely to deliver the policy objectives faster or in a less costly manner than mandatory requirements under the Ecodesign Directive.

## Acknowledgements

The authors would like to thank the experts involved in the development of this study for the valuable input provided, including the colleagues from other European Commission DGs providing inputs and support, the members of the organisations participating in the stakeholder consultation. The authors are also grateful to Ms. Anna Atkinson (DG JRC) for the proof-reading and Mr. Carlos Javier Munoz Crespo (DG JRC) for the editorial support.

## Executive summary

According to the Ecodesign Directive (Directive 2009/125), self-regulation, including voluntary agreements offered as unilateral commitments by industry, can enable quick progress due to rapid and cost-effective implementation, and allows for flexible and appropriate adaptations to technological options and market sensitivities.

Imaging equipment has been regulated with such a Voluntary Agreement (VA) under the Ecodesign Directive since 2013. Between 2019 and 2021, the industry has been working on a new VA proposal, including cartridges and containers, as well as other recommendations made by different stakeholders, including material efficiency requirements. This proposal was published in April 2021. The 2020 Circular Economy Action Plan (CEAP20) refers to this product group, stating that 'Printers and consumables such as cartridges will be covered [by the upcoming Ecodesign Working Plan] unless the sector reaches an ambitious voluntary agreement within the next six months'.

The VA proposal has been evaluated by the DG JRC on behalf of DG ENV, to assess compliance of the VA with the requirements for self-regulation, and to ensure that the level of ambition of the commitments is in line with the CEAP20. In order to produce this assessment, the JRC has carried out an extensive literature review and stakeholder consultation, collecting feedback from a variety of relevant stakeholders in this sector, mainly through bilateral meetings. The stakeholders consulted for the assessment of the VA included imaging equipment and original cartridge manufacturers, cartridge remanufacturers, non-governmental associations and Member State representatives. Other relevant DG's from the European Commission were also consulted.

After gathering feedback from all stakeholders, the JRC has analysed in detail the VA proposal, from the perspective of compliance with the Article 17 of the Ecodesign Directive on Voluntary Agreements, and in particular with the admissibility criteria described in Annex VIII of the Directive. The assessment has also taken into account the Commission guidelines for self-regulation measures.

In the evaluation, the JRC identified various aspects that could be considered an improvement from the current VA, such as the inclusion of cartridges within the scope of the document and the enhancement of resource efficiency commitments applicable to printers, including design for dismantling rules and a comprehensive list of spare parts. Under the VA proposal, Signatories commit to design cartridges that, when they are remanufactured, will be able to print. They also commit to design printers that will not prevent the use of remanufactured cartridges. Both are steps in the right direction.

However, several exemptions apply to these commitments that significantly reduce this potential. The above commitments only apply when the cartridge has been remanufactured by a signatory of the VA. The commitments are also not applicable when cartridges are placed on the market through a subscription service. Finally, if a consumer has agreed contractually to use only original cartridges, the printer may use software updates to block remanufactured cartridges.

Consumable reuse targets commitments in the VA commitment (14% for ink and 40% for toner) were also considered not sufficiently ambitious, as pointed out by consulted Member State and stakeholder representatives, some calling for at least a doubling of the target. It was also questioned whether a reuse target is an appropriate instrument in this context. On top of that, the assessment showed that some consumables are designed to have a very low page yield, whereas the VA proposal does not include commitments to increase the page yield of consumables.

Based on these elements, it was concluded that the VA proposal does not demonstrate its capacity to drive the market in the right direction or at an acceptable speed, in particular in the commitments that affected cartridge design and reuse and it is not likely to deliver the policy objectives faster or in a less costly manner than mandatory requirements under the Ecodesign Directive. Based on this conclusion, the preparation of regulatory measures for this product group has been announced in the Ecodesign Working Plan 2022-2024.

# 1 Introduction

According to the Ecodesign Directive (Directive 2009/125), self-regulation, including voluntary agreements offered as unilateral commitments by industry, can enable quick progress due to rapid and cost-effective implementation, and allows for flexible and appropriate adaptations to technological options and market sensitivities. This Directive establishes that priority should be given to alternative courses of action such as self-regulation by the industry where such action is likely to deliver the policy objectives faster or in a less costly manner than mandatory requirements.

Imaging equipment has been regulated with a Voluntary Agreement (VA) under the Ecodesign Directive since 2013. The VA was revised in 2015, in order to align it with the Energy Star 2.0 specifications for this product group. A number of new commitments in support of material efficiency were added. The Commission endorsed that revision. In December 2017 a new revision process started, triggered by two events: the publication of the Commission recommendations on guidelines for self-regulation measures (2016/2125), and the imminent publication of Energy Star 3.0 specifications. A new version was proposed by the industry in 2019, which left cartridges and containers out of scope. This proposal was not endorsed by the Commission.

Between 2019 and 2021, the industry has been working on a new VA proposal, including cartridges and containers, as well as other recommendations made by different stakeholders, including material efficiency requirements, among other aspects. This proposal was published in April 2021.

The 2020 Circular Economy Action Plan (CEAP20) refers to this product group, stating that 'Printers and consumables such as cartridges will be covered [by the upcoming Ecodesign Working Plan] unless the sector reaches an ambitious voluntary agreement within the next six months'.

The VA proposal has been evaluated by the DG JRC on behalf of DG ENV, to assess compliance of the VA with the requirements for self-regulation, and to ensure that the level of ambition of the commitments is in line with the CEAP20. The purpose of this report is to provide an assessment of the VA proposal, evaluating how effectively it addresses the main environmental issues associated to this product group and if it is compliant with the admissibility criteria for self-regulation under the Directive 2009/125/EC and with the ambition level required by the CEAP20. This report is structured in the following sections:

- Section 2 contains a summary of the most relevant EU policy and legislation;
- Section 3 offers a description of the imaging equipment product groups, the current market situation and the most relevant environmental aspects;
- Section 4 explains the main environmental issues in the imaging equipment sector;
- Section 5 includes a description of the current version of the VA and a description of the new proposal;
- Section 6 includes the assessment of the VA proposal, based on admissibility criteria for self-regulation under the Ecodesign Directive;
- Section 7 presents the main conclusions and recommendations.

For clarification, in this document, when the authors refer to the current version of the VA, this will be the version of the VA currently in force, published in April 2015 (VA v5.2). In this document, this version will be referred to as *VA 2015* or *current VA*. When the authors refer to the new proposal of the VA, this will be version of the VA proposed by Eurovaprint<sup>1</sup> (a non-profit association grouping all major manufacturers of imaging equipment that operate in Europe) on behalf of signatories on April 2021 (Draft FY20 v.5). In this document, this version will be referred to as *VA 2021* or *VA proposal*.

---

<sup>1</sup> [www.eurovaprint.eu](http://www.eurovaprint.eu)



## 2 Relevant EU policy and regulation

In this section, the most relevant EU legislation applicable to imaging equipment and consumables is briefly described.

### 2.1 The Ecodesign Directive

The Ecodesign Directive 2009/125 (European Commission, 2009) establishes a framework for the setting of Community ecodesign requirements for energy-related products, with the aim of ensuring the free movement of such products within the internal market. This Directive

*Seeks to achieve a high level of protection for the environment by reducing the potential environmental impact of energy-related products, which will ultimately be beneficial to consumers and other end-users.*

In Article 1 (Subject matter and scope), it is stated that

*This Directive provides for the setting of requirements which the energy-related products covered by implementing measures must fulfil in order to be placed on the market. It contributes to sustainable development by increasing energy efficiency and the level of protection of the environment, while at the same time increasing the security of the energy supply.*

This Directive is relevant for the energy-related product group, among other reasons, because the device (imaging equipment) consumes energy during its operation and in view of reported issues related to product durability and the potential of consumables to harm the environment if their waste management is not appropriately addressed.

In Article 17 on Self-regulation, the Directive states that

*Voluntary agreements or other self-regulation measures presented as alternatives to implementing measures in the context of this Directive shall be assessed at least on the basis of Annex VIII.*

In Annex VIII, a list of indicative criteria is given, in order to evaluate the admissibility of self-regulatory initiatives. These criteria include the following aspects:

- *Openness of participation. Self-regulatory initiatives must be open to the participation of third country operators, both in the preparatory and in the implementation phases.*
- *Added value. Self-regulatory initiatives must deliver added value (more than 'business as usual') in terms of the improved overall environmental performance of the product covered.*
- *Representativeness. Industry and their associations taking part in a self-regulatory action must represent a large majority of the relevant economic sector, with as few exceptions as possible. Care must be taken to ensure respect for competition rules.*
- *Quantified and staged objectives. The objectives defined by the stakeholders must be set in clear and unambiguous terms, starting from a well-defined baseline. If the self-regulatory initiative covers a long time-span, interim targets must be included. It must be possible to monitor compliance with objectives and (interim) targets in an affordable and credible way using clear and reliable indicators. Research information and scientific and technological background data must facilitate the development of these indicators.*
- *Involvement of civil society. With a view to ensuring transparency, self-regulatory initiatives must be publicised, including through the use of the Internet and other electronic means of disseminating information. The same must apply to interim and final monitoring reports. Stakeholders including Member States, industry, environmental NGOs and consumers' associations must be invited to comment on a self-regulatory initiative.*
- *Monitoring and reporting. Self-regulatory initiatives must contain a well-designed monitoring system, with clearly identified responsibilities for industry and independent inspectors. The Commission services, in partnership with the parties to the self-regulatory initiative, must be invited to monitor the achievement of the objectives. The plan for monitoring and reporting must be detailed, transparent and objective. It must remain for the Commission services, assisted by the Committee referred to in Article 19(1), to consider whether the objectives of the voluntary agreement or other self-regulatory measures have been met.*

- *Cost-effectiveness of administering a self-regulatory initiative.* The cost of administering self-regulatory initiatives, in particular as regards monitoring, must not lead to a disproportionate administrative burden, as compared to their objectives and to other available policy instruments.
- *Sustainability.* Self-regulatory initiatives must respond to the policy objectives of this Directive, including the integrated approach, and must be consistent with the economic and social dimensions of sustainable development. The protection of the interests of consumers, health, quality of life and economic interests, must be integrated.
- *Incentive for compatibility.* Self-regulatory initiatives are unlikely to deliver the expected results if other factors and incentives — market pressure, taxes, and legislation at national level — send contradictory signals to participants in the self-regulatory initiative. Policy consistency is essential in this regard and must be taken into consideration when assessing the effectiveness of the initiative.

These criteria will be used to evaluate the admissibility of the VA proposal in section 6 of this report.

In 2022, the Commission published the Ecodesign and Energy Labelling Working Plan 2022/2024, focusing on energy efficiency, strengthening the attention on circularity aspects of ecodesign (European Commission, 2022).

## 2.2 The Circular Economy Action Plan

In March 2020, the European Commission presented the new CEAP20 (European Commission, 2020). This plan provides a future-oriented agenda for achieving a cleaner and more competitive Europe in co-creation with economic actors, consumers, citizens and civil society organisations. It aims at accelerating the transformational change required by the European Green Deal, while building on circular economy actions implemented since 2015.

The CEAP20 is relevant for imaging equipment products and consumables because it specifically mentions:

*‘Printers and consumables such as cartridges will be covered [by the upcoming Ecodesign Working Plan] unless the sector reaches an ambitious voluntary agreement within the next six months.’*

## 2.3 The Waste Framework Directive

The Waste Framework Directive 2008/98 (European Commission, 2008) lays down measures to protect the environment and human health by preventing or reducing the generation of waste, the adverse impacts of the generation and management of waste and by reducing overall impacts of resource use and improving the efficiency of such use.

It is relevant to highlight that, in Article 4 of Directive 2008/98, a waste hierarchy is established, to apply as a priority order in waste prevention and management legislation and policy (Figure 1.)



**Figure 1. Waste Hierarchy**

This hierarchy, although not specifically developed for imaging equipment products and cartridges, is relevant in this context since it can be used as guiding principle for the assessment of the ecodesign measure aiming to address the issue of waste generation.

## 2.4 The Waste Electrical and Electronic Equipment Directive

The Waste Electrical and Electronic Equipment Directive 2012/19 (European Commission, 2012) on waste electrical and electronic equipment (the WEEE Directive) lays down measures to protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste from WEEE. By reducing overall impacts of resource use and improving the efficiency of such use it establishes the main guidelines to manage such waste within the European Union. This Directive is directly related to this product group, since the waste generated by this product group (both imaging equipment devices and their consumables) are classified as WEEE, as they contain some form of electronic circuitry. From this Directive, it is relevant to highlight that, in Article 4 regarding product design, it is stipulated that:

*Member States shall, without prejudice to the requirements of Union legislation on the proper functioning of the internal market and on product design, encourage cooperation between producers and recyclers and measures to promote the design and production of electrical and electronic equipment (EEE), notably in view of facilitating reuse, dismantling and recovery of WEEE, its components and materials.*

*Member States shall take appropriate measures so that the ecodesign requirements facilitating reuse and treatment of WEEE established in the framework of Directive 2009/125 are applied and producers do not prevent through specific design features or manufacturing processes, WEEE from being reused, unless such specific design features or manufacturing process present overriding advantages, for example, with regard to the protection of the environment and/or safety requirements.*

## 2.5 Guidelines for self-regulation

In 2016, the Commission published a recommendation (European Commission, 2016) on guidelines for self-regulation measures.

*Following these guidelines will help to ensure that an ecodesign self-regulation measure will be considered by the Commission as a valid alternative to an implementing measure.*

In the Objectives section of ecodesign Directive, it is also established that

*Directive 2009/125/EC provides for voluntary agreements or other self-regulation measures as an alternative to implementing regulations under its framework, prioritising them where they are likely to deliver the policy objectives faster or in a less costly manner than mandatory requirements.*

The definitions of the indicative criteria for admissibility of self-regulation initiatives (presented in section 2.1 of this report) are further developed in these Self-regulation guidelines. Based on these guidelines, in this report it is assessed whether the VA complies with the criteria for self-regulation.

### 3 Description of product group and market

The purpose of this section is to provide background on the most common imaging equipment products and the current status of the market. The research questions that this section is aiming to answer are:

- Which are the most common imaging equipment products and consumables?
- What is the current market situation?
- What are the key market trends?
- What are the principles of the main business models?

#### 3.1 Imaging equipment products

The VA 2015 includes into its scope the following imaging equipment products. The definitions are equivalent in the VA 2021:

- *Copiers: a commercially-available imaging product whose sole function is the production of hard copy duplicates from graphic hard copy originals. The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as copiers or upgradeable digital copiers (UDCs).*
- *Multifunction devices (MFD): a commercially-available imaging product, which is a physically-integrated device or a combination of functionally-integrated components that performs two or more of the core functions of copying, printing, scanning, or faxing. The copy functionality as addressed in this definition is considered to be distinct from single sheet convenience copying offered by fax machines. The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as MFDs or multifunction products (MFPs).*
- *Printers: a commercially-available imaging product that serves as a hard copy output device, and is capable of receiving information from single-user or networked computers, or other input devices (e.g., digital cameras). The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as printers, including printers that can be upgraded into MFDs in the field.*
- *Fax machines: a commercially-available imaging product whose primary functions are scanning hard copy originals for electronic transmission to remote units and receiving similar electronic transmissions to produce hard copy output. Electronic transmission is primarily over a public telephone system, but also may be via computer network or the Internet. The product also may be capable of producing hard copy duplicates. The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as fax machines.*

A number of different marking technologies are used within imaging equipment to place content onto physical media. The most common marking technologies used in imaging equipment are Electro-Photographic (EP) (Laser), Inkjet (IJ) and Solid Ink (SI).

Imaging equipment products are classified as TEC (Typical Energy Consumption) and OM (Operational Mode) products. This differentiation is based on the energy performance evaluation methods applicable to each of them. OM products are typically used in households and speciality applications such as large printing equipment. These products spend a significant part of their time in low power modes and have a wide range of usage profiles, which can vary tremendously depending on the type of the user. TEC products are typically used in business applications where power consumption from printing is also considered important (Huang et al, 2019).

#### 3.2 Consumables

There are two types of consumables in this product group: cartridges and containers. The definitions are included in VA 2021:

- *Cartridge: a customer replaceable module that holds toner or ink and that must be inserted into or connected to an imaging equipment product for the imaging equipment product during print.*

- *Container: a container that holds toner or ink and is designed to refill ink or toner tanks of an imaging equipment product and that includes electronic circuitry.*

The VA 2021 provides further definitions regarding consumables, depending on different factors:

- *Empty cartridge/container: cartridge/container that the end user is discarding, as a waste and that has been collected through a selective collection process.*
- *Newbuild compatible cartridge/container: any cartridge that is not an Original Equipment Manufacturer (OEM) Cartridge and is not a Remanufactured Cartridge or Refilled Cartridge*
- *OEM cartridge/container: a cartridge/container produced by or for the OEM for use in or with the OEM's branded Products. An OEM Cartridge can be new or a Remanufactured Cartridge or Refilled Cartridge.*
- *Remanufactured cartridge/container a cartridge resulting from a commercial process where used are collected, prepared for reuse, remanufactured, refilled, labelled and repackaged. Components may be replaced in order to return the Cartridge to working condition and to meet desired functionality requirements, provided that the Cartridge retains all or as much as possible of the original body. The Cartridge shall contain:*
  - *a) for toner Cartridges, greater than 50% by weight of reused parts not counting toner;*
  - *b) for ink Cartridges, greater than 75% by weight of reused parts not counting ink.*

*The fraction of reused parts shall be calculated from the parts which are typically replaced/reused during remanufacturing and the bill of materials. Where a bill of materials is not available the fraction of reused parts may be measured as a mass balance average over at least 100 units.*

### 3.3 The market of imaging equipment and consumables

The purpose of this section is to give a brief overview of the current market situation for imaging equipment and consumables, in terms of sales, market share and typical business models.

#### 3.3.1 Sales of imaging equipment products and consumables

In 2019, the DG ENER commissioned a study to support the process of the revision of the VA that was taking place at that time. This report was published in October 2019 and contains information on market, regulation, user behaviour, technologies, as well as environmental assessments of base cases and design options. The title of the report is "Revision of Voluntary Agreement on Imaging equipment. Tasks 1-7" (Huang et al, 2019).

Some of the data used in this report has been taken from Huang et al (2019). For instance, Table 1 contains sales data of imaging equipment in the EU for the period 2015-2040 and Table 2 contains sales data of consumables in the EU for the period 2015-2040. As it can be seen, both the market of imaging equipment products and consumables are in decline in terms of sales.

**Table 1. EU sales of imaging equipment**

Million units	2015	2020	2025	2030	2035	2040	Average annual growth (%)
Printer (IJ)	0.96	0.91	0.86	0.82	0.78	0.74	-1%
Printer (EP)	3.82	3.64	3.46	3.29	3.13	2.97	-1%
MFD (IJ)	14.82	14.09	13.4	12.74	12.12	11.53	-1%
MFD (EP)	4.18	3.98	3.78	3.6	3.42	3.25	-1%
Scanner	0.46	0.88	0.88	0.88	0.88	0.88	n/a

Copier	0.57	0	0	0	0	0	n/a
Fax	0.4	0	0	0	0	0	n/a

**Table 2. EU sales of consumables**

Million units	2015	2020	2025	2030	2035	2040	Average annual growth (%)
Ink cartridges	80.76	69.9	64.74	61.57	58.55	55.68	-1.48%
Ink containers	323.03	279.61	258.97	246.28	234.21	222.73	-1.48%
Toner cartridges	117.86	102.02	94.49	89.86	85.45	81.27	-1.48%
Toner containers	29.47	25.5	23.62	22.46	21.36	20.32	-1.48%

In 2018, DG ENV commissioned a study to provide evidence to assess the implementation of Article 4 of the WEEE Directive, through the case of re-using printer cartridges. As a result, targeted recommendations for the consideration of the Commission were given, in order to address weaknesses in the VA associated to Article 4. The title of the report was “*Study on the implementation of product design requirements set out in Article 4 of the WEEE Directive: The case of reusability of printer cartridges*” (Vaugh et al., 2018).

Some of the data used in this report has been taken from Vaugh et al (2018). For instance, Table 3 contains data on the market share of consumables in Western EU.

**Table 3. Market share of consumables (Vaugh et al, 2018)**

Ink	Original	68%
	Compatible	25%
	Remanufactured	6%
	Counterfeits	1%
Toner	Original	79%
	Compatible	18%
	Remanufactured	2%
	Counterfeits	1%

According to Huang et al (2019), other trends identified for the imaging equipment sector are:

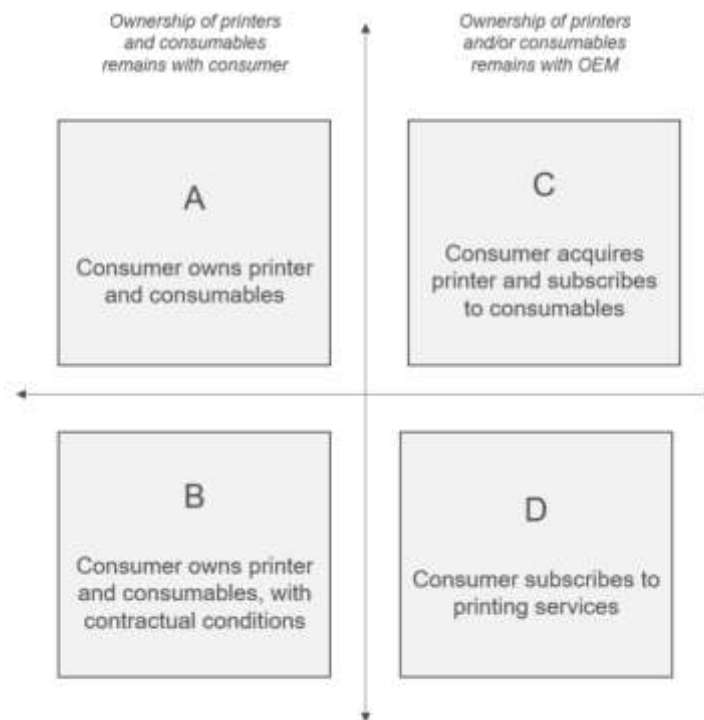
- a reduction in the total number of pages printed, due to digitalisation of activities and paperless offices;
- a progressive switch from single-function to multi-function units. The sales of standalone printers, scanners or faxes are replaced by the sales of devices that combine two or more of those functions;
- an increase in Printing as a Service schemes.

In Table 1, it can be seen that most of the sales beyond 2020 correspond to printers and MFDs. For simplification, in this report the term “printer” will be used to refer to both of them. Moreover, a significant

amount of content in this report will refer to cartridges and containers. For simplification, the word “cartridges” will be used to refer to both, unless specified otherwise.

### 3.3.2 Business models

The imaging equipment sector is a complex market, where a wide variety of business models can be found. This variety depends on the relationship established between the different actors: on one hand, business-to-consumer (B2C), on the other, business-to-business (B2B). Another factor affecting the variety of business models is related to ownership of the printer and/or the cartridges, which can remain either with the supplier or with the consumer. Considering this, a classification of different business models in the imaging equipment sector is proposed in this section, based on information gathered during stakeholder consultation (Figure 2).



**Figure 2. Classification of business models in the imaging equipment market**

It must be noted that this classification is a simplification of the complexity of the imaging equipment market and does not aim at cataloguing every potential business model in the sector, but simply the most prevalent ones.

#### 3.3.2.1 Ownership of printer and consumables remains with the consumer

##### Option A: Full ownership of printer and consumables

Consumers acquire the printer and the cartridges as a product, without establishing any contractual agreement with the OEM. In these cases, consumers own the printer and purchase the cartridges, ink, or toner refills whenever they need them, without any commitment with the original manufacturer. When the cartridges are depleted, the consumers have the option of purchasing new original cartridges, compatible cartridges or remanufactured cartridges. Both the printer and the cartridges remain at the ownership of the consumer. This business model is more common in the business-to-consumer (B2C), although it can also be found in the business-to-business (B2B) sector, particularly in small office segments.

##### Option B: Ownership of printers and consumables, with contractual conditions on the use of consumables

A variation of the above option is one where the consumer acquires the imaging equipment and establishes a contractual agreement with the OEM, committing for instance to buy and use only their original cartridges for a specific period. During this period, the OEM may prevent the consumer from using non-original cartridges, with technologies which will be detailed in subsequent sections of this report (Section 4.3.3). These business models are often attractive for consumers because printers are offered at a substantial discount. After this period ends, the consumer can choose between original, compatible or remanufactured cartridges. Again, this

business model is more common in B2C, although it can also be found in the B2B sector, particularly in small office segments.

The commonly known “razor and blade” business model is widely used in products such as coffee machines and pods, consoles and games or cars and spare parts (Geursen, 2013). Although not exclusively, this type of business model can be easily applied under Option B described above, when the printer is sold cheap, with margins made through the price of the consumable. Therefore, over a period of time, the losses made on the printer sale can be recouped through the sale of the consumables.

### *3.3.2.2 Ownership of printer and/or consumables remains with OEM*

Consumers can also acquire imaging equipment as a service. These cases are often known as “subscription services”, and a variety of options can be found in the market that fall within this description. According to feedback from manufacturers, these business models represent around 10% of the sector today. Recent publications suggest that for certain manufacturers, subscription models are growing around 1% monthly (The Recycler, 2021).

#### Option C: consumer acquires printer and subscribes to the use of cartridges

A common subscription is one where the consumer acquires the printer but not the cartridges. In this case, the OEM provides cartridges when the consumer needs them. The OEM establishes a collection system for the new and depleted cartridges, often via post. Typically, the consumer will subscribe to print a maximum specific number of pages over a period (monthly for instance). The amount to pay per period will depend on the number of pages the consumer is subscribed to. In modern devices, the printer sends a signal via the Internet to the OEM to inform that the cartridges are running out of ink/toner, in order to optimise the collection and delivery of cartridges, and to ensure that the user always can print. If the user surpasses the maximum amount, the OEM can either prevent him from printing, or charge him an additional amount. It is also common that under these subscription services, consumers are prevented from using non-original cartridges. This option can be found in both the B2C and B2B sectors.

#### Option D: consumer subscribes to printing services

A different subscription is one where the OEM keeps the ownership of both the printer and the cartridges. The consumer (typically a business) will pay depending on the amount of pages they print, or the amount of ink/toner they use. Often, installation and maintenance services are included in the agreement. Under these business models, the OEM has the incentive to maximise printer life and to optimise the use of toner and inks and their related cartridge systems. These options are commonly known as Printing-as-a-Service (PaaS) or Managed Print Services (MPS) and are more common in the B2B sector.



## 4 Environmental issues in the imaging equipment sector

In this section, the main issues in the imaging equipment industry, from the environmental point of view, will be discussed. The research questions this section is aiming to answer are:

- Which are the environmental hotspots of imaging equipment products?
- From the environmental impact point of view, which are the main issues in the imaging equipment industry?
- What are the main barriers preventing the solution of these issues?

In order to identify the main environmental issues in this sector, two reports have been used as a reference:

- Waugh et al (2018). *Study on the implementation of product design requirements set out in Article 4 of the WEEE Directive. The case of reusability of printer cartridges*. This report focuses on the environmental impact of cartridges and points out the different barriers that prevent cartridge reuse.
- Huang et al (2019). *Revision of the Voluntary Agreement on Imaging Equipment. Task 1-7*. This report analyses both the impacts of printers and cartridges, identifying most common technologies in the market, as well as potential areas of improvement.

Based on the analysis of these reports and on feedback from different stakeholders, a significant number of individual issues have been identified within the imaging equipment sector. Most of these individual issues are interrelated, being part of a wider environmental issue. Considering the goal of this study, two fundamental issues have been identified:

- replacement of printers before their technical lifetime;
- cartridge design can be improved in terms of circularity.

These issues, as well as the barriers that prevent their solution, will be addressed in more detail in the subsequent sections.

### 4.1 Environmental hotspots

In this section, a brief hotspot analysis is conducted on imaging equipment. This consists of a rapid assimilation and analysis of a range of information sources, including life cycle based studies, market and scientific research, expert opinion and stakeholder concerns (Barthel et al, 2017). For this analysis, a number of scientific publications and reports have been evaluated. The direct comparison of results between different publications is not feasible due to methodological differences between the studies. There are also differences in terms of the objectives of each study and on the number and type of indicators evaluated.

In Huang et al, (2019), the system boundaries of the analysis considers both printers and cartridges. In this study, the production of the device and the use of cartridges are identified as the environmental hotspots. The indicators evaluated were primary energy demand and Global Warming Potential. The authors add that the imaging equipment product group differs from most other IT product groups by having the production phase and consumption of consumables as the most dominant phases. This is due to low electricity consumption in the use phase, short lifetime, high content of electronics and other materials with high embedded energy and needed use of consumables for the image creations. The impact of paper consumption is not considered.

In Bozeman et al (2011), a study published by Xerox Corporation, a laser printer and a solid ink are compared, including within the system boundaries the devices and the consumables. For a laser printer, the largest impacts in terms of Cumulative Energy Demand and Global Warming Potential are related to use phase electricity, transport and cartridges. The high impact of transport is explained because manufacturing is assumed in Japan and product use in the EU and USA. For a solid ink printer, the largest contributor is use phase electricity, mainly because this printer does not require a cartridge. The impact of paper consumption is not considered.

Other studies have a reduced scope and system boundaries: Bergling et al (2002), First Environment (2004) and Four Elements (2016) consider only the life cycle of the cartridge and its associated paper consumption, leaving out of the system boundaries the impacts of the printer. In a note published by Eurovaprint in 2017 (Eurovaprint, 2017), the authors mention that Lexmark conducted a Life Cycle Assessment (LCA) with similar characteristics. When paper is included in the analysis, it is generally considered an environmental hotspot. In these cases, cartridge reliability and printing quality play a key role in reducing the amount of paper consumed. Finally, Krystofik et al (2014) consider only the life cycle of different types of cartridges, focusing on specific cartridge components and leaving out of the assessment the impact of printers and other

consumables such as paper. In this case, the print head is identified as the cartridge component with the highest environmental impact.

#### 4.1.1 Environmental assessment of cartridge reuse

In this section, a summary of published research on the environmental assessment of cartridge reuse is presented. A differentiation will be made between studies published in peer-reviewed scientific journals; studies published in non-peer-reviewed journals, Universities or websites; and studies commissioned by original cartridge manufacturers.

##### Studies published in peer-reviewed journals

In Krystofik et al (2014), the authors compare the environmental impacts of remanufactured, refilled and new cartridges. The printing quality of the three types of cartridges is assumed the same. The study focuses on transport impacts: on one hand, the transport of a new cartridge from its manufacturing plant up to the retail shop; on the other hand, the transport related to remanufacturing/refilling it. In terms of end of life, the new cartridge is assumed to be sent to "municipal solid waste" (US average). The authors conclude that both refilled and remanufactured cartridges offer environmental improvement compared to new cartridges.

In Badurdeen et al (2018), a methodology is proposed to solve multi-objective product design problems considering conflicting economic and environmental objectives. The purpose is to ensure that product design is optimized considering a life cycle approach, considering the extraction of raw materials, product use and end of life alternatives. The methodology is applied on an industrial case study for the design of toner cartridges. The results show that reuse, remanufacturing and recycling strategies provide over 20% savings in total lifecycle cost, total global warming potential, and total water use in comparison to an equivalent new product.

##### Studies published in other journals, Universities or websites

In Berglind et al (2002), a study published by the University of Kalmar (Sweden), the authors compare the life cycle impacts of two end of life alternatives for a toner cartridge: recycling and remanufacturing. The printing quality of new, recycled and remanufactured cartridges is assumed the same. According to their results, reuse of toner cartridges is the option with the lowest environmental impacts.

In Gell (2008), a study commissioned by the UK Cartridge Remanufacturers Association, the carbon footprints of a remanufactured toner printer and a new cartridge are compared. The printing quality of the two types of cartridges is assumed the same. According to their results, the carbon footprint of remanufactured cartridges is lower: 40% lower in short-life cartridges and 60% in long-life cartridges.

In Ferrari (2008), a study conducted in the Università di Modena e Reggio Emilia for SAPI (a company that remanufactures cartridges), the environmental impacts of new and remanufactured cartridges are compared. In this case, it is assumed that the remanufactured cartridge is able to print a higher number of pages than the new one. Based on this, it is concluded that remanufacturing a cartridge causes less environmental damage than producing a new equivalent cartridge.

In Kara (2010), a study conducted by the UK Centre for Remanufacturing and Reuse, the carbon footprints of a remanufactured toner cartridge and a new cartridge are compared. The printing quality of the two types of cartridges is assumed the same. According to their results, a remanufactured cartridge has a 46% lower carbon footprint than a new one. Significant materials savings are also made by remanufacturing a cartridge: a new cartridge requires 16 times more material than a cartridge refill.

In Fraunhofer Umsicht (2019), a study conducted by the Fraunhofer Institute for Environmental and Energy Technology for Interseeroh, the authors evaluate the environmental savings of reprocessing and reusing toner cartridges. According to their results, reusing a single cartridge saves 4.49 kg of greenhouse gas emissions compared to new production. In addition, 9.39 kg of primary resources are saved per cartridge. In comparison, recycling a cartridge saves 0.41 kg of greenhouse gas emissions and 1.94 kg of resources.

In Chung et al (2013), a study conducted in the University of British Columbia (Canada), a comparison is made between original and remanufactured cartridges in terms of their environmental, economic and social impacts. Different printing qualities are assumed for each cartridges: remanufactured cartridges need 11% more paper to accomplish the same task. Considering this, the authors conclude that remanufactured cartridges impose a smaller toll on the environment based on material resources, greenhouse gas emissions, and waste generation.

##### Studies commissioned by original cartridge manufacturers

Since 2011, some original cartridge manufacturers (particularly HP) have been publishing studies where the environmental impact of new original and remanufactured cartridges are compared: First Environment (2004) and Four Elements (2011, 2014, 2019, 2021). The structure, assumptions and conclusions of these studies is very similar. A fundamental aspect of those studies is the printing quality difference established between new and remanufactured cartridges, as assumed in Chung et al (2013). In other words, more paper is used in remanufactured cartridges to produce the same amount of valid printed pages with original cartridges.

In First Environment (2004) a new HP cartridge is compared with a remanufactured cartridge. Their results indicate that critical drivers of environmental impacts over the life cycle are print quality, cartridge reliability and end of life management. According to the authors, a cartridge that reliably prints high quality pages and that is recycled at end of life, most likely has lower overall environmental impacts than a cartridge that does not share these attributes. However, the authors conclude that no definitive statement can be made about the environmental performance of one product type over the other.

In Four Elements (2011), it is assumed that remanufactured cartridges need 15% more paper to achieve the same amount of valid printed pages. It is also assumed that the original cartridge is 100% recycled, whereas the end of life fate of the remanufactured cartridge is a combination of landfill and incineration. Similar assumptions are made in the rest of studies commissioned by HP (Four Elements 2014, 2019 & 2021), both in terms of printing quality and end of life. In all those studies, the original cartridge provides better environmental performance than the remanufactured cartridge for every impact category evaluated.

#### Conclusions on cartridge reuse

The amount of published research in peer-reviewed journals addressing cartridge reuse is scarce: only two studies have been found. In both cases, remanufactured cartridges have been highlighted as having less environmental impact than new cartridges. It must be noted that available studies in the literature are mainly focusing on energy-dominated impact categories. Therefore, the known –and documented– environmental impacts are mainly related to the energy aspects, while information and data on impacts related to materials and/or waste are lacking.

A wider variety of studies published in non-peer-reviewed journals can be found. These studies are commissioned by different actors, from remanufacturers to Universities. In all those studies, remanufactured cartridges have been highlighted as having less environmental impacts than new cartridges.

Original cartridge manufacturers have commissioned over the last years several environmental assessment studies involving cartridge reuse. In all those studies, differences in printing quality between original and remanufactured cartridges are assumed. These differences in printing quality are translated in a larger amount of paper needed to produce the same functional unit. In all those studies, original cartridges provide better environmental performance than remanufactured cartridges.

Printing quality is a parameter that influences environmental assessments and the related conclusions. In four of the studies presented, the larger paper consumption associated with remanufactured cartridges caused more favourable results for new cartridges. In contrast, despite this extra paper use, remanufactured cartridges were still the best option according to Chung et al (2013).

The conclusions attained in the different studies seem to be influenced by the role of the authors within the imaging equipment sector. Whereas studies conducted by remanufacturers and/or Universities tend to favour remanufactured cartridges, studies conducted by OEMs tend to favour original cartridges.

## 4.2 Replacement of printers before technical lifetime

In products similar to printers, reliability and reparability aspects seem to be behind the low lifetime of those devices (Cordella et al, 2021). However, this does not seem to be the case for printers. As OEMs state, printers are durable and long-lasting appliances with low failure rates. Some of the business models currently operating in the B2B sector (particularly C and D described in section 3.3.2) benefit from longer printer lifetimes. Both options C and D can be associated to a circular economy. As stated in Boorsma et al (2022), these business models tend to ensure the highest return rates of devices and/or consumables to increase circularity. OEMs also have an incentive to prolong printer lifetime: the longer the device is in service, the longer the consumer will be using the original cartridges.

However, in business models which are not subscriptions (A and B in section 3.3.2), more common in the B2C sector, prices of printers and cartridges may push consumers to replace printers earlier than they need. In both cases, OEMs have the incentive of increasing the sales of new cartridges. There is also no particular

incentive to prolong printer lifetime. Both options A and B can be associated to a linear, rather than to a circular economy.

In this section, data is presented regarding technical printer lifetime and on the potential substitution of devices before that lifetime is reached.

#### Printer lifetime in published bibliography

In their environmental assessment, Huang et al (2019) estimate lifetime of printers as 5 years for ink and 6 years for laser appliances. They add that the release of new models of imaging equipment is, on average, significantly faster now than in the past. Many laser-based products typically have model lifetimes of many years. During this time period, changes may be made to key components to increase the level of energy efficiency found in existing models of products. Inkjet based models have typically had shorter lifetimes than laser-based models. However, the rapid increase in ENERGY STAR v2.0 penetration rates from 25% in 2013 to 99% by 2017 suggests that either the lifetime of many imaging equipment models is now much reduced or manufacturers are making improvements in the energy efficiency levels of existing models in order to meet new ENERGY STAR requirements.

In HOP (2017), an analysis was conducted to better understand the environmental, social and technical issues behind printers and cartridges. In this study, it is considered that the average lifetime of an inkjet printer is around 3 years. However, this time could be increased 2 additional years if reparability was adequately promoted.

In ADEME (2019), an analysis is conducted on the environmental and economic consequences of product lifetime extension of different products, including printers. In this report, the authors consider that the potential lifetime of a printer is 6 years. In the analysis section, their hypothesis is that lifetime of printers is generally not fulfilled. The authors consider that the dates of onset of the failure or perceived obsolescence by the consumer is between 2-3 years.

Data from the Open Repair Alliance (2021), based on the analysis of over 800 repairs of printers at community repair events, shows that less than 40% of printers repairs are successful at these events. Repairs conducted at these events involve multiple fault types. While some of them are activities often related to maintenance (paper feed 25%, printhead cleaning 9.6%), others revolve around parts likely needing a replacement part (ink cartridge 17.5%, power supply/connectors 7.4%, printhead failure 6.1%, internal damage 5.5%, paper output 5.3%). According to that data, a significant amount of the fault types were still repairable.

#### Printer lifetime according to stakeholders

According to NGOs, around 80% of printers are known to be replaced within the first 3 years after purchase (ECOS, 2021). Representatives of the remanufacturing association estimate that printers are used at 10% of their potential (designed) lifetime due to fast replacement cycles.

### 4.2.1 Barriers for fulfilling printer technical lifetime

Based on the research conducted as part of this project, it appears that the barriers preventing longer average printer lifetime can be triggered by the business model. In this section, a separate analysis will be made for Business-to-business (B2B) and business-to-consumer (B2C) sectors.

#### Printer lifetime in the B2C sector

In the B2C sector, printers are generally sold as a product and ownership of the device remains with the end-user, who replaces cartridges when needed (options A and B described in section 3.3.2 of this report). In this sector, printers are generally simpler and therefore cheaper than in the professional sector. Small inkjet cartridges are more common than large capacity toner cartridges.

Based on bibliography review and stakeholder feedback, it can be argued that the prevalent business model in the B2C sector is based on the sale of printers at a competitive price, making the margins through the sales of cartridges. In this sector, OEMs have thus an incentive to retain customer purchasing original cartridges.

According to some remanufacturers interviewed, the end user tends to use more original OEM cartridges during the first years of the printer's life. When the printer becomes older, they increasingly switch to remanufactured ones. In other words, the older the printer, the more likely it is that they will use non-original cartridges. Therefore, in their view OEMs have an incentive to promote short printer life cycles of printers.

Short printer life cycles in the B2C sector can be stimulated by OEMs with low purchase price of printers. On occasions, as stated in Huang et al (2019), it is cheaper to purchase a new printer than to buy a full set of new cartridges. The high price of original ink cartridges has also been addressed by the media recently (Wakefield, 2021). Low price of printers, combined with high price of standalone cartridges, can encourage consumers to replace printers earlier than technically required.

This early replacement of devices was described in Svensson-Hoglund et al (2021) as a market barrier for reparability. In their view, in sectors that produce devices for the consumer marketplace, the OEM business model is driven by the volume of product sales, which leads to a strategic emphasis on replacement. There is also little incentive to perform repairs when the profits from selling new replacements are more attractive. From the consumer point of view, the most significant concern when faced with the choice between repair and replacement is the price of the replacement. It is estimated that the willingness to pay for repairs of small electronics is around 20% of the replacement cost.

As explained in section 3.3.2, in the B2C sector consumers can also find subscription services, where the users acquire the printer and are mailed new cartridges when the device signals that the current one is running low.

#### Printer lifetime in the B2B sector

In the B2B sector, printing is generally offered as a service. In this sector, aspects such as scale, long term cost, availability and outsourcing of supporting capabilities are key factors in purchasing decisions. Therefore, companies pay for a subscription and in exchange they receive the devices, the cartridges and often maintenance services. When cartridges are depleted, they are generally collected by the OEM and replaced with new ones. In this sector, devices are more complex and therefore more expensive. Large capacity toner cartridges are more common than small inkjet cartridges. In this sector, OEMs have an incentive to prolong printer lifetime, in order to keep the consumer using their original cartridges.

Approaches that focus on switching from physical products to immaterial products (also known as “servitization” or “product-as-a-service” approaches) can help to avoid the use of materials and their subsequent end of life management. Product-as-a-Service (PaaS) approaches are prioritised in the CEAP20, where it is stated that by selling products as a service the economic logic shifts and profits are no longer dependent on the volume of products sold. Instead, it becomes profitable to ensure that the products provided as a service are durable and repairable, as the ownership remains with the business and the need to buy new products is a business cost. Several examples have shown that the servitization of a product can extend its life (Han et al, 2020). It is also argued that an increase in service-orientation, rather than product-orientation, will facilitate the design of systems with significantly lower environmental impacts while maintaining economic prosperity (Lieder et al, 2016). The benefits of PaaS schemes have also been highlighted by the Ellen Macarthur Foundation (2022), pointing out that in some of these business models, cartridge design and durability can be improved, and packaging use can be reduced, eliminating up to 57% of waste.

However, although PaaS is a strategy highlighted as beneficial strategy in a Circular Economy logic, potential trade-offs must always be considered. In Goedkoop (2021), for instance, a few examples are given where PaaS approaches may not provide an environmental benefit. Some stakeholders have provided data from a professional Managed Printed Services (MPS) provider, with over one million printers included in the analysis. Key facts from this analysis are the following:

- over 80% of all monitored devices are less than 3 years old;
- 28% of printers printed less than 3% of their recommended printing volume;
- 55% of all printers printed less than 15% of their recommended volume;
- 82% of all printers printed less than 50% of their recommended volume.

Therefore, despite the expected benefit of prolonging printer lifetime, it appears that technical lifetimes of printers are often not fulfilled in the B2B sector either. Short printer lifetime in the B2B sector is not related to reliability issues, given that the business models in the sector rely on printers being operational in order to support cartridge sales. According to OEMs, a great deal of consideration goes into product design and service offering, in order to ensure high quality and low failure rates of the products on the market.

Some stakeholders explain that, on occasions in the B2B sector (typically options C or D), when a new contract for printing services is established, all devices are replaced, irrespective of whether they need replacement or not. This also generates unnecessary waste and can be interpreted as a barrier for prolonging printer lifetime.

#### 4.2.2 Consequences of not fulfilling printer technical lifetime

Based on published bibliography and on stakeholder feedback, it appears that printer technical lifetime is often not fulfilled, both in the domestic and in the professional sector. Considering this shortened lifetime, NGOs have conducted research on the amount of waste generated by discarded printers in the EU. This research uses data from Huang et al (2019) in terms of number of units placed on the market, bill of materials, percentages of materials directed to different end of life options, etc. The results of this analysis are quoted in Oldyrevas (2021).

According to the results of this analysis, around 500.000 tonnes of waste material is produced per year from discarded printers, of which just over 10.000 tonnes (2%) is reused in new products. The largest single end of life destination for materials from discarded imaging equipment is material recycling (360.000 tonnes). Around 140.000 tonnes is estimated to be incinerated or landfilled during 2021.

#### 4.3 Cartridge design and circularity

The prevalence of certain business models have an influence on the type of products that are placed on the market, and on specific design features, which may favour or hinder circularity. In terms of cartridges, two relevant aspects arise: page yield and cartridge reuse.

##### 4.3.1 Cartridge page yield

Cartridge page yield is a factor which is directly related to the generation of cartridge waste. Optimising the use of materials, simplifying cartridge design can help to increase the number of pages that can be printed with a single cartridge. Consequently, this can reduce the total amount of cartridges that are manufactured and therefore, managed at end of life (Kaps et al, 2019).

According to some members of the remanufacturing industry, there is a tendency in the market of OEM cartridges to reduce their page yield. In their view, in the last 20 years cartridge models have been changed in such a way that the content of the newer models is lower, unnecessarily shortening the average cartridge lifespan.

One design strategy applied to reduce page yield of cartridges can be observed in Figure 3 (black/white) and Figure 4 (colour). Both pictures show different versions of the same cartridge model. The sponge shown in the pictures contains the ink that is used to print. These pictures have been provided by the remanufacturers' association ETIRA.



**Figure 3. Black/white cartridge with different levels of use of the available volumes**



**Figure 4. Colour cartridge with different levels of use of the available volume**

When the sponge fills the entire cartridge volume (cartridges in the left) there is optimal usage of the cartridge. According to the European Toner & Inkjet Remanufacturers Association (ETIRA<sup>2</sup>), OEMs have increasingly placed compartments inside the cartridge, thus reducing the size of the sponge volume inside the cartridge and leaving an empty space on the other side. This way, the total ink content within the cartridge is reduced. OEMs justify different page yields with the need of offering customers different price points.

The inclusion of these compartments to reduce cartridge capacity is also an issue for remanufacturers. If they want to make full use of the cartridge capacity, they need to remove these compartments, adding complexity and cost to the remanufacturing process.

In terms of page yield, some stakeholders highlight the issue of starter kits, cartridges sold together with printers. Generally, these cartridges have significantly lower page yields than the standard ones.

#### 4.3.2 Reuse of cartridges and containers

Cartridge reuse rates are a key factor to understand the performance of the market in making use of the available materials. Different cartridge reuse rates are published depending on the source:

- in Huang et al (2019), it is estimated that 15-20% of all cartridges in the EU are reused as a cartridge after first use, including OEM and non-OEM cartridges;
- in Waugh et al (2018), it is estimated that 20% of toner and 13% of ink cartridges are remanufactured in the EU;
- according to ETIRA, it is estimated that around 20-25% of cartridges are currently remanufactured in the EU;
- in ECOS (2021), it is estimated that remanufacturing rates in Europe are around 10%.

In Waugh et al (2018), technical and economic potential to reuse cartridges are published (Table 4).

**Table 4. Cartridge reuse potential**

	Technical potential	Economic potential
Toner	92%	86%
Inkjet	87%	84%

Considering current reuse rates published in different sources and the technical and economic potential of cartridge reuse, it appears that there is an untapped potential to increase reuse rates of cartridges in the EU.

Feedback from stakeholders and publications such as Waugh et al (2018) indicates that OEMs currently prioritise waste recovery strategies (such as recycling or energy recovery) over reuse. In principle, this would go against the recommended waste hierarchy (Directive 2008/98), which prioritises “Preparation for reuse” over “Recycling”. By remanufacturing and reusing cartridges, it is possible to reduce the consumption of virgin materials, hence minimising environmental impacts.

<sup>2</sup> <https://www.etira.org/>

### 4.3.3 Technical barriers for the reuse of cartridges

Technical barriers hinder cartridge reuse based on technical characteristics of the cartridge. They are generally introduced –intentionally or unintentionally- during the design phase of the cartridge.

#### 4.3.3.1 *Chips and embedded software*

The most commonly cited technical barrier for reuse is the use of chips in the cartridges and embedded software in the printer. These chips are electronic components incorporated to some cartridges to provide useful functionality such as ink level information or page counters. According to Huang et al (2019), the first types of chips were simple devices that could be easily reset at the end of a consumable's life. In the early 2000's they started to become more complex. Chips today include extremely complex encryption codes and perform a number of functions. They are typically mounted on a small circuit board and support communication between the cartridge and imaging equipment. Some of the functions they perform are:

- Include a memory to store information;
- Include a power control circuit to supply the processor;
- Provide power protection from voltage spikes;
- Store cartridge specific information;
- Store yield data;
- Store geographical data;
- Allow communication between the cartridge and the imaging equipment;
- Store data about toner or ink levels and usage.

Despite these functions, according to a variety of sources (e.g. Waugh et al, 2018), these chips are generally programmed in a way that, when the ink or toner has been depleted, they cannot be reset in order to be used again in a remanufactured cartridge. This causes that independent remanufacturers without access to knowledge of the hardware and software systems may have to undertake reverse engineering activities, or replace the chips with new ones. The use of these chips that block reuse of cartridge is considered a prime concern within the industry. In Huang et al (2019), this is also cited as the largest single barrier to consumable remanufacturing.

#### 4.3.3.2 *Availability of spare parts including cartridge chips*

The current regulatory framework does not facilitate reparability and therefore life extension of devices. In the current VA, the provision of spare parts is related to printers only, and not to consumables. A common request from different stakeholders in the industry is the inclusion of the cartridge chips as a spare part.

Some associations of remanufacturers consider that the inclusion of cartridge chips as standard spare parts would have a positive effect for the genuine remanufacturers who collect and prepare the cartridges for reuse. They add that it will also introduce more competition in the cartridge market.

#### 4.3.3.3 *Firmware updates*

This barrier consists in firmware updates which stop non-OEM cartridges from being used. These updates are sent to imaging equipment after having been placed on the market, and can result in changes to the encryption process between the device and the electronic chip. In some cases, the original OEM chips are able to adapt to these updates and changes to the encryption process, but non-OEM chips cannot adapt. The result is that those chips will no longer function correctly, making remanufactured cartridges unusable (Huang et al, 2019).

#### 4.3.3.4 *Design for remanufacture*

Another commonly cited technical barrier for remanufacturing is the poor design for remanufacturing that can be found in some imaging equipment and cartridges. The most common examples are irreversible joining techniques between different components, such as gluing, sonic welding or adhesive tapes.

In other occasions, it is the fragile and complex design of cartridges that prevents disassembly and therefore reuse. The continuous introduction of slightly new features in cartridge designs (small plastic elements) make their remanufacturing and the compatibility with printers more difficult.



#### 4.3.4 Market barriers for the reuse of cartridges

Market barriers hinder reuse based on market features that may unfairly disadvantage the other sectors in the imaging equipment industry (such as the remanufacturing sector).

##### 4.3.4.1 *Competition from counterfeit cartridges*

An aspect that hinders cartridge reuse is the increased entrance in the market of counterfeit cartridges with lower quality. In Waugh et al (2018), the sales of such cartridges, also known as clones, was estimated as 4%, although data might be already out of date. According to representatives of the remanufacturing industry, the European market is currently “flooded” with around 50 million non-OEM single use cartridges annually.

The concern within the industry is that these cartridges might be cheaper because they are not compliant with European requirements on hazardous substances, printing quality or safety. On top of that, due to their low quality materials and the lack of clarity of potential hazardous substances contained, these cartridges are generally not collected by remanufacturers, often ending up as WEEE after a single use.

In October 2019, industry media reported that several newbuilt non-OEM cartridges had been found to contain excessive levels of Decabromodiphenylether (DecaBDE), a halogenated flame retardant that, because of its health risks, had been prohibited in the EU since 2008 in electronics above certain levels, and fully prohibited in many other products. The original OEM equivalent did not contain DEcaBDE (ETIRA, 2021). In a study conducted by the association of remanufacturers, it was observed that four of those non-OEM cartridges had DecaBDE levels ranging from 2,000 mg/kg to 17,000 mg/kg, although only 1,000 mg/kg of DecaBDE is allowed under the EU's RoHS directive (0.1% w/w). The wider group of polybrominated diphenyl ethers (PBDE) is also only allowed at levels lower than 0.1% w/w according to the RoHS Directive 2011/65/EU.

In 2020, a study was conducted with eight non-OEM new build toner cartridges in terms of emissions, conducted by Germany's expert TÜV LGA test centre. The results showed that all eight new non-OEM newbuild cartridges failed the LGA emissions tests for multiple reasons, mostly the presence of hazardous chemicals. By contrast, a test of two toners widely used by European remanufacturers passed the LGA emissions test.

The increasing entrance on the market of these cartridges affects both OEMs and remanufacturers. On one hand, these cartridges are offered at a substantially lower price than original OEM cartridges, affecting their sales. On the other hand, since they cannot be easily remanufactured, they act as a market barrier for reuse.

It remains unclear whether the Ecodesign Directive can contribute effectively to address the unfair competition based on the use of counterfeit cartridges containing restricted hazardous chemicals. Enforcement of existing EU legislation including Restriction of Hazardous Substances Directive (RoHS) and patent rights on producers of cloned consumables would help to alleviate the negative impacts of these products and ensure that third party consumables have a toxicity profile that is compliant with EU chemicals legislation.

##### 4.3.4.2 *Claims about quality issues and warranty validity*

A recurring topic mentioned by OEMs is their concern that reused cartridges will not perform to the standards of OEM-approved new cartridges regarding the quality of printing. In Huang et al (2019), some examples of OEMs claims about quality issues with remanufactured consumables are published. These generally have the aim of creating customer mistrust towards compatible or reused cartridges. According to a study conducted by Wilson (2021) most of consumers believe that 3<sup>rd</sup> party cartridges do not work adequately. The most common reasons of user to avoid 3<sup>rd</sup> party cartridges are fear of incompatibility with the device (39%), printing quality (31%) and fear of ink leakage (29%).

From the other hand test methods mentioned in the EU Green Public Procurement (GPP) Criteria and/or hand Type-I ecolabels as the “Nordic Swan Ecolabel for Remanufactured OEM Toner Cartridges” can be valid tools to ensure the quality of cartridges.

Another form of market barrier for reuse is the propagation of inaccurate claims that imaging equipment warranties will be voided by the use of non-OEM consumables. In Huang et al (2019), there are also examples of published claims that imaging equipment warranties may be impacted by use of non-OEM consumables.

##### 4.3.4.3 *Unfair commercial practices*

At the same time, some OEMs have been found to not inform consumers adequately about the technical barriers described in section 4.3.4.

The Italian Competition Authority has found that the limitations on the use of non-original cartridges are not adequately highlighted on the sales packages (AGCM, 2020). In particular, according to the Authority, the OEM has failed to adequately inform consumers - at the time of purchase - about the presence of this relevant and significant limitation, leading them to believe that they need replacing non-original ink/toner cartridges due to shortages or defects thereof and hence to use only original cartridges. These limitations have been renewed and modified through subsequent printer firmware updates, proposed by the OEM to consumers, once again without properly informing them of the consequences of these updates, neither at the time of their dissemination, nor on its website, nor at the when information was requested to the assistance centres (AGCM, 2020).

The Commission has finalised a proposal aiming at the Unfair Commercial Practices Directive 2005/29/EC (COM(2022) 143 final). The general provisions of the Unfair Commercial Practices Directive on misleading practices can be applied to early obsolescence cases when they negatively affect consumers, using a case-by-case assessment. However, there were, until now, no specific provisions in the Directive or in its Annex I (blacklist) that regard early obsolescence practices as unfair under all circumstances. Among the eight additional commercial practices proposed to be added in Annex I there is:

- omitting to inform the consumer that a software update will negatively impact the use of goods with digital elements or certain feature of those goods even if the software update improves the function of other features;
- Inducing the consumer into replacing the consumables of a good earlier than for technical reasons is necessary.
- Omitting to inform that a good is designed to limit its functionality when using consumables, spare parts or accessories that are not provided by the original producer.

#### 4.3.4.4 *Public Procurement specifications*

It is common to find public procurement specifications that either explicitly exclude the use of reused cartridges, or fail to promote or encourage their usage. In order to overcome this issue, Green Public Procurement guidelines were published in 2020 (Kaps et al, 2020).

#### 4.3.5 Legal barriers for the reuse of cartridges

According to different sources (e.g. Waugh et al (2018), Huang et al (2019)) the current regulatory environment is not yet well suited to promote the reuse of products or encourage dematerialisation and greater material efficiency.

These barriers mostly concern legal actions taken by manufacturers for infringement of copyright or patents. Patents make it harder for independent actors to reuse, because they must ensure any activity does not infringe upon the OEM's intellectual property. Three main concerns over intellectual property rights creating inappropriate barriers to reuse include (Waugh et al, 2018):

- inappropriate granting of patents on non-innovative aspects of printer cartridge design and on the remanufacturing process itself (even when the OEM does not intend to remanufacture its own cartridges);
- Independent remanufacturers often do not have the resources available to participate in lengthy legal processes against large OEMs.
- Brand distortion. Reused cartridges generally still bear the original markings of the OEM. Any purchaser of such a reused cartridge might then assume that all liabilities, certifications and guarantees associated with the item might still apply and might be endorsed and warrantied by the OEM

#### 4.3.6 Consequences of low cartridge circularity

Based on published bibliography and on stakeholder feedback, it appears that there are several barriers in the imaging equipment sector today hindering cartridge circularity. Considering this, NGOs estimated that around 150,000 tonnes of waste cartridges is produced per year from consumables (Oldyrevas, 2021) in the European Union. Around 14,000 tonnes is reused in new cartridges. The largest single end of life destination for consumable material is recycling (67.000 tonnes). Around 68.000 tonnes of end of life cartridges is estimated to be incinerated or landfilled during 2021 in EU.

## 5 The current Voluntary Agreement (VA) and the new proposal

The main aspects of the current version of the VA for Imaging Equipment (VA 2015) will be described in section 5.1 and the main aspects of the main proposal of VA (VA 2021) in section 5.2.

### 5.1 The current Voluntary Agreement for imaging equipment (VA 2015)

#### 5.1.1 Signatories of the current VA

The current version of the VA is in force since April 2015. The signatories of the VA 2015 were:

1. Brother International Europe
2. Canon Europe Ltd.
3. Dell
4. Epson Europe BV
5. Hewlett Packard Company
6. Konica Minolta Business Solutions Europe GmbH
7. Kyocera Document Solutions
8. Lexmark International nv/sa
9. OKI (UK) Ltd.
10. Panasonic Europe Ltd.
11. Ricoh Europe PLC
12. Samsung Electronics Europe
13. Sharp Electronics GmbH
14. Toshiba TEC Germany Imaging Systems GmbH
15. Xerox

#### 5.1.2 Definitions in VA 2015

The most relevant definitions provided in VA 2015 are included in this section. As it can be seen, no definition is provided for “cartridge” or “container” in VA 2015 (from ANNEX C, PART VII of the Commission Decision 2009/347/EC).

*Copier: A commercially-available imaging product whose sole function is the production of hard copy duplicates from graphic hard copy originals. The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as copiers or upgradeable digital copiers (UDCs).*

*Fax Machine: Commercially-available imaging product whose primary functions are scanning hard copy originals for electronic transmission to remote units and receiving similar electronic transmissions to produce hard copy output. Electronic transmission is primarily over a public telephone system, but also may be via computer network or the Internet. The product also may be capable of producing hard copy duplicates. The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as fax machines.*

*Multifunction Device (MFD): A commercially-available imaging product, which is a physically-integrated device or a combination of functionally-integrated components that performs two or more of the core functions of copying, printing, scanning, or faxing. The copy functionality as addressed in this definition is considered to be distinct from single sheet convenience copying offered by fax machines. The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as MFDs or multifunction products (MFPs).*

*Non-OEM Cartridge: A toner or ink cartridge not sold by the OEM that is remanufactured and/or refilled*

*OEM (original equipment manufacturer): a company that manufactures and commercializes/imports products under its own brand name into the EU territory.*

*Printer: A commercially-available imaging product that serves as a hard copy output device, and is capable of receiving information from single-user or networked computers, or other input devices (e.g., digital cameras). The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as printers, including printers that can be upgraded into MFDs in the field.*

*Signatories: means all member companies that have signed this Voluntary Agreement*

### 5.1.3 Scope of VA 2015

The scope of VA 2015 is:

- Copiers
- Multifunction Devices (MFDs)
- Printers
- Fax machines

VA 2015 also includes cartridges into the scope.

In terms of marking technologies, it applies to Electrophotography (EP), Inkjet (IJ), including high performance IJ and Solid Ink (SI).

VA 2015 only applies to household and office equipment.

### 5.1.4 Energy requirements in VA 2015

Energy requirements in VA 2015 are included into the Primary Design Requirements section. They consist in compliance with some of the specifications of Energy Star 2.0. Compliance targets are set for different years and technologies, from 70% to 93%.

The specifications of Energy Star 2.0 that Signatories need to comply are:

- energy consumption requirements (TEC and OM products);
- default delay times (OM products);
- duplex availability (TEC products).

### 5.1.5 Resource efficiency requirements in VA 2015

VA 2015 establishes that all product models shall offer as a standard feature the capability to print several pages of a document on one sheet of paper (N-up printing).

In terms of design for recycling, VA 2015 establishes requirements for the easy separation of plastic parts over 100g, for the use of commonly used fasteners and joining components, the avoidance of non-separable connections between different materials and the material marking of plastic parts.

In terms of polymer composition, VA 2015, establishes requirements regarding number of polymers in a single component, the design of large plastic parts to ease their recycling and the reduced used of coatings.

For cartridges, VA 2015 establishes that

- any cartridge produced by or recommended by the OEM for use in the product shall not be designed to prevent its reuse and recycling;
- the machine shall not be designed to prevent the use of a non-OEM cartridge.

The above requirements shall not be interpreted in such a way that would prevent or limit innovation, development or improvements in design or functionality of the products, cartridges, etc.

In terms of recycled plastic content, VA 2015 establishes that Signatories shall make information available to customers on the minimum percentage of postconsumer recycled plastic content.

### 5.1.6 Information requirements in VA 2015

VA 2015 contains information requirements for resource efficiency and energy efficiency, with “the intention to ensure that the end-user is made aware of good efficiency practices when they first begin to use a new product.” Minimum information provided to the end-user is also specified in VA 2015.

The availability of spare parts is covered within this section of VA 2015. It establishes that:

- Signatories shall make available spare parts for the minimum time periods after the end of product manufacturing;
- For Electrophotography, Solid Ink and High Performance Inkjet models - 5 years;
- For Inkjet models - 3 years.

Making spare parts available shall only involve offering spare parts for sale through their usual spare part distribution channels and shall not require Signatories to trade directly with customers or users.

VA 2015 states that Signatories shall provide end-users with information on suitable end-of-life management options for used cartridges.

VA 2015 establishes that Signatories shall make available and provide to users information regarding recycled paper via website or other means, as well as an acknowledgement of the importance of the promotion of paper recycling.

Finally, the VA 2015 also establishes the information on product environmental characteristics that has to be communicated with end-user.

An exemption of compliance with information on resource efficiency/energy efficiency, cartridge disposal and product environmental characteristics is made for models sold in small numbers (less than 5,000 units/year).

### 5.1.7 Independent inspection in VA 2015

Section 7 of the VA 2015 is dedicated to the Independent Inspector, who is responsible of collecting and processing information, determining a Signatory's compliance with the VA and carrying out audits.

The engagement of the Independent Inspector requires to observe confidentiality in order to protect commercial secrets or to preserve sensitive data; be impartial in all its actions and base its opinions and reports only on the facts; interpret applicable rules and figures in a truthful and sincere manner; be free of conflicts of interest; and perform its tasks with due care and supervise adequately all performed tasks for which it will be responsible.

### 5.1.8 Reporting in VA 2015

In terms of reporting frequency, Signatories shall submit reports to the Independent Inspector reporting based on compliance with the VA once a year.

Reports will show anonymous results. However, if a company is found to be non-compliant, the Annual Progress Report shall provide the identity of the Signatory and detail the reasons for such non-compliance.

### 5.1.9 Auditing in VA 2015

Section 9 of the VA covers auditing activities. VA establishes that audits can be random and/or intelligence based, based on a number of requirements.

#### Random based

- Minimum two per year;
- Chosen at random by the Independent Inspector;
- If more than two audits take place, an external body covers the costs;
- If a company has been audited randomly, it cannot be audited again for another two years.

#### Intelligence based

Subject to provisions on fees outlined in the VA 2015, the Independent Inspector shall investigate an allegation by a Third Party of a specific instance of non-compliance with the VA by a specific Signatory.

#### 5.1.10 Nature and organization of the VA 2015

Different aspects on the nature of the instrument are covered under this section of VA 2015. For instance:

- Each Signatory signs and enters into this Agreement only on its own behalf and makes its commitment under the Voluntary Agreement to the European Commission.
- This Agreement is not a commercial agreement and shall not give rise to any commercial expectations or liabilities between the Signatories.
- Each Signatory shall be treated equally.

In terms of organisation aspects, among others it establishes that:

- Signatories and the European Commission are members of the Steering Committee (one person to represent each).
- Chair mandates last 2 years.
- Meetings of the Steering Committee shall be open to different observers.
- The Chair must convene a Steering Committee meeting whenever any of the conditions justifying the termination of the self-regulation measure occur.

To ensure transparency, VA 2015 indicates that EuroVAprint has set up a website providing information on:

- Full members list
- Latest VA text
- Official Commission guidelines
- Annual compliance reports
- Non-compliance Reports from the independent inspector
- Exclusion of a non-compliant Signatory
- Minutes of Steering Committee meetings
- Annual energy usage report
- Annual market coverage of all Signatories and market coverage update after any change of Signatory status

#### 5.1.11 Voting rules in VA 2015

Section 11 of the VA 2015 establishes voting rules. It states that consensus is a priority, but if it cannot be achieved, the decision will be based on a voting procedure. Only VA Signatories (EuroVAprint members or otherwise) and the European Commission enjoy full voting rights. A favourable outcome of an initiative is 2/3 of those present voting in favour.

#### 5.1.12 Non-compliance in VA 2015

If a Signatory fails to meet commitments on Primary Design, Other Resource Efficiency and Information requirements, the Signatory should be subject to an audit in the year. If this audit finds that the Signatory is still not in compliance, it will be considered to have withdrawn from the VA.

In case of non-compliance with the deadlines in Reporting, the Signatory will have 1 month to propose a compliance plan that would correct the situation.

## 5.2 Description of the proposal for a Voluntary Agreement (VA 2021)

In this section, a description of the new proposal for Voluntary Agreement (VA 2021) will be presented, focusing on areas of particular relevance and comparing it with the content of VA 2015. This section does not include the full text of VA 2021, but a summary of the most relevant requirements. For the whole text, it is recommended to check the published version of VA 2021 (Eurovaprint, 2021).

### 5.2.1 Signatories of the VA 2021

The OEM Signatories of the VA are:

1. Brother International Europe
2. Canon Europe Ltd.
3. Epson Europe BV
4. HP Inc.
5. Konica Minolta Business Solutions Europe GmbH
6. Kyocera Document Solutions Europe BV
7. Lexmark International nv/sa
8. Sharp Electronics GmbH
9. Toshiba TEC Germany Imaging Systems GmbH
10. Xerox

In VA 2021, the figure of Supporting Signatories is introduced (see below in Definitions section). The Supporting Signatories of the VA are:

1. Armor Group
2. Clover Imaging Group
3. KMP AG
4. 3T Supplies AG (Peach)

In Section 3 of the VA 2021, a number of conditions and detailed in order for a company to become a Signatory or a Supporting Signatory, including windows for new membership applications.

### 5.2.2 Scope of VA 2021

The scope of VA 2021 is defined in Table 5.

**Table 5. Scope of VA 2021**

Equipment type	Media format	Marking Technology	Evaluation method
Multifunction device	Standard	High-performane IJ, EP, SI	TEC
		IJ	OM
Printer	Standard	High-performane IJ, EP, SI	TEC
		IJ	OM

Compared to VA 2015, in terms of product categories, VA 2021 does not include fax machines or copiers. As in VA 2015, professional imaging products are not included either into the scope of VA 2021.

### 5.2.3 Primary design requirements in VA 2021

In VA 2021, products need to demonstrate compliance with some elements of Energy Star 3.0, with different target tiers:

- energy consumption requirements (TEC and OM Products);
- default delay times (TEC and OM Products);
- automatic Duplexing capability (TEC Products).

December 2022: OM products: 90%; TEC products: 75%

January 2023: OM products: 95%; TEC products: 90%

#### 5.2.4 Resource efficiency requirements in VA 2021

As in VA 2015, in VA 2021 it is stated that all Products shall offer as a standard feature the capability to print several pages of a document on one sheet of paper (N-up printing). In terms of Design for Recycling (Section 7.2 in VA 2021), requirements are included on manual separation of parts, fasteners, non-separable connections and plastic parts marking. No significant changes are introduced compared to VA 2015.

New requirements are included in VA 2021 for Design for Dismantling for Recycling and Recovery (Section 7.3). It is stated that:

*OEM Signatories shall ensure that joining, fastening or sealing techniques do not prevent access to the following components in a non-destructive extraction method, and that the extraction method can be carried out using non-proprietary and Commonly Available Tools:*

- a) Batteries*
- b) Printed circuit boards greater than 10 cm<sup>2</sup>*
- c) Ink and toner Cartridges and Containers*
- d) Plastic containing brominated flame retardants*
- e) Electronic displays greater than 100 cm<sup>2</sup>*
- f) External electric cables*
- g) Electrolyte capacitors containing substances of concern (height > 25 mm, diameter > 25 mm or proportionately similar volume)*

*Accessing such components shall be facilitated by OEM Signatories documenting the sequence of dismantling operations needed to access the targeted components, i.e. each of these operations, the type and the number of joining, fastening and sealing techniques(s) to be unlocked, and tool(s) required. Dismantling instructions will be made available to third parties upon request.*

*These requirements shall not apply:*

- a) to the extent that non-removable joining, fastening or sealing techniques are necessary to ensure the safety of the Product concerned or its relevant components; or*
- b) to the extent that such requirements are exempted by specific provisions of other Community law applicable to the Products or components concerned.*

In terms of Availability of Spare parts, Service information and Critical Software updates (Section 7.4 of VA 2021), it is stated that:

*This Section is effective after 18 months from VA Endorsement.*

*OEM Signatories shall make available the Spare and relevant repair information:*

- (i) for a minimum period of 5 years after manufacturing the last unit of the model in relation to new remanufactured Product models;*
- (ii) for a minimum period of 7 years after manufacturing the last unit of the model in relation to new Product models not covered by (i).*

OEM Signatories shall ensure that these Spare Parts can be replaced with the use of Commonly Available Tools and without permanent damage to the appliance.

The list of spare parts is:

- a) Hard disc drives (HDD)
- b) Solid state drives (SSD)



- c) Print heads
- d) Laser unit
- e) Fuser unit
- f) Drum unit
- g) Transfer belts
- h) Roller kits
- i) Internal power supplies
- j) Control circuit boards
- k) External power supplies
- l) Control panels including electronic displays
- m) Toner collection unit
- n) Ink collection unit
- o) Power cords and cables

Spare Parts, the procedure for ordering and the relevant repair information shall be easily identifiable and publicly available on the free access website of the OEM Signatories, at the latest two years after the Placing on the Market of the first unit of a model and until the end of the period of availability of these Spare Parts.

Replacement instructions are to be made available either online via manufacturer's freely accessible websites or in the Product manual or provided with the Spare Parts.

The OEM Signatories shall ensure the delivery of Spare Parts within 15 working days of completion of the OEM's standard order processing procedures.

An exception is included for Product price-points nominally <EUR 300. For those products, OEM Signatories may either: make available Spare Parts or operate a whole unit exchange service model.

In terms of availability of software and firmware updates (Section 7.5 of VA 2021), it is established that:

*Firmware for a model shall be made available for a minimum period of 5 years after the Placing on the Market of the last unit of the relevant Product model, free of charge or at a fair, transparent and non-discriminatory cost.*

*OEM Signatories shall not Place on the Market Products designed to be able to detect they are being tested with the aim of reaching a more favourable level for any of the parameters declared or included in any of the documentation provided.*

*A software update shall never have the effect of changing the Product's performance such that it no longer meets the requirements of the Voluntary Agreement.*

In terms of polymer composition (Section 7.6 in VA 2021), requirements are included on number of polymers, recyclability of large casing parts and coatings. No significant changes are introduced compared to VA 2015.

In terms of recycled plastic content (Section 7.7 in VA 2021), requirements are included of information to customers on minimum percentage of post-consumer recycled content and parts excluded for the calculation. No significant changes are introduced compared to VA 2015.

### 5.2.5 Information requirements in VA 2021

In Section 8 of VA 2021, information requirements for end-users are established. The most relevant are detailed here.

In terms of repair information (Section 8.1 of VA 2021), it is stated that user instructions shall include information facilitating access to professional repair (internet webpages, addresses, contact details).

In terms of resource efficiency and energy efficiency information to provide to end-users (Section 8.3 of VA 2021), a small update is made to the requirements already included in VA 2015 (no significant change).

## 5.2.6 Cartridge and container requirements

VA 2021 includes a whole new section dedicated to cartridge and container requirements (Section 9). Several requirements are included in this section. The most relevant are described here.

In terms of cartridge design commitment (Section 9.1 of VA 2021), it is stated that:

*Signatories shall not design, or modify during remanufacturing, any Cartridge or Container to prevent:*

*- Printing (including cartridge acceptance, calibration, clean and align printheads, and not blocking Data Collection Agents) in the Product for which it is intended with a Remanufactured Cartridge, Refilled Cartridge, Remanufactured Container or Refilled Container produced by any Supporting Signatory; and its recycling.*

In terms of printer design commitment (Section 9.3 of VA 2021), it is stated that:

*Neither the Product nor any OEM software or firmware updates for the Product shall be designed to prevent printing (including cartridge acceptance, calibration and, clean and align printheads) using:*

*- a Remanufactured Cartridge or Refilled Cartridge produced by a Supporting Signatory that functions using only Original Electronic Circuitry; or*

*- a Remanufactured or Refilled Container produced by a Supporting Signatory that functions using only Original Electronic Circuitry.*

VA 2021 establishes that printer design commitments described above do not apply if the end user made a decision through a contract, terms and conditions, or printer features to use only OEM cartridges/containers (Section 9.4).

Regarding subscription and service models (Section 9.2 of VA 2021), it is stated that cartridge design commitment does not apply. In those cases:

*The Signatory shall take back from agreed location in the EU and remanufacture or recycle the Cartridges.*

*The Signatory shall provide solutions through bilateral arrangements so that the Cartridges can be remanufactured by Supporting Signatories.*

Section 9 of VA 2021 includes detail information on bilateral arrangements to be made between Signatories and Supporting Signatories. This is a complex section of the VA with several exceptions and sub-clauses, so for reference it is recommended to check the latest published version of the VA. In essence, this section states that:

*OEM Signatories commit to offer to Supporting Signatories bilateral arrangements on commercially reasonable terms with a defined scope that provide the following elements for printing with Remanufactured Cartridges produced by the Supporting Signatory that function using only Original Electronic Circuitry in OEM Signatory Products:*

*- a functioning ink or toner level gauge and/or approximate page count remaining if provided with the OEM Cartridge*

*- single installation message without the use of inflammatory terminology*

*- that the functionality above is not impacted by OEM Signatory software or firmware updates.*

*Nothing in this section is intended to prevent or restrict any OEM Signatory or Supporting Signatory from:*

*- agreeing to any other commercially reasonable terms in any bilateral arrangement beyond those set out in Paragraph 9.2.1.2, 9.4 or Paragraph 9.5.1 either by adding to the bilateral arrangements referred to in Paragraph 9.5.1 or through separate bilateral arrangements; or*

*- entering into any bilateral arrangements with any legal entity that is not a Signatory.*

*OEM Signatories and Supporting Signatories commit to negotiate bilateral arrangements in good faith.*

*Nothing in this Voluntary Agreement obliges any OEM Signatory or Supporting Signatory to divulge to any Signatory any competitively sensitive provision of any bilateral arrangement to which it is a party.*

In terms of take back programs (Section 9.6 of VA 2021), it is established that Signatories shall offer a take back solution for Cartridges, ensuring that they comply with all applicable waste transportation and management laws. Costs of take-back solutions are the responsibility of the relevant Signatory or person acting on its behalf.

In Section 9.7 of VA 2021, a list of environmental legal and safety requirements applicable to cartridges is published.

In terms of page yield, Section 9.8 of VA 2021 indicates that Signatories shall measure page yield for ink and toner Cartridges in accordance with the relevant ISO/IEC Standards where the use of those standards is appropriate. Signatories shall make ink and toner Cartridge yield information available to Customers via freely accessible websites or in user manuals. This obligation shall not apply for Cartridges where the end user customer pays for a service or on a per page basis.

In Section 9.9 of VA 2021, clauses are included regarding intellectual property. It is stated that

*Nothing in this VA shall be construed or applied to limit OEM Signatories or Supporting Signatories' obligations to comply with the law relating to Intellectual Property or to limit them in taking legal action to protect their Intellectual Property.*

*Nothing in this VA requires any Signatory to offer bilateral arrangements or access to the solutions otherwise offered to Supporting Signatories who do not respect or do not provide appropriate safeguards to respect the Intellectual Property of OEM Signatories.*

In terms of cartridge reuse targets, Section 9.10 of the VA 2021 indicate the following:

*Reuse Rate targets in 2025:*

*Toner cartridges and containers: 40%*

*Ink cartridges and containers: 14%*

## 5.2.7 Independent inspection in VA 2021

Section 10 in the VA 2021 includes information on the figure of the Independent Inspector, the different tasks it performs for verification of compliance, the characteristics of the actual inspections and the selection procedure of the Independent Inspector.

## 5.2.8 Reporting in VA 2021

Section 11 in the VA 2021 includes information on reporting of compliance. It is stated that the Independent Inspector shall prepare two separate Annual Compliance Reports one for OEM Signatories and one for Supporting Signatories. The frequency of reporting is once per year (in April). These reports shall be submitted no later than two months after the end of the reporting period.

The Annual Compliance Report shall include:

- a) information about the data collection and processing methods used and any difficulties encountered in preparing the report;*
- b) summaries of any inspections carried out during the reporting period;*
- c) a list of non-compliant Signatories;*
- d) information about the reasons for any non-compliance; and*
- e) recommendations for future reporting periods.*

The Annual Compliance Reports will only show anonymous results.

The Independent Inspector shall also prepare the Annual Product Testing and Documentation Verification Report for Signatories and Supporting Signatories, once per year (in October). These reports shall be submitted no later than six months after the end of the reporting period.

This report shall include:

- a) information about the data collection and processing methods used and any difficulties encountered in preparing the report;*
- b) the results of documentation checking;*
- c) the approach for selecting Products for testing and, if specific Models or Signatories were targeted, the reasons for doing so;*
- d) a list of Products tested and a summary of the individual results;*
- e) a list of non-compliant Signatories;*
- f) information about the reasons for any non-compliance; and*
- g) recommendations for future reporting periods.*

The Signatories must also ensure that EuroVAprint publishes once a year an energy consumption report that is prepared by the Independent Inspector, containing:

- Total energy consumption of OM units per year;
- Total energy consumption of TEC units per year.

### 5.2.9 Third party allegation in VA 2021

Section 12 of the VA 2021 establishes rules for third party allegation. In essence, when a third party submits a substantiated allegation of possible non-compliance:

- The Independent Inspector shall evaluate the evidence provided;
- The Independent Inspector may dismiss any allegation that is inadequately substantiated;
- The Independent Inspector shall be under no obligation to investigate the same matter more than once, unless supported by significant new evidence;
- The Independent Inspector should provide an overview of all allegations submitted;
- The Independent Inspector shall provide an overview of all allegations made in the Annual Compliance Report including their status and/or outcome;
- On the basis of the information received the Independent Inspector may undertake an investigation;
- Each Signatory will cover the costs of investigating 2 allegations per reporting period.

### 5.2.10 Nature and organization of the VA 2021

Section 13 of the VA 2021 provides information on the nature and organization of the Voluntary Agreement. In terms of nature of the agreement, it does not add significant changes to VA 2015.

In terms of organisation, it provides guidelines on the meetings, the election of a Chair, invitations to meetings, agendas, documents to be presented, draft minutes and expenses related to Independent Inspector.

In terms of market coverage, it is explained how it will be assessed and when minimum market coverage will need to be proved.

Regarding transparency measures, the VA 2021 mentions the existence of a website set up by EuroVAprint, including information on a variety of aspects.

### 5.2.11 Decision making procedures in VA 2021

As in VA 2015, agreement by consensus will be prioritised in VA 2021. When consensus cannot be achieved, a subcommittee will be appointed, consisting in 5 OEM Signatories in the case of matters relating to Sections 5 to 8 of the VA; and shall consist of 5 OEM Signatories and 5 Supporting Signatories in case of matters relating to Section 1 to 4 and 9 to 18 of the VA.

### 5.2.12 Non-compliance of the VA 2021

Section 15 of the VA 2021 describes guidelines for non-compliance with the VA. In essence:

- Where a Signatory fails to meet its Commitments under the VA, the Signatory shall be requested to take corrective actions.

- Non-compliance that continues for more than six months after that report of the Independent Inspector shall lead to immediate exclusion of the Signatory.
- In cases where non-compliance determines withdrawal or exclusion of OEM Signatories the market coverage of the remaining OEM Signatories shall be re-assessed.
- The defaulting Signatory may reapply for membership of the Voluntary Agreement.

### 5.3 Comparison between the VA 2015 and the VA 2021

This section (Table 6 - Table 10) contains brief comparisons between different elements of the VA 2015 and the VA 2021.

**Table 6. Comparison VA 2015 and VA 2021 (Scope)**

		VA 2015 (Current)	VA 2021 (Proposal)
Scope	Product categories	Copiers. Multifunction Devices (MFDs). Printers. Fax machines.	Multifunction Devices (MFDs). Printers. Media format: Standard
	Marking technologies	Inkjet High performance IJ Electrophotographic Solid Ink	Inkjet High performance IJ Electrophotographic Solid Ink
	Household/Office equipment	This Voluntary Agreement is limited to household and office equipment, meaning: Standard black & white (BW) format products with maximum speed < 66 A4 images per minute Standard Colour format products with maximum speed <51 A4 images per minute	The following products are not included in the scope of the Voluntary Agreement: -products that are designed to operate directly on three-phase power; -products that meet the ENERGY STAR® v3.0 definition of 'Professional Imaging Product' (defined in Annex A);

**Table 7. Comparison VA 2015 and VA 2021 (Primary design requirements)**

		VA 2015 (Current)	VA 2021 (Proposal)
Primary design requirements	Primary requirements	Compliance with Energy Star 2.0 and Default Duplex setting requirements, with the following targets:  Jan-Dec 2017 OM products: 93% TEC products: 80	Compliance with Energy Star 3.0  Dec 2022 OM products: 90% TEC products: 75%  Jan 2023 OM products: 95% TEC products: 90%
	Energy consumption	Energy Star Version 2.0 Energy consumption (TEC and OM)	Energy Star Version 3.0 Energy consumption (TEC and OM)
	Default delay times	Applicable to OM products	Applicable to TEC and OM products
	Default duplex printing	Default	Default
	Exemption for duplex requirements	TEC products whose intended function is to print on special single-sided media for the purpose of single sided printing (e.g. release coated paper for labels, direct thermal media, etc.) are exempt from the duplex requirements.	None

**Table 8. Comparison VA 2015 and VA 2021 (Resource efficiency requirements)**

		VA 2015 (Current)	VA 2021 (Proposal)
Resource efficiency requirements	Availability of N-up printing	All products	All products
	Design for recycling	Included	Included
	Polymer composition	Included	Included
	Recycled plastic content	Included	Included
	Design for Dismantling for Recycling and Recovery	Not included	Included
	Availability of Spare parts and service information and critical software updates	Commitment included, without list of spare parts	Commitment included, with list of spare parts
	Availability of software and firmware updates	Not included	Included

**Table 9. Comparison VA 2015 and VA 2021 (Information requirements)**

		VA 2015 (Current)	VA 2021 (Proposal)
Information requirements	Publication of list of products	Not included	Included
	Information on Repair	Not included	Included
	Resource efficiency and energy efficiency	Included	Included
	Cartridge disposal and treatment	Included	Not included
	Information on paper recyclability	Included	Included
	Improvement on paper recyclability	Included	Not included
	Information on product environmental characteristics	Included	Included
	Exemptions for small numbers	Included	Not included



**Table 10. Comparison VA 2015 and VA 2021 (Cartridge requirements)**

		VA 2015 (Current)	VA 2021 (Proposal)
Cartridges	Printer Design commitment	The machine shall not be designed to prevent the use of a non-OEM cartridge. The requirement shall not be interpreted in such a way that would prevent or limit innovation, developments or improvements in design or functionality of the products, cartridges, etc.	Neither the Product nor any OEM software or firmware updates for the Product shall be designed to prevent printing (including cartridge acceptance, calibration and, clean and align printheads) using: -a Remanufactured Cartridge or Refilled Cartridge produced by a Supporting Signatory that functions using only Original Electronic Circuitry; or -a Remanufactured or Refilled Container produced by a Supporting Signatory that functions using only Original Electronic Circuitry.
	Reuse of cartridges	Any cartridge produced by or recommended by the OEM for use in the product shall not be designed to prevent its reuse and recycling. The requirement shall not be interpreted in such a way that would prevent or limit innovation, developments or improvements in design or functionality of the products, cartridges, etc.	Signatories shall not design, or modify during remanufacturing, any Cartridge or Container to prevent: Printing (including cartridge acceptance, calibration, clean and align printheads, and not blocking Data Collection Agents) in the Product for which it is intended with a Remanufactured Cartridge, Refilled Cartridge, Remanufactured Container or Refilled Container produced by any Supporting Signatory; and its recycling.
	Exemption for Subscription and Service models	Not included	Included
	Exemption when customer decides to use only OEM cartridges or OEM containers	Not included	Included
	Bilateral arrangements	Not included	Included
	Take back programs	Not included	Included
	Legal requirements and safety data sheets	Not included	Included

	Page Yield	Not included	Included
	Intellectual property and sustainability	Not included	Included
	Data and targets for continuous improvement	Not included	Included
	Information on remanufacturing, reuse and end of life management	Not included	Included

## 6 Assessment of VA 2021

The Ecodesign directive states that:

*Priority should be given to alternative courses of action such as self-regulation by the industry where such action is likely to deliver the policy objectives faster or in a less costly manner than mandatory requirements. Legislative measures may be needed where market forces fail to evolve in the right direction or at an acceptable speed.*

Considering this, the JRC has analysed in detail the VA 2021, from the perspective of compliance with the Article 17 of the Ecodesign Directive on Voluntary Agreements, and in particular with the admissibility criteria described in Annex VIII of the Directive:

1. Openness of participation
2. Added value
3. Representativeness
4. Quantified and staged objectives
5. Involvement of civil society
6. Monitoring and reporting
7. Cost-effectiveness of administering a self-regulatory initiative
8. Sustainability
9. Incentive for compatibility

The assessment has also taken into account the Commission guidelines for self-regulation measures (Commission Recommendation 2016/2125).

More specifically, the assessment of the “Added Value” and “Sustainability” aspects has taken into account the environmental issues described in chapter 4 of this report, the objectives of the “EU Green Deal” and the “Circular Economy Action Plan” and the principles of the waste hierarchy described in the “EU Waste Framework Directive”.

In order to produce this assessment JRC has carried out an extensive literature review and stakeholder consultation, collecting feedback from a variety of relevant stakeholders in this sector, mainly through bilateral meetings. The stakeholders consulted for the assessment of the VA are:

- Imaging equipment and original cartridge manufacturers. In this assessment, they are referred to as “OEMs”. These OEMs form part of EVAP.
- Cartridge remanufacturers. In this assessment, they are referred to as “remanufacturers”. Most of the remanufacturers consulted form part of ETIRA (although some remanufacturers out of this association were consulted as well).
- Non-governmental associations. Feedback received from ECOS and EEB. In this assessment, they are referred to as “NGOs”.
- Member States. Feedback received from some of the representatives more heavily involved in the development of the voluntary agreements (NL and BE). In this assessment, they are referred to as “MS”

The following sections are structured in a sequential way, aiming to describe the assessment process by the following research questions:

- Are there any aspects in the VA 2021 that may fail to address the main environmental issues identified in Section 4 of this report or the other admissibility criteria from Annex VIII of the ecodesign Directive?
- What are the views of different stakeholders on these aspects?
- Does the JRC consider that the VA address effectively these environmental and/or admissibility issues?
- Is the VA 2021 likely to deliver the policy objectives faster or in a less costly manner than mandatory requirements?

### 6.1 Analysis of aspects in the VA that require further analysis

A number of aspects in the text of the VA 2021 have been identified that require further analysis. The purpose of this section is to explain in detail the nature of those aspects. For each aspect, the following structure will be used:

Description: a brief explanation of the aspect

Stakeholder feedback: a summary of all the comments received from different members of the industry on that particular aspect

VA rationale: an explanation of why this aspect has been addressed in that particular way in the VA, provided by Signatories or Supporting Signatories

Assessment: A summary of the conclusions reached by the JRC team.

## 6.2 Introduction, Objectives & Scope

### 6.2.1 Market coverage

#### Description

In the Annex VIII of the ecodesign Directive it is stated that:

*Industry and their associations taking part in a self-regulatory action must represent a large majority of the relevant economic sector, with as few exceptions as possible. Care must be taken to ensure respect for competition rules.*

In Section 3.3 of Self-regulation guidelines on Representativeness, it is stated that

*The self-regulation measure should state the market coverage of its signatories which should be at least 80 % of units placed on the Union market and/or put into service of the type of products covered by the measure. The signatories should provide evidence, compiled or verified by an independent legal or natural person proving that the self-regulation measure has a market coverage of at least 80 %.*

In Section 1 of the VA 2021, no accurate data is provided on the market coverage. Some OEMs have recently withdrawn from the VA, raising questions over the compliance of the VA with the 80% threshold, which might be in conflict with criteria in Annex VIII of ecodesign Directive on Representativeness.

#### Stakeholder feedback

Market coverage data presented in the VA 2021 may be influenced by the withdrawal of Samsung, Ricoh and Panasonic in 2017. In October 2021, Konica-Minolta announced as well their withdrawal from the VA. According to The Recycler (2021), the market share may not be large enough for the Commission to endorse the VA.

Moreover, the market coverage of the VA refers to imaging equipment products, and not cartridges. Since the VA 2021 now concerns cartridges as well, some stakeholders have suggested that they should be somehow accounted in the market coverage calculations. For this reason, NGOs argue that the overall market coverage achieved by the VA cannot be properly assessed. They add that counting only four remanufacturers among its supporting signatories at present, the VA is likely to concern only a small segment of the entire market for reused and remanufactured printer consumables in Europe. While ETIRA counts 36 members in total, only two of these members are listed as supporting signatories to the VA at present. According to the remanufacturers interviewed, the current Supporting Signatories cover around 2% of the EU remanufacturing market.

Some stakeholders suggest using alternative indicators to account market coverage (such as total number of pages printed, or total value of printers placed on the market). In their view, these indicators would be more representative of the current market situation in the imaging equipment sector. They add that with alternative indicators it is likely that the 80% threshold would not be achieved.

#### VA rationale

OEMs indicate that, on the market coverage for printers, in March 2018 EuroVAprint contracted RINA (the Independent Inspector) to provide a figure for the market share represented by the VA (version 5.2) from an independent provider of market data. The Independent Inspector confirmed that the market coverage for printers of the companies involved in the current revision of the VA remained in excess of 80% (97.4%) of products placed on the market in the EU that are within scope of the VA. They add that there is no reason to believe that this has changed significantly since 2017. Panasonic has exited the imaging equipment market and Samsung has been acquired by HP (HP's market coverage includes the former Samsung business).

In response to the article published by The Recycler (2021) regarding the withdrawal of Konica Minolta, OEMs argues that the market share after this event is estimated to be around 91.3%. This assessment does not take into account variations in market share between parties. According to them, even with variations since 2017 it is highly unlikely that the figure is below 80%.

On the possibility of accounting Supporting Signatories as well in market coverage, EVAP has always made clear its view that OEMs do not represent 80% of the cartridge and container market. They add that there is no reliable data on the cartridge and container market coverage. EVAP suggested that an independent researcher could assess the market coverage. However, the Commission informed EVAP that for the purpose of the market share of the VA, the Commission will use the market share for printers portion.

### Assessment

If market coverage is considered as the self-regulation guidelines recommend (total units placed in the market), even with the withdrawal of Signatories such as Panasonic or Konica Minolta, current status is 91.3%, based on data provided by EVAP. In the absence of alternative data to contrast this figure, it must be assumed that market coverage is compliant with the 80% minimum threshold of units placed in the market.

For improvement purposes in terms of transparency, the actual market coverage figure at the time of publication of the VA should be published. Additionally, a brief description on the accounting methodology should be included.

For future versions of a potential VA, the possibility of using an alternative indicator (different to units placed in the market) should be explored. In the imaging equipment market there are products with a wide spread in terms of value, price, performance and capacity. Considering only number of units placed in the market to estimate market coverage might be a misrepresentation of the market. Another option for the future might be splitting market coverage calculation in two product categories: business-to-business and business-to-consumer printers.

Although different indicators and measurement methods might be used in future versions of a potential VA, with the current methodology –based on number of units placed on the market- this aspect is considered compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Representativeness. Even with the recent withdrawal of some OEMs, it appears unlikely that OEMs will not meet the 80% threshold with current calculation methods.

## 6.2.2 Time period for Supporting Signatories to join the VA

### Description

In the Annex VIII of the Ecodesign Directive is stated that:

*Self-regulatory initiatives must be open to the participation of third country operators, both in the preparatory and in the implementation phases.*

Section 3.1 of Self-regulation guidelines on Openness of Participation states that

*Companies active in the same product market should be able, at any time, to join the self-regulation measure, on the condition that they participate in its operational costs.*

In Section 3.1 of the VA 2021, it is stated that

*Companies active in the imaging equipment hardware industry sector can become OEM Signatories to the Voluntary Agreement, provided that they submit to the Steering Committee the completed membership form during either the 30 days following VA Endorsement or during March and April, or September and October each year which are the biannual windows for new membership applications.*

*Companies meeting the definition of Supporting Signatory can become Supporting Signatories to the Voluntary Agreement provided that they submit to the Steering Committee the completed membership form during either the 30 days following VA Endorsement or during March and April or September and October each year which are the biannual windows for new membership applications.*

Supporting Signatories cannot join the VA at any time, as the self-regulation guidelines indicate.

### Stakeholder feedback

NGOs argue that the VA 2021 proposes to limit the time period during which applications to join the VA can be submitted to four months only. According to them, such a restriction is in clear conflict with the Commission's guidelines on self-regulatory measures.

#### VA rationale

Manufacturers explain that the purpose of establishing joining windows is to simplify administration of the VA. The VA includes annual compliance reporting including reporting data for the purposes of target calculations. This would quickly become unnecessarily complicated if companies were to join at any point throughout the year.

In addition, the process of negotiating and implementing bilateral arrangements will involve significant work for both OEM Signatories and Supporting Signatories and creating some structure in terms of timing will be beneficial.

For these reasons there is a considerable benefit to aligning the dates from which new member companies will start to comply under the VA. Following comments from stakeholders the VA was amended from one annual joining window per year, to two so that companies will either start complying in January or in July of a compliance calendar year. If a company misses a joining period this reduces the period until the next opportunity to 6 months which should not result in significant business impact.

It is important to note that there will also be a joining window at the start of the VA following endorsement. According to OEMs, this arrangement strikes a balance between the two objectives of openness of participation and effective management of the VA and does not prejudice potential signatories.

#### Assessment

The justifications provided by OEMs to establish two joining windows seem reasonable, considering the benefits in effective management and simplification of administration tasks. With the two windows provided, a company wishing to join the VA would only need to wait a maximum of 6 months.

This aspect is considered compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Openness of Participation.

### 6.3 Energy efficiency

#### 6.3.1 Energy efficiency requirements

##### Description

Annex VIII of the Ecodesign Directive states that

*The objectives defined by the stakeholders must be set in clear and unambiguous terms, starting from a well-defined baseline. If the self-regulatory initiative covers a long time-span, interim targets must be included. It must be possible to monitor compliance with objectives and (interim) targets in an affordable and credible way using clear and reliable indicators. Research information and scientific and technological background data must facilitate the development of these indicators.*

Section 4 of Self-Regulation Guidelines on Quantified and Staged objectives states that

*The requirements should apply to at least 90% of all units placed on the market by each Signatory. The VA 2021 establishes in Section 6.1 Primary requirements for imaging equipment products. Essentially, it states that*

*Products Placed on the Market by OEM Signatories after VA Endorsement shall meet the following requirements of ENERGY STAR v3.0*

*a) Energy consumption requirements (TEC and OM Products)*

*b) Default delay times (TEC and OM Products)*

*c) Automatic Duplexing capability (TEC Products)*

*in accordance with the targets set out in Table*

**Table 11. Primary requirements for imaging equipment**

	OM Products	TEC Products
Tier I (VA endorsement – December 2022)	90%	75%
Tier II (from January 2023)	95%	90%

In Tier I, the 90% applicability rule would not be complied for TEC products (only 75% targeted). In Tier II, energy efficiency requirements would still not be applicable to every product on the market.

#### Stakeholder feedback

Some Member State representatives add that energy efficiency requirements included in VA 2021 will not drive a significant change from current situation. The VA would only achieve to carry on with a business-as-usual situation in terms of energy efficiency (which has already improved significantly over the years).

NGOs consider that there is insufficient justification for the proposed staged compliance targets in Tier II, which only require 95% of OM and 90% of TEC products to reach energy efficiency targets. In their view, any regulatory instrument in relation to printers should be designed to cover 100% of both OM and TEC products placed on the EU market over time.

#### VA rationale

OEMs argue that the energy efficiency commitments of the proposed VA are based on the most ambitious set of requirements for the sector. In their view, the tiered approach and percentage targets in the VA are necessary because it will take time for industry to transition products to these ambitious energy standards and a small amount of margin is required to take into account variables in that process of transition.

#### Assessment

According to impact assessments conducted as part of previous reviews of the imaging equipment VA, significant savings in energy consumption have already been achieved over the last years. Moreover, Energy Star is the most recognised energy efficiency standards in the sector. It is concluded that the potential gains of increasing compliance thresholds up to 100% in Table 11 would be marginal.

Considering that energy consumption is not an environmental hotspot in this product group, this aspect is considered compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Quantified and Staged objectives.

JRC suggests to align this VA with the latest revision of the Energy Star criteria for Imaging Equipment (version 3.2) effective from the 18<sup>th</sup> of November 2021.

## 6.4 Resource efficiency

### 6.4.1 Ambiguity in resource efficiency commitments

#### Description

Criteria 4 of Annex VIII of the Ecodesign Directive for admissibility of Self-regulation initiatives on Quantified and Staged objectives states that

*The objectives defined by the stakeholders must be set in clear and unambiguous terms*

In Section 7.2.1 of the VA 2021, it is stated that

*Non-separable connections between different materials shall be avoided unless they are technically or legally required*

In a similar way, in Section 7.3.3, it is stated that

*Design for dismantling requirements shall not apply to the extent that non-removable joining, fastening or sealing techniques are necessary to ensure the safety of the Product concerned or its relevant components.*

The two examples above contain expressions that are ambiguous or open to interpretation. Another similar example can be seen in Section 7.6.5, where it is stated that

*The use of coatings for special parts is to be reduced to a minimum, unless it can be demonstrated that it does not alter recyclability.*

No specific limitation is introduced as regards the use of coatings, just a recommendation that these be 'reduced to a minimum', expression which is open to interpretation.

#### Stakeholder feedback

According to NGOs, the VA 2021 allows for exemptions in cases where this is "technically required" or is "necessary to ensure the safety of the product concerned", without specifying how this is to be justified in practice.

#### VA rationale

OEMs argue that in the interest of harmonization this requirement was leveraged from the Electronic Product Environmental Assessment Tool (EPEAT) standard for imaging equipment which does not define 'technically required'. They do not consider it necessary to define technically required, since this terminology can be objectively assessed by the Independent Inspector.

In the case of non-appliance of requirements "to ensure the safety of the product", OEMs point out that all products in scope of the VA are also in scope of technical regulations addressing product safety. This means that there is a high level of industry understanding of safety issues for the products in question and trying to define it in the VA would just introduce gaps.

In the case of "coatings reduced to a minimum", the requirements were leveraged from Blue Angel and EPEAT and the relevant conformity assessment procedures are used. This is a long-established ecolabel requirement. The Independent Inspector is capable of an objective assessment of 'reduced to a minimum'.

#### Assessment

Understanding that it is not possible to define every instance in which it might be "technically required" to have non-separable connections, it does leave an open door for interpretation, that regulation should try to avoid to the extent of its possibilities. For reference, in other product groups covered by ecodesign regulations (e.g. electronic displays), in the section on Marking of plastic components, it is stated that:

*Plastic components are exempt from the marking requirements if marking is technically not possible because of the molding method.*

Therefore, in similar product groups, ambiguity is reduced by giving an indication on when the requirement might not be applicable.

The JRC agrees with OEMs in the fact that the Independent Inspector will very likely be capable of an objective assessment of these aspects.

However, the abundance of these expressions in the text, together with similar exemptions in other sections of the VA, set a general tone of lack of concretion, which might limit its ability to achieve the objectives. Although this aspect is not related to any of the environmental hotspots or issues within the industry, it is considered that improvements can be made in this sense.

Although improvements can be made, the noted deficiencies do not lead to infringement with self-regulation criteria of Annex VIII of ecodesign Directive.

### 6.4.2 Dismantling rules

#### Description

In Section 7.3.1 of the VA 2021, it is stated that

*OEM Signatories shall ensure that joining, fastening or sealing techniques do not prevent access to the following components (when present) in a non-destructive extraction method, and that the extraction method can be carried out using non-proprietary and Commonly Available Tools:*



- a) Batteries
- b) Printed circuit boards greater than 10 cm<sup>2</sup>
- c) Ink and toner Cartridges and Containers
- d) Plastic containing brominated flame retardants
- e) Electronic displays greater than 100 cm<sup>2</sup>
- f) External electric cables
- g) Electrolyte capacitors containing substances of concern

The list above and the list of spare parts published in Section 7.4.1 of the VA do not match. This might be in conflict with Criteria 2 of Annex VIII of ecodesign Directive on added value.

#### Stakeholder feedback

According to NGOs, the proposed VA does not require for all the components identified as relevant spare parts to be made easy to disassemble with commonly available tools without causing permanent damage to the device, including through a restriction on the use of fasteners for joining components (the lists of parts in Sections 7.3.1 and 7.4.2 do not match).

They add that only a highly limited number of components is proposed to be subjected to disassembly requirements, some of which (e.g. displays and capacitors) are defined in a way which would further exclude large numbers of these parts from the obligation.

#### VA rationale

OEMs argue that the wording used in Section 7.4.2 of the VA is the same as in Ecodesign Regulation 2019/2021. They point out that it is intentional that the two lists differ because they are addressing a different issue. Section 7.3.1 includes rules for design for dismantling (recycling), whereas section 7.4.2 includes rules for design for repair (spare parts). They add that if a component can be replaced as a spare part using commonly available tools, it can also be dismantled at end of life using commonly available tools.

The VA also includes an appropriate obligation on fasteners requiring OEM Signatories to utilize commonly used fasteners for joining components, subassemblies, the chassis and enclosures.

#### Assessment

The JRC team agrees with OEMs in the sense that sections 7.3.1 and 7.4.2 are addressing different issues (design for recycling and design for repair, respectively), therefore it makes sense that the wording and the lists of parts differ slightly.

This aspect is considered compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Added value.

### 6.4.3 Spare part delivery time

#### Description

In Section 7.4.1 of the VA 2021, it is stated that the commitments on availability of spare parts

*is effective after 18 months from the VA endorsement.*

In Section 7.4.5.1, it is stated that

*The OEM Signatories shall ensure the delivery of Spare Parts within 15 working days of completion of the OEM's standard order processing procedures*

The delivery time of spare parts, as well as their initial availability, might be too long. This might be in conflict with Criteria 2 of Annex VIII of ecodesign Directive on Added value.

#### Stakeholder feedback

NGOs highlight that the proposed 18-month delay in application of the spare part availability requirement will significantly impact the numbers of products covered and is not justified.

Moreover, a delivery time of 15 working days is likely to create significant barriers to repair, given that the vast majority of new products are delivered in less than 15 days. In their view, the general business practice of delivering parts in 3-5 working days would be reasonable and sufficient.

#### VA rationale

OEMs argue that the proposed 18 months period was included in the VA 2021 in alignment with the recently approved ecodesign implementing measures and accounts for the operational transition necessary. In addition to that, the spare part delivery commitment of 15 working days is also aligned with existing ecodesign implementing measures.

OEMs clarify that their industry has no interest in having non-operational products in the market, given their interest in keeping the cartridge business supported. They conclude that OEMs will always strive to deliver and repair as soon as possible.

#### Assessment

The VA proposes a period of initial availability and then a delivery time for spare parts. The 18 month period to make effective the applicability of provision of spare parts, and the delivery time within 15 working days are both in line with similar product groups under ecodesign Directive.

Although it seems possible that the delivery time can be reduced to 3-5 working days as some stakeholders suggest, it is understood that the 15 working days included in the VA represent a maximum, potentially applicable to remote areas or to account for potential delays out of control of OEMs.

It is considered that the proposal of the VA can contribute effectively to increase average product lifetime of printers. Therefore, this aspect is considered compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Representativeness

### 6.4.4 Spare part list

#### Description

In Section 7.4.2 of the VA 2021, regarding availability of spare parts, it is stated that

*OEM Signatories shall ensure that these Spare Parts can be replaced with the use of Commonly Available Tools and without permanent damage to the appliance:*

- a) Hard disc drives (HDD)*
- b) Solid state drives (SSD)*
- c) Print heads*
- d) Laser unit*
- e) Fuser unit*
- f) Drum unit*
- g) Transfer belts*
- h) Roller kits*
- i) Internal power supplies*
- j) Control circuit boards*
- k) External power supplies*
- l) Control panels including electronic displays*
- m) Toner collection unit*
- n) Ink collection unit*
- o) Power cords and cables*

The spare part list might be incomplete. This might be in conflict with Criteria 2 of Annex VIII of ecodesign Directive on Added value.

#### Stakeholder feedback

According to NGOs, the list does not comprise additional components which are well-known causes of printer failures according to independent repairers, such as: motors, gears, printer memory, batteries, density sensors, cartridges attachment components (including recalibration chips), hinges and spare parts for non-printer functions in multi-functional devices including scanner parts.

#### VA rationale

OEMs argue that parts for which there is no demand as a spare part have not been included in the list. They highlight that requiring manufacturers to produce and stock parts has an environmental impact. Where there is no demand for those parts, they would end up being scrapped increasing the overall environmental impact.

#### Assessment

The proposed list of spare parts comprises 15 components. Although the list might be expanded to include every component suggested by different stakeholders, there is no specific information available showing that the components left out are more prone to failures than the ones included in the list. Moreover, the JRC agrees with EVAP on the fact that producing and stocking spare parts without significant demand can have a detrimental impact on the environment.

Therefore, the list of spare parts is considered sufficient and in line with similar product groups regulated under the ecodesign Directive. It is considered that the proposal of the VA can contribute effectively to increase average product lifetime of printers. Therefore, this aspect is considered to be compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Added value.

### 6.4.5 Cartridge chips as spare parts

#### Description

Cartridge chips are a key component in the imaging equipment industry and they are not included in the spare part list of the VA 2021. This might be in conflict with Criteria 2 of Annex VIII of ecodesign Directive on Added value.

#### Stakeholder feedback

Several stakeholders have expressed the necessity to include in the list of spare parts the cartridge chips, in order to facilitate that remanufactured cartridges with full functionality can be produced by anyone in the market. In the view of remanufacturers, the fact that chips cannot be easily reset when the cartridge has been depleted is an example of planned obsolescence, since it is purely a software-based artificial obstacle.

Remanufacturers add that the use of chip technology in the imaging equipment industry to isolate third-party providers should be a thing of the past. Fair and undistorted competition is a prerequisite for successfully implementing the Circular Economy Action Plan. The recommendation of some associations of remanufacturers is to make chips available through some sort of exchange mechanism, to avoid chips being bought at large numbers by third party new build cartridge manufacturers. In their view, this exchange mechanism should work similar to the repair of mobile phones: a remanufacturer would send in the collected used chips and would get back reset chips that have been refurbished by the OEM or by an official licensed OEM partner.

In this exchange system, chips on empty collected cartridges should be sent back to the OEMs they originated from. This could be by using an online EVAP portal, to which access is only granted if the WEEE registration numbers are checked at registration to the portal, and if the user agrees to the terms that the exchanged chips must only be used on cartridges that are being prepared for reuse in the European market. If so, the collected chips would be replaced by refurbished chips against a payment of a fair re-setting fee and freight reimbursement. If chips supplied via that online portal are later found on new build cartridges, this EVAP OEM can then be entitled to an adequate fine to be paid by the company bringing these cartridges on the European market.

They add that generation of WEEE could be reduced drastically if chips were included in the VA as a standard spare part, because highly encrypted chips that can be found today in the market are commercially useless for the cartridge remanufacturing industry. They also consider it would be a boost for true competition in the cartridge remanufacturing sector.

#### VA rationale

OEMs do not consider appropriate to include cartridge chips in the spare part list. In their view, when a cartridge has been depleted, the chip does not malfunction or needs reparation. It is not a broken or damaged component, therefore it should not be provided as a spare part.

#### Assessment

The difficulty of re-setting cartridge chips is one of the main barriers preventing cartridge reuse today. However, the JRC considers that this topic cannot be addressed as a spare part availability issue. As already stated by some stakeholders, chips are generally not damaged when the cartridge is depleted, so including them in the spare part list is not the ideal solution, as it could easily increase the manufacturing and waste generation of cartridge chips.

On the exchange mechanism suggested by some stakeholders, being a potentially interesting proposal, the JRC has not sufficient information to evaluate at this point if this is the appropriate solution for this issue. In fact, it brings additional questions regarding the complexity required in terms of logistics, with several organisations continuously transporting chips from OEMs to remanufacturers and back. This proposal might also need an assessment in terms of the environmental impact caused by such a transport and logistic system.

It seems more appropriate to address the technical barriers caused by cartridge chips in other sections of the VA, such as in the cartridge and printer design requirements, or indirectly through ambitious reuse targets.

Although it is related to one of the main issues in the industry and is one of the main technical barriers, this aspect is addressed in other commitments of the VA. Therefore, this aspect is considered compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Added value.

### 6.4.6 Spare parts: availability period, target audience and affordability

#### Description

In Section 7.4.2 of the VA 2021, it is stated that

*for Product models first Placed on the Market after the date referred to in 7.4.1, OEM Signatories shall make available the Spare Parts listed in (a) – (o) below for such Products and relevant repair information:*

*(i) for a minimum period of five years after manufacturing the last unit of the model in relation to new remanufactured Product models;*

*(ii) for a minimum period of seven years after manufacturing the last unit of the model in relation to new Product models not covered by (i).*

Different spare part availability periods are considered for new and for remanufactured products. The target audience of each spare part is not specified (professional repairers or end-users). Affordability of spare parts is not addressed in the VA 2021. This might be in conflict with Criteria 2 of Annex VIII of ecodesign Directive on added value.

#### Stakeholder feedback

Justification for different availability periods of spare parts for new and remanufactured printers has not been provided in VA 2021. On top of that, it has not been specified to whom the spare parts shall be available, in contrast with other product groups' ecodesign implementing regulations, where it is stated if spare parts are available to end-users, professional repairers or both.

Remanufacturers add that the topic of spare part affordability has not been addressed in the VA 2021. If spare parts are too expensive, consumers will unlikely repair their printers.

#### VA rationale

OEMs consider that it is reasonable to offer different spare part availability periods for new and for remanufactured printers. A remanufactured product was once a new product. It has already had a 'first life' including a first service life (currently 5 years, extended to 7 years with this VA revision). After being remanufactured it will have a 'second life' and service life. It is reasonable for the second service life to be shorter than the first.

#### Assessment

It seems reasonable to have different part availability periods for new and reused printers. The availability periods proposed (7 and 5 years, respectively) are in line with similar product groups regulated under the ecodesign Directive.

Ideally, to be completely in line with other product groups, the target audience of spare parts should be defined.

Although affordability of spare parts is an important topic, implementing measures under the Ecodesign Directive do not address directly the price of products or of spare parts. In similar product groups under ecodesign there are no requirements that set a maximum price for spare parts, so it does not appear reasonable to include this in the imaging equipment VA.

It is considered that the proposal of the VA can contribute effectively to increase average product lifetime of printers. Therefore, this aspect is considered compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Added value.

#### 6.4.7 Exemption for printers <300 EUR

##### Description

In Section 7.4.6 of the VA 2021, it is stated that

*for Product price-points nominally <EUR 300 (as of 2021) OEM Signatories may either:*

*-make available Spare Parts in accordance with Section 7.4.2 or*

*-operate a whole unit exchange service model using reused/refurbished parts or Products taking into account availability of returned units capable of repair and their condition during the sales period of the Product and for a minimum period of five years after the last unit of a model is Placed on the Market.*

Section 3.4 of self-regulation guidelines on quantified and staged objectives state that

*The requirements should apply to at least 90% of all units.*

This exemption might also be in conflict with criteria 2 of Annex VIII of ecodesign Directive on Added value, which states that

*Self-regulatory initiatives must deliver added value (more than 'business as usual') in terms of the improved overall environmental performance of the product covered.*

*The self-regulation measure should list all the types of products within its scope, provide definitions of these products, and list product types belonging to the product group falling within the scope of the self-regulation measure but exempt from its requirements. Justifications should be provided for any exemptions made.*

##### Stakeholder feedback

According to NGOs, the exemption of providing spare parts for printers below 300 EUR contradicts the existing ecodesign rules for other product categories and other existing environmental initiatives. In their view, it legitimises the continuation of short-lived, disposable printers on the EU market, because generally the most problematic printers in terms of short lifetime are the cheapest ones, which are the ones being excluded from providing spare parts. They add that there is an incentive for OEMs to design cheap printers with low cost materials.

Moreover, while the whole unit exchange model is suggested to lead to 'appropriate reuse of parts', the only verification evidence necessary for the purpose is a general policy statement in a document, without any commitment or verification on the replacement product itself.

Other stakeholders' concerns are related to the 300 EUR threshold itself. According to Member States, it is difficult to establish a specific figure because prices vary between member states and with time. Member States also mention that the threshold price might be too high.

##### VA rationale

OEMs argue that this section of the VA 2021 requires manufacturers to either make spare parts available or operate a whole unit exchange service model using reused or refurbished parts, taking into account the

availability of returned units capable of repair. Therefore it offers the manufacturers the possibility to operate a "replace by refurbished" service model.

According to OEMs, this approach is consistent with circular economy principles: replace by refurbished is product reuse. This option has been included because it reflects the reality of what most of manufacturers already do because it is efficient and makes economic sense. In their view, there is no basis to argue that this approach legitimises short-lived, disposable printers. OEMs do not consider this an exemption of compliance with spare part provision, but an option for manufacturers to offer a different solution to customers when they need to repair a device. According to them, this is the most common way of operating in the industry today.

In section 7.4.6 it is stated that the "replace for refurbished" option will be conducted "taking into account availability of returned units capable of repair and their condition during the sales period of the Product". OEMs clarify that this clause is included to account for certain periods of the product lifecycle (mainly the first months after it enters the market), where the number of returned units will still be very low, so the availability of parts to repair or refurbish other devices will also be low. In those cases, they claim that it would be up each OEM to decide how the issue of repairing the printer would be solved.

In terms of cost for the consumer, under a whole unit exchange model outside the warranty period, the OEMs would likely require the customer to pay for an exchange printer, at a discounted rate. The costs would be down to each OEM and would vary from model to model. They add that for lower cost printers, the cost of stocking and supplying spare parts and for customers to have them repaired is likely to be higher than the costs to the customer under a whole unit exchange model.

### Assessment

The exemption for printers <300 EUR means that OEMs do not need to provide spare parts for a significant section of the market, potentially not compliant with the 90% threshold requirement.

Having a threshold in a VA related to product price has certain difficulties. Price is not a fixed parameter and even a nominal price provided by the OEMs can evolve significantly with time. Also, price can differ between markets, so this exemption might be at the same time applicable in some Member States and not applicable in others. In addition, the rationale behind the actual threshold (300 EUR) has not been justified in the VA.

Giving OEMs the possibility of not providing the spare parts for printers below a certain price threshold entails some other risks. Generally, the printers that most likely contribute to quick generation of waste are the ones sold at a low price, often made of cheaper materials and lower durability and reliability characteristics. Some of the spare parts listed in 6.4.4 are very simple and should not imply high barriers for customers, if the parts are easy accessible and design allows a Do-It-Yourself repair.

In the Business-to-Consumer market, after the two year of legal warranty period, if a specific component in a printer fails and the OEM only offers the "replace by refurbished" policy, the customer might be encouraged to buy a new printer, rather than exchanging the one that failed with a refurbished printer. Another aspect to take into account is that section 7.4.6.2 of the VA states that the exchange service model will be done taking into account availability of returned units capable of repair. It remains unclear what would happen in a situation where the OEM is exempt of providing spare parts, and at the same time, there are no available units to complete the exchange service.

Therefore, it is considered that this section of the VA does not address appropriately the issue of prolonging average printer lifetime, considering that it exempts a large market share of printers from providing spare parts.

Therefore, this issue has been considered non-compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Quantified and Staged objectives.

## 6.4.8 Polymer composition

### Description

Section 3.4 of self-regulation guidelines on Quantified and staged objectives state that

*The self-regulation measure should list all the types of products within its scope, provide definitions of these products, and list product types belonging to the product group falling within the scope of the self-regulation measure but exempt from its requirements. Justifications should be provided for any exemptions made.*

It also states that

*The requirements should apply to at least 90% of all units.*

Section 7.6 of the VA 2021 presents commitments on polymer composition. However, these commitments are not applicable to OM products. The exclusion of OM products from the commitments on polymer composition has not been justified, and might affect the 90% applicability rule, which might be in conflict with criteria on Quantified and staged objectives.

#### Stakeholder feedback

Although there is no data regarding the percentage of products that would be exempted from this requirement, there is a concern that excluding TEC products will lead to a significant number of products not being covered by the polymer composition commitments.

#### VA rationale

OEMs argue that the requirements were leveraged from Blue Angel and EPEAT. The relevant conformity assessment procedures are used, and the scope of applicability was also harmonized. Leveraging requirements from applicable ecolabels is an example of an action that is “likely to deliver the policy objectives faster or in a less costly manner than mandatory requirements” and is therefore an important element in a VA.

#### Assessment

The exclusion of OM products from this commitment has not been justified in the VA proposal. Moreover, this exemption does not add any significant improvement compared with the current situation, since polymer composition in the current VA is addressed with the same level of ambition.

This exclusion can be interpreted as non-compliance with Section 3.4 of the Self-Regulation Guidelines, in terms of Quantified and Staged objectives, because no justification has been provided for the non-applicability of TEC products. It is also unclear if this might affect the 90% applicability rule.

However, based on the feedback collected as part of this project, material composition of printers does not seem to be a priority in terms of environmental impacts. Although ideally every product should be covered under this commitment (both TEC and OM), the potential benefits of including both appear small.

### 6.4.9 Post-consumer recycled plastic

#### Description

Section 7.7 of the VA 2021 states commitments on recycled plastic content of products. The commitment says that

*For all Products OEM Signatories shall make information available to Customers on the minimum percentage of postconsumer recycled plastic content, calculated as a percentage of total plastic (by weight) in each Product*

However, the VA 2021 does not propose any targets for recycled plastic content. This might be in conflict with Criteria 2 of Annex VIII of ecodesign Directive on Added value.

#### Stakeholder feedback

NGOs highlight that, contrary to the aims of the Circular Economy Action Plan, the proposed VA does not propose any targets for recycled plastic content in printer products, only a commitment to provide information to consumers on such content if present.

This aspect was also mentioned by Huang et al (2019) as a potential improvement to include in VA 2021:

*Manufacturers could be required to ensure that a certain percentage of products meet ambition levels of post-consumer recycled content in their products. This would allow the manufacturers some flexibility which ensuring that there were stretch goals on non-energy in use environmental design features*

#### VA rationale

OEMs highlight that considerable work is ongoing to develop standard methodologies for the calculation, verification and reporting of recycled content plastics in products. This work needs to be done at least at the level of EEE and today a common standard for certification/verification does not exist.

#### Assessment

Based on the feedback collected as part of this project, increasing the amount of recycled plastic in printers does not seem to be a priority in terms of reducing their environmental impact. On top of that, there is no standard methodology available to verify compliance of this commitment.

This aspect is considered compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Added value.

## 6.5 Information requirements

### 6.5.1 List of qualified products

#### Description

In the Annex VIII of the Ecodesign Directive it is established that:

*With a view to ensuring transparency, self-regulatory initiatives must be publicised, including through the use of the Internet and other electronic means of disseminating information.*

*The same must apply to interim and final monitoring reports. Stakeholders including Member States, industry, environmental NGOs and consumers' associations must be invited to comment on a self-regulatory initiative.*

In Section 3.5 of Self-Regulation Guidelines on Involvement of civil society, it is established that

*The website should contain an up-to-date lists of products declared compliant by the signatories*

Section 8.1 of the VA 2021 states that

*The up-to-date list of qualified Products, according to the requirements set out in Sections 5 to 8 of this Voluntary Agreement, together with additional information on how these Products were tested (e.g. parameters and results) will be published on the EuroVAprint website in the format shown in Annex G.*

In the VA 2021, the publication list of qualified products does not apply to Section 9 regarding cartridges, which might be in conflict with Self-regulation guidelines.

#### Stakeholder feedback

The product information that is proposed to be made publicly available (tables in Annex G) does not include information related to material efficiency requirements. According to NGOs, this will result in significant gaps in transparency with regard to implementation.

#### VA rationale

OEMs argue that there is no need to set out material efficiency information beyond stating that the product complies with the VA requirements. According to them, there is little value in just restating the requirements of the VA and it is sufficient to state that the product meets the VA requirements. They add that the requirement to list products that satisfy the requirements of the VA was discussed over the last three years with the Commission and the draft VA has been written to address the Commission's requirements in those discussions.

#### Assessment

This section is related to the provision of relevant information to the general public regarding compliant products. Most of the technical criteria in the VA 2021 is related to printers. Beyond reuse targets and design commitments, there are no technical criteria in the VA 2021 that refer specifically to cartridges.

This aspect is considered compliant with self-regulation criteria of Annex VIII of the Ecodesign Directive, particularly in terms of Involvement of civil society.



## 6.6 Cartridge commitments

### 6.6.1 Cartridge and printer design commitments

#### Description

In previous sections of this report (sections 4.3.3, 4.3.4 and 4.3.5), a number of barriers for the reuse of cartridges were described, fundamentally the use of chips that prevent printing with a remanufactured cartridge, and the presence of software in the printer that prevents the acceptance of non-original cartridges. The VA 2021 addresses these issues in Section 9.1 and Section 9.3.

Section 9.1 of the VA 2021 states that:

*Signatories shall not design, or modify during remanufacturing, any Cartridge or Container to prevent:*

*Printing (including cartridge acceptance, calibration, clean and align printheads, and not blocking Data Collection Agents) in the Product for which it is intended with a Remanufactured Cartridge, Refilled Cartridge, Remanufactured Container or Refilled Container produced by any Supporting Signatory;*

*and its recycling.*

Section 9.3 of the VA 2021 states that:

*Neither the Product nor any OEM software or firmware updates for the Product shall be designed to prevent printing (including cartridge acceptance, calibration and, clean and align printheads) using:*

*a Remanufactured Cartridge or Refilled Cartridge produced by a Supporting Signatory that functions using only Original Electronic Circuitry; or*

*a Remanufactured or Refilled Container produced by a Supporting Signatory that functions using only Original Electronic Circuitry.*

The commitments in Sections 9.1 and 9.3 are only applicable if the cartridge has been remanufactured by a Supporting Signatory. This might leave out of the commitment a considerable number of cartridges, which might be in conflict with criteria for self-regulation guidelines on Quantified and staged objectives:

*The requirements should apply to at least 90 % of all units (covered by the self-regulation measure) placed on the market and/or put into service by each signatory.*

Moreover, although different in terms of wording, these commitments were already available in the current version of the VA (and therefore applicable since 2015). There is a concern that commitments in Section 9.1 and 9.3 will not reduce the introduction of technical barriers for reuse in new cartridges, which might be in conflict with criteria on Added value of Annex VIII of ecodesign Directive:

*Self-regulatory initiatives must deliver added value (more than 'business as usual') in terms of the improved overall environmental performance of the product covered.*

#### Stakeholder feedback

Different stakeholders have expressed concerns over the restricted scope of these commitments, because they are only applicable when the cartridge has been remanufactured by a Supporting Signatory. Remanufacturers point out that even less cartridges than today might be remanufactured if these commitments are endorsed. NGOs add that if the commitments only apply to cartridges remanufactured by Supporting Signatories, there is a risk of leaving a significant amount of SMEs out of the market.

In Section 9.3 of the VA there is also a reference to cartridges using Original Electronic Circuitry. There is a concern among some stakeholders regarding the applicability of this commitment to cartridges without electronic circuitry.

Some stakeholders indicate that commitments in sections 5.4.1 and 5.4.2 of VA 2015 were proven to not work, essentially because they included a clause that exempted them if innovation was prevented or limited, a clause that OEMs were using to exempt their cartridges from the commitments (this clause is not included in the new VA proposal).

Member States consider that without ambitious reuse targets for cartridges, these commitments will not overcome the issues related to chips and software described in section 4.3.3 of this report. They add that these commitments would almost be irrelevant if the VA would contain strict and ambitious reuse targets.

In addition, the main technical barrier that prevents the reuse of cartridges (the use of chips) is not mentioned in the commitment.

#### VA rationale

OEMs indicate that sections 9.1 and 9.3 were designed to build on the approach taken in VA 2015, which is to set out a design obligation for cartridges and a design obligation for printers.

Section 9.1 is the design obligation for cartridges, and it is written generally so that signatories commit not to design or modify during remanufacturing cartridges or containers so that they will not print when remanufactured or refilled. The commitment would apply to any design or modification used to prevent the functionality listed: that would include chips. Any attempt to list design features or technologies that could be used to prevent printing with remanufactured or refilled cartridges would run the risk of being incomplete and therefore it is best to leave the commitment general.

In terms of the complex wording, OEMs point out that it is the result of careful negotiations between EVAP and the remanufacturers bringing their detailed industry knowledge into the process. The wording has been carefully reviewed by both teams to make it achieve the specific aims and avoid gaps and loopholes.

OEMs confirm that this commitment is only applicable to cartridges remanufactured by Supporting Signatories. This has been done to tackle the unfair competition of clones manufacturers that enter the market with low price remanufactured cartridges that may not comply with all quality and environmental requirements. It has also been introduced as an incentive for remanufacturers to become Supporting Signatories of the VA 2021.

In terms of cartridges without original electric circuitry, according to OEMs, the vast majority of printing systems on the market today use cartridges that have electronic circuitry. This is key to delivering the functionalities and quality expected by customers. Given these expectations it is virtually inconceivable that manufacturers would go back to cartridges without electronic circuitry. They add that the cartridge design commitment (Section 9.1) applies to all kinds of cartridges (with and without electronic circuitry). The reason that the printer design commitment (Section 9.3) focuses on the issue of electronic circuitry is because, without some form of electronic circuitry with which the printer identifies the cartridge, there is no printer design issue relating to cartridge acceptance to address.

#### Assessment

Commitments in Sections 9.1 and 9.3 in VA 2021 are essentially the same commitments already available in VA 2015 (Sections 5.4.1 and 5.4.2). However, the commitments appear to be more restricted in VA 2021, since they are only applicable to cartridges remanufactured by a Supporting Signatory. Ideally, from an ecodesign perspective, cartridges should be available for remanufacturing by any organisation operating in the market, and not only by a limited number of remanufacturers.

It is worth highlighting that the VA does not require to have a minimum threshold in terms of market share for Supporting Signatories (as it does for printers: 80%). Therefore, the commitments not to use technical barriers may be applicable to a very restricted part of the market. Compared with current situation, this commitment does not add a significant improvement, apart from the removal of the clause regarding the prevention of innovation. Considering that in the VA proposal this commitment is applicable to a restricted section of the market (the Supporting Signatories), it could be interpreted that the level of ambition is lower than today.

These sections of the VA do not seem to address appropriately the issue of low cartridge reuse. There is a risk that even less cartridges than today are subject to the design commitments. These sections do not seem either to unblock the technical barriers related to chips and software. Therefore, this aspect is considered non-compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Quantified and staged objectives.

### 6.6.2 Bilateral arrangements

Sections 9.1 and 9.3 of VA 2021 contain commitments to ensure that remanufactured cartridges still have the function of printing. However, cartridges generally have other additional functionalities (such as page

count or toner/ink level gauge) that are not included in those commitments. In the VA 2021, these extra functionalities are ensured via bilateral arrangements (Section 9.5). In this section, the OEMs commit to:

*offer bilateral arrangements on commercially reasonable terms (...) that provide the following elements for printing with remanufactured cartridges:*

*-a functioning ink or toner level gauge and/or approximate page count remaining*

*-single installation message without the use of inflammatory terminology*

*-that the functionality above (...) is not impacted by software or firmware updates.*

There are several concerns regarding bilateral arrangements in the context of the imaging equipment VA. These concerns will be evaluated individually in the following sub-sections.

#### *6.6.2.1 Bilateral arrangements, ecodesign Directive and WEEE*

##### Description

It is unclear if the commitments included in Section 9.5 of the VA are within the scope of an ecodesign self-regulation initiative. This might be in conflict with criteria in Annex VIII of ecodesign Directive on Sustainability:

*Self-regulatory initiatives must respond to the policy objectives of this Directive including the integrated approach, and must be consistent with the economic and social dimensions of sustainable development. The protection of the interests of consumers, health, quality of life and economic interests, must be integrated.*

It is also unclear if these commitments are in conflict with Article 4 of the WEEE Directive:

*Member States shall take appropriate measures so that the ecodesign requirements facilitating reuse and treatment of WEEE established in the framework of Directive 2009/125 are applied and producers do not prevent through specific design features or manufacturing processes, WEEE from being reused, unless such specific design features or manufacturing process present overriding advantages, for example, with regard to the protection of the environment and/or safety requirements.*

##### Stakeholder feedback

Some stakeholders consider that bilateral arrangements are not ecodesign-type commitments and strongly advice their removal from VA 2021. In their view, having clause 9.5 in the VA would look like the Commission is endorsing certain commercial practices on the cartridges market, and this should be strictly avoided. Remanufacturers consider as well that voluntary agreements are environment policy tools, not tools to regulate the market.

Most of stakeholders consulted consider that the section on bilateral arrangements is prescribing how the actual targets on reuse should be achieved. They consider that a voluntary agreement should be focused on the commitments, rather than on how these commitments are achieved. In essence, bilateral arrangements are interpreted an aspect that OEMs and remanufacturers should arrange between themselves without intervention of a voluntary agreement to be endorsed by the Commission.

Member State representatives add that, similar to the commitments in section 9.1 and 9.3 of the VA, with ambitious reuse targets, there would be no need to have a clause on bilateral arrangements in the VA. According to them it should be for the OEMs to determine how to achieve these targets, without prescribing how this should be achieved.

In terms of bilateral arrangements and their relationship with the WEEE Directive, NGOs and remanufacturers consider that bilateral arrangements are in conflict with Article 4 of WEEE. In opposition to that, Member States representatives do not see a particular conflict in this sense.

##### VA rationale

OEMs argue that Section 9.5 of the VA 2021 has been designed to address the issue of the functionality a cartridge has when remanufactured using the original electronic circuitry. According to them, in the April 2019 Stakeholder Meeting and December 2019 Consultation Forum, a key point raised by remanufacturers was that the ink/toner level gauge does not function when they remanufacture a cartridge using the original electronic circuitry. Section 9.5 of the VA is designed to provide solutions to this.

In terms of how bilateral arrangements would work in practice, OEMs highlight that the VA deliberately does not specify “how” OEMs should provide the functionality referred to in paragraph 9.5. This must be down to the discretion of the OEM but, most likely, bilateral arrangements would be commercial agreements between the individual OEM and remanufacturer to either sell or reset chips, or put the remanufacturer in a position to reset chips, so that the remanufacturer’s cartridges can have the functionality specified.

### Assessment

Bilateral arrangements are indirectly related to ecodesign, since their goal is to facilitate remanufacturing of cartridges. However, the remanufacturing that is facilitated is limited to a relatively small segment of the market (the Supporting Signatories), which might be in conflict with the criteria of self-regulation initiatives on Quantified and staged objectives (“requirements applicable to 90% of units”). Overall, instead of setting design requirements, the principle of bilateral arrangements seems to guide the market to operate in a specific way: defining the relationships between manufacturers and remanufacturers.

Bilateral arrangements have been explained by OEMs as “a solution to address the issue of the cartridge functionality when remanufactured”. However, it must be noted that this issue (certain functionalities being blocked) may have been introduced by the same OEMs. Bilateral arrangements are essentially contracts established between OEMs and remanufacturers to allow cartridges being reused: a contract where the remanufacturer could be asked to pay a fee so that the OEM removes the technical barrier, most likely an encrypted chip.

It appears less clear whether bilateral arrangements are in conflict with Article 4 of the WEEE Directive. This directive is not aimed at OEMs, it is transposed in national legislation (therefore not directly applicable to OEMs). Moreover, the functionality limitation does not block the reuse of the cartridge but limits the functionality of the reused cartridge, for instance by not offering the page count anymore.

#### *6.6.2.2 Technical competence needed to remanufacture cartridges*

### Description

It is unclear whether the intervention of OEMs is essential, in order to remanufacture a cartridge with full functionality. Activities for preparation for reuse are addressed differently easier in other product groups regulated under ecodesign. This might be in conflict with criteria in Annex VIII of ecodesign Directive on Added value:

*Self-regulatory initiatives must deliver added value (more than business as usual) in terms of overall environmental performance of the product covered*

Moreover, the provision of this extra functionality in remanufactured cartridges is limited to a restricted section of the market (the Supporting Signatories), which might be in conflict with criteria in Annex VIII of ecodesign Directive on Quantified and Staged Objectives:

*The requirements should apply to at least 90% of units placed on the market by each Signatory*

### Stakeholder feedback

Some remanufacturers argue that although some level of competence is needed to remanufacture a cartridge with full functionality, most of the remaining remanufacturers in the market have the competence to do it. They highlight that the limited functionality of cartridges when they have been depleted is software-based, artificially done by OEMs so that remanufacturers need to enter into bilateral arrangements with them.

### VA rationale

OEMs justify the need of clause 9.5 on bilateral arrangements, indicating that some level of technical competence is required to remanufacture a cartridge with full functionality. They highlight that, in order to have those extra functionalities, from a technical point of view some form of intervention is needed. According to manufacturers, some level of technical competence is required to complete this step, hence the need to establish bilateral arrangements with Signatories.

OEMs argue that with current cartridge technology, it is unavoidable that when a cartridge is depleted, it loses level gauge accuracy unless the level is set again to zero. They add that without adding significant additional material and cost to the cartridge, the methods used by manufacturers provide the best experience for the customer. When the cartridge has been remanufactured, the printer and cartridge have no way of determining

how much toner/ink is in the cartridge. This means that the printer/chip needs to be given new information on the fill level for the ink/toner level gauge to function.

### Assessment

In other product groups where technical competence is required to repair the appliance in question, Ecodesign Directive implementing measures require manufacturers to provide access to repair information to professional repairers. Before providing access to this information, manufacturers can require professional repairers to demonstrate such technical competence, based on an official registration system. Proof of an insurance covering liabilities resulting from its activity, can also be required.

It is fair from OEMs point of view to require some level of technical competence from professionals remanufacturing their original products. However, bilateral arrangements in Section 9.5 of the VA do not establish any conditions or requirements in terms of technical competence. It only describes how the negotiations should be established between OEMs and remanufacturers (in good faith, on commercially reasonable terms, etc.). If technical competence of remanufacturers is a concern for OEMs, then the conditions of bilateral arrangements should be clear and based on that technical competence.

Compared with current situation, the limitation to provide this extra functionality only to a restricted part of the market (the Supporting Signatories) does not add a significant improvement in terms of the overall environmental performance of the product.

#### *6.6.2.3 Bilateral arrangements and fair competition*

##### Description

In order to remanufacture a cartridge with full functionality, remanufacturers may need to enter into a bilateral arrangements with an OEM. Considering that most of the remanufacturing sector is composed of SMEs, it might be difficult for many of them to enter into a bilateral arrangement with an OEM, limiting fair competition. This might be in conflict with criteria in Annex VIII of ecodesign on Representativeness:

*Care must be taken to ensure respect for competition rules*

##### Stakeholder feedback

According to the remanufacturing sector, there is a risk of leaving many small and medium operators out of the cartridge remanufacturing market. They add that there are few incentives for OEMs to enter into a bilateral arrangement with small remanufacturers, because those firms lack the required critical mass needed to receive a bilateral arrangement. They also consider that applicable provisions are vaguely worded in the VA and that it is unclear how many or what format bilateral arrangements will have, and what they will deliver in practice. In their view, it is likely that only a small number of remanufacturers will receive offers for a bilateral arrangement, and even fewer will have signed one. That might constitute an unfair limitation of fair competition.

One Member State representative consulted agrees in the weak negotiating position of SMEs in establishing bilateral arrangements, because OEMs will generally prefer reaching arrangements with two or three large remanufacturers, than with a larger number of small ones. Another Member State representative is less concerned about the position of remanufacturers in these negotiations. In their view, if an ambitious reuse target is set, this should force manufacturers to work with remanufacturers, in order to achieve the target. They add that it is unlikely that OEMs will achieve reuse targets by themselves, so they will need to find other actors in the market. In essence, an increase in the reuse targets may benefit the ones with the knowledge in the remanufacturing activity (remanufacturers). A potential consequence of this might be that remanufacturing companies are acquired by bigger manufacturers (market consolidation).

##### VA rationale

OEMs do not foresee the position of remanufacturers in negotiations as a potential issue, because if OEMs wish to use the bilateral arrangements approach, then the VA requires them to offer bilateral arrangements on commercially reasonable terms. The specific terms will depend on the technology and the particular solution but to be commercially reasonable an offer will have to form a reasonable basis for an agreement.

They add that there is a requirement for the parties to negotiate in good faith, a term that is widely used in connection with agreements and negotiations. It is intended to place an explicit obligation upon OEMs and the remanufacturers to negotiate and to do so fairly. If an OEM or remanufacturer doesn't do so, then this

provides the basis for a complaint that can be considered by the Independent Inspector and the Steering Committee.

Assuming good faith, the OEM and individual remanufacturers will then have to negotiate the actual agreements. The requirements of each individual remanufacturer may differ and therefore each negotiation and each eventual agreement will differ. Where an OEM opts to use bilateral arrangements, it will have to actually enter into bilateral arrangements in order to comply with the VA.

The VA requires the OEM to enter into bilateral arrangements with at least 50% of the signatories that remanufacture its collected OEM cartridges using the original electronic circuitry. OEMs highlight that if the compliance threshold were set at 100%, then there would be no incentive for the remanufacturers to negotiate. Equally the requirement to make an offer on commercially reasonable terms and to negotiate in good faith acts to prevent OEMs from stopping negotiations once they have signed the minimum number of bilateral arrangements.

OEMs expect that creating this incentive to negotiate on both sides will result in the best and fairest outcomes. Apart from the Annual Compliance Report process, if companies do not enter into bilateral arrangements or provide the functionality solutions by other means, then remanufacturers will leave the VA and the European Commission would likely withdraw support for the VA. Therefore, there is a fundamental incentive for OEMs to make this work.

### Assessment

The remanufacturing industry is characterised by a large number of small and medium enterprises, which may find it difficult to establish a bilateral arrangement with a large corporation such as the Signatories of the VA. The possibility to access the remanufacturing market should be open for anyone meeting clear conditions, and not a limited amount of organisations that are able to achieve a bilateral arrangement with an OEM.

At the moment, there are only four Supporting Signatories in the VA 2021, which signals limited interest or support from remanufacturers, in particular SMEs, to join the VA. It has been argued that bilateral arrangements are a way to create an incentive for remanufacturers to join the VA. However, joining the VA entails some costs for remanufacturers. A scenario can be envisaged where a SME remanufacturer joins the VA, contributes to its costs, but still is unable to reach a bilateral arrangement. In this scenario, the SME would be paying to maintain the VA, without access to the only benefits (access to extra functionalities in cartridges).

Increasing competition in the cartridge remanufacturing sector is expected to have significant benefits in terms of ecodesign, as it could help increase current reuse rates. The need to establish a commercial agreement with an OEM in order to remanufacture a cartridge with full functionality seems a step in the opposite direction. However, there are no indications that elements related to bilateral arrangements are not compliant with applicable competition rules.

#### *6.6.2.4 Bilateral arrangements and transparency*

##### Description

In terms of transparency, Section 9.5.6 of the VA 2021 states that

*Nothing in this VA obliges any Signatory or Supporting Signatory to divulge any competitively sensitive provision of any bilateral arrangement to which it is a party.*

*(Annex D-2) Details of concluded arrangements, or the offer of such, are to remain confidential. In the annual compliance report the evidence above shall be anonymous.*

Bilateral arrangements are therefore proposed to be confidential. This might be in conflict with self-regulation guidelines on Added value:

*If some or all of the signatories have concluded a separate agreement or association of any kind in relation to the objectives of the self-regulation measure, all relevant documents relating to the agreement or the association should be mentioned and made publicly available.*

##### Stakeholder feedback

The potential issue of transparency in the context of the bilateral arrangement was brought up by NGOs. In their view, if bilateral arrangements are confidential, it precludes any possibility for outside scrutiny.

## VA rationale

In terms of transparency, manufacturers argue that the VA provides a balance: on the one hand, the principles of the bilateral arrangements set out in Annex I should be public, while on the other hand, individually negotiated bilateral arrangements need not be. According to manufacturers, it has always been part of delivering the VA that the signatories have commercial freedom to reach individual bilateral arrangements with various counterparts, who may have different characteristics and relationships to each other.

Manufacturers add that individually negotiated bilateral arrangements are competitively sensitive. The proposed draft VA differs from anything in existence in ecodesign voluntary agreements in that it involves bilateral arrangements between signatories from different sectors of the industry to enable remanufacturing. Allowing those negotiations and the eventual arrangements to remain confidential will support open negotiations between the parties, support competition, and allow the parties to protect confidential information including trade secrets.

According to manufacturers, if OEM Signatories have to produce standard bilateral arrangements that are not subject to a confidential negotiation, those standard bilateral arrangements are likely to benefit some Supporting Signatories more than others, depending on the specifics of their businesses.

## Assessment

With the above clauses, there seems to be some conflict with Self-Regulation Guidelines in terms of transparency. Even if bilateral arrangements were considered a valid solution in the context of this VA, it would be impossible for any independent inspector to evaluate the conditions in which these agreements are established.

### *6.6.2.5 Overall Assessment of bilateral arrangements*

This section of the VA does not seem to address appropriately the issue of low cartridge reuse. It does not seem to sufficiently unblock the technical barriers related to reuse. The provided solutions are restricted to specific confidential arrangements, only available to supporting signatories of the VA. The ability to enter into such arrangements does not seem to be based on technical competences as a precondition. The provisions raise concerns over the ability of SMEs to gain access to bilateral arrangements.

Overall, the provisions on bilateral arrangements do not comply with Annex VIII of the Ecodesign Directive on self-regulation initiatives (particularly in terms of Quantified and staged objectives and Added value), in particular since the design commitments associated with bilateral arrangements only apply to a limited segment of the market and in view of the confidentiality of bilateral arrangements.

Therefore, this aspect is considered non-compliant with self-regulation criteria of Annex VIII of ecodesign Directive.

## 6.6.3 Exemptions on Subscription and Service models

### Description

Section 9.1 of the VA establishes cartridge design commitments. This commitment tries to tackle the issues related to technical barriers that prevent printing with remanufactured cartridges

The VA 2021 includes some exemptions where these commitments do not apply. One of these exemptions is included in Section 9.2, where it states that the cartridge design commitment does not apply when the cartridge has been supplied under a subscription or service model. In those cases, it is established that

*The Signatory shall take back (...) and remanufacture or recycle the Cartridges.*

*The Signatory shall provide solutions through bilateral arrangements (...) so that the Cartridges can be remanufactured by Supporting Signatories.*

*The quantities of those Cartridges (...) shall be reported under the process set out in Paragraph 9.11 and Annex J.*

According to OEMs, under that business model there is a risk that a consumer might receive the printer and the cartridge, stop paying the monthly fee, but carry on printing. To avoid this, the manufacturer needs to be able to stop the service if the consumer stops paying.

With this exemption, under subscription and service models OEMs can design cartridges that have technical barriers that prevent them from printing if they are remanufactured. Considering current market trends, a large and rising amount of cartridges might be excluded from the design commitments, which might be in conflict with Self-regulation guidelines criteria on Quantified and staged objectives:

*The requirements should apply to at least 90 % of all units*

#### Stakeholder feedback

Some stakeholders have shown concerns on the justification for this exemption. They consider that consumer mistrust in circumventing the contract is not a sufficient argument to leave a considerable amount of cartridges out of the design commitments. Moreover, there is no data available that shows how often these circumventions are taking place.

Member states mention similar arguments to the ones provided in previous sections: with ambitious reuse targets these exemptions would lose relevance, because OEMs would need to find solutions to make sure they comply with the targets.

NGOs disagree with this exemption. In their view, this is an attempt of OEMs to leave out of the design commitments as many cartridges as possible and it has not been justified properly.

Some remanufacturers highlight that a large part of the cartridge market would be excluded from the VA with this exemption. This would result in less cartridge reuse in the EU. They add that there is a risk that with this exemption, around 70-80% of cartridges will be excluded from the cartridge design commitments.

Some remanufacturers also consider that these business models have an effect on printers' lifetime. They state that when a subscription contract expires and a new contract is established, the original printers are generally replaced with a new one.

#### VA rationale

OEMs highlight that subscription and service models are an important part of the existing printing market. They also consider that subscription and service models present a number of benefits from a circular economy perspective, in terms of:

- Reduce: by spreading the cost for customers over the period of the subscription or contract, higher yield cartridges can be supplied without creating upfront costs that would be unacceptable to customers. This means that fewer cartridges can be supplied for the same amount of printing
- Reuse: subscription and service models usually enable companies to have a closer relationship with customers that enables higher return rates through more controlled collection processes. Higher return rates of cartridges that are in better condition increases opportunities for reuse
- Recycle: higher return rates also create opportunities to increase recycling rates where cartridges or their components can't be reused. Controlled collection increases the ability for companies to return recycled plastic into their own manufacturing operations

OEMs add that it is beneficial for customers if companies offer different business models for selling printing products or services.

Under these business models the manufacturer needs to have a way to prevent the consumer from circumventing the agreement. As with any other service, the manufacturer needs to be able to stop the service if the customer stops paying. For example, under some subscription models the manufacturer designs the cartridge so that it becomes associated with that particular printer and can stop it from printing if the customer stops paying. The consequence is that, if that cartridge is remanufactured, it would not print. Hence the need of the exemption in Section 9.2.

In the conditions where this exemption is applied and signatories are allowed to prevent the use of remanufactured cartridges, the VA ensure end of life solutions for the original cartridges by either take the cartridge back or provide solutions so that the cartridge can be remanufactured (as stated in section 9.2.1.1 and 9.2.1.2 of the VA).

OEMs argue that if the VA doesn't include the exception in paragraph 9.2 then these business models would be prevented.

According to OEMs, these models account for less than 10% of the market and the likely trend is to increase. OEMs also insist that subscription and service model cartridges are subject to the reuse targets.

#### Assessment



First, it is worth noting that no definition is provided in the VA 2021 regarding subscription and service models. As already indicated in Section 3.3.2 of this report, there is a high variety of models in the market that can be understood as subscriptions. This lack of definition introduces ambiguity in the commitment. Subscription and service models are also a growing market share, so this exemption potentially could involve a large market share of cartridges in the near future.

Endorsing this exemption means that, if a cartridge has been sold under any kind of subscription, OEMs would be allowed to introduce a technical barrier that prevents its reuse. This exemption could be interpreted as a non-compliance with the Self-Regulation Guidelines. If a Signatory has a large market share on subscription and service models, it could mean that a large proportion of the cartridges they produce are exempt of complying with the cartridge design commitments. While the OEMs commit to take back the supplied cartridges, the VA provides the option to recycle them rather than remanufacturing them.

Subscription and service models provide an opportunity for developing the circular economy, because there is an incentive for OEMs to design more durable cartridges or with higher page yields. There are also higher opportunities for cartridge reuse if OEMs establish collection and reuse systems of the cartridges they place on the market under these business models. However, with this exemption, there is a limitation to third party repair and reuse, so the circularity benefits might be lost in the long run. Allowing this exemption may have negative consequences on the remanufacturing rate, since there will be a restriction to the opportunities for remanufacturing.

Compared with current situation, the inclusion of this exemption in the VA proposal does not add a significant improvement, since the cartridge design commitment would be applicable to less cartridges than today (this exemption is not included in current VA).

This aspect is considered non-compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Quantified and staged objectives.

#### 6.6.4 Exemptions when customer agrees to use only OEM cartridges

##### Description

Section 9.3 of the VA establishes printer design commitments aiming at avoiding the use of software and firmware to prevent printing using remanufactured cartridges. An exemption on the printer design commitment is included in Section 9.4 of the VA 2021, where it states that the printer design commitment

*shall not apply during the period for which the end user customer made a decision through a contract, terms and conditions, or printer features based on clearly presented information to use only OEM Cartridges.*

*Where this paragraph applies, the OEM Signatory shall provide a solution through bilateral arrangements to the Supporting Signatories to make them accept cartridges after the contract period is finished.*

In essence, under these business models, when buying a printer the customer agrees contractually to buy cartridges only from that OEM for a specific period of time. According to OEMs, under that business model there is a risk that a consumer might use not only original cartridges, but also compatible or remanufactured cartridges for some periods of time. To avoid this, the OEMs need to be able to prevent the customer from printing when a non-OEM cartridge is used.

With this exemption, OEMs can design printers that have software-based barriers that block the use of remanufactured or new compatible cartridges. Considering current market trends, this could have a detrimental impact on the remanufacturing market. This clause includes terms which are open to interpretation, such as “clearly presented information”.

There might be as well a conflict with section 3.4 of Self-Regulation Guidelines on Quantified and staged objectives, which states that:

*The requirements should apply to at least 90% of all units placed on the market by each signatory*

##### Stakeholder feedback

Remanufacturers argue that this exemption will have a negative effect on the remanufacturing industry and on the total amount of reused cartridges. If remanufactured cartridges are blocked in printers under these business models, consumers are discouraged to buy them.

NGOs add that there is a risk that OEMs may make use of this exemption by informing the consumer (e.g. by placing a sticker on external packaging or a dedicated section on the product website) that they should use OEM cartridges only. Also, the term “clearly presented information” might be open to interpretation.

#### VA rationale

Similar to the case of subscription and service models, OEMs argue that some customers try to circumvent these contracts by using other cartridges. For instance, a customer buys a printer at a discount with the commitment to use only cartridges from that OEM. The customer starts using those cartridges but at some point switches to potentially cheaper remanufactured or 3<sup>rd</sup> party cartridges. According to OEMs, for this business model to work, they need to be able to prevent the customer from doing that.

According to OEMs there is no basis for suggesting that the VA 2021 allows companies to conceal the details of the business model or otherwise deceive customers, since these business models still have to adhere to all the appropriate consumer protection requirements.

#### Assessment

If a Signatory has a large market share printers sold under these business models, it could mean that a large proportion of the printers they produce are exempt of complying with the printer design commitments. This exemption could be interpreted as a non-compliance with the 90% applicability rule of Quantified and Staged objectives.

This proposal does not seem to bring any benefit for the consumer. If a consumer wishes to use only original cartridges, they can do it freely without the need of a contract. Moreover, if a customer has accepted willingly the conditions of a contract, the obligations of both the provider of the service and of the customer are determined by other regulatory instruments, rather than ecodesign.

This section of the VA does not seem to address appropriately the issue of low cartridge reuse as it would reduce the opportunities for the reuse of the cartridges. This aspect is considered non-compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Quantified and staged objectives.

### 6.6.5 Page yield

#### Description

In terms of page yield, the VA 2021 states that

*Signatories shall measure page yield in accordance with the relevant ISO/IEC Standards.*

*Signatories shall make yield information available to Customers via freely accessible websites or in user manuals.*

*This obligation shall not apply for Cartridges that are only supplied under business models where the end user customer pays for a service or on a per page basis.*

Low page yields result in more frequent consumable replacements and contributes to the generation of waste. The VA 2021 includes a commitment to inform the consumer on page yield, but not a minimum threshold, which might be in conflict with criteria in Annex VIII of ecodesign Directive on Added value:

*Self-regulatory initiatives must deliver added value (more than business as usual) in terms of the improved overall environmental performance of the product covered*

#### Stakeholder feedback

Some stakeholders consider that the introduction of page yield information in the VA proposal is an important step forward, in comparison with the current VA. In their view, it is essential to inform the customer about the fundamental characteristics of the product, so that they can choose appropriately.

Member States would be in favour of introducing commitments of minimum page yield. According to them it would not need to be a particularly strict threshold, but a minimum level of compliance in order to gradually remove the worst products in the market from page yield point of view. NGOs agree with this position: they

strongly support the idea of including minimum thresholds for page yield. They also highlight that the commitment in section 9.8 of the VA excludes cartridges that are supplied under product-as-service business models.

Remanufacturers consider that low content cartridges should be banned from the market. They also introduce the topic of “introductory cartridges” (cartridges sold together with printers). These cartridges are reported to contain less ink than the cartridges sold separately by OEMs.

Another issue related to this topic mentioned by remanufacturers is the introduction of design features with the only purpose of reducing page yield. They explain that a cartridge has a fixed outside shape. According to them, OEMs have reduced the toner/ink content, with techniques such as the addition of compartments inside the ink compartment to reduce its size or leaving an empty space inside the cartridge that has no function other than reducing the total ink content inside the cartridge (see Section 4.3.1 of this report).

### VA rationale

According to OEMs, the page yield of cartridges is one of a number of product characteristics on which companies compete. Page yield also depends on product type and on the prevalent technology of the business model where the cartridge is supplied. In their view, it would be undesirable from a competition perspective to harmonise this through the VA.

OEMs add that cartridge size is driven by a number of factors including customer price preference, material efficiency (including ink) and customer usage. Cartridges are generally physically smaller than those of 20 years ago but, notwithstanding that, they may deliver as many or even more pages to the customer than their predecessors. This is due to how efficient the system is in using ink/toner to deliver an acceptable print to the customer. These improvements have greatly reduced the materials consumed and placed on the market.

### Assessment

Low page yields result in more frequent consumable replacements and therefore contribute to the generation of waste. Most of the commitments regarding cartridges in the VA 2021 have the aim of increasing cartridge reuse, but even before that, cartridge waste should be avoided or reduced, and this could be done by increasing cartridge page yield.

This commitment in the VA proposal does not seem to add a significant value compared to current situation. Although there is a commitment to provide information to consumer on this parameters, this is already done in most cases today. The absence of a minimum threshold in terms of page yield suggests that the level of ambition on this topic is not sufficient.

This section of the VA does not seem to address appropriately the issues of high waste generation and low cartridge reuse due to low page yield. Therefore, this aspect is considered non-compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Added value.

Having a commitment on minimum page yield is expected to have multiple advantages. First, it is very much in line with the typical ecodesign requirement: it is related to the product itself, it drives design changes, it would be relatively easy to measure and demonstrate compliance, and it would most likely provide benefits in terms of waste reduction and circularity.

Second, it can be seen as a technology-neutral indicator. Page yield can be improved in different ways: increasing cartridge capacity, improving the efficiency of the printing operation, optimising cartridge design, etc. Each OEM could follow different strategies to reach the minimum threshold.

Third, a generalised increase in page yield would be beneficial for the remanufacturing industry as well. If a remanufacturer wants to remanufacture a cartridge up to its maximum capacity while it contains a separate compartment to reduce page yield (see Section 4.3.1 of this report), they will need to remove this, increasing the complexity of the remanufacturing process.

An example of an indicator based on the page yield that might be used is the “consumable mass resource efficiency”. Page yield material efficiency is the page yield achieved per amount of material (mass) of consumable. This indicator could incentivise manufacturers to design cartridges to optimise ink/toner capacity, and also to design cartridges which are more efficient from the material use perspective.

An example of application of this kind of requirement can be seen in Technical Specification (TS) 17 of the GPP Criteria for imaging equipment (Kaps et al, 2020). This TS (Consumable mass resource efficiency) states that:

The consumable mass resource efficiency (measured number of images that may be produced by a consumable per gram of the consumable material) calculated according to equation (1) must not be lower than the threshold indicated in the table below:

Consumable type	Minimum consumable mass resource efficiency
Toner cartridge or container & drum	$(2 \times [10 \times \tanh(0.1 + 0.0003 \times (C_{Mass} - 10)) - 0.5] + 1)$
Ink cartridge or container	$(2 \times [15 \times \tanh(0.2 + 0.0004 \times (C_{Mass} - 8)) - 1] + 2)$

Tanh = hyperbolic tangent

$$(1) \text{ Consumable mass resource efficiency} = \frac{\text{Page yield}}{\text{Consumable mass}}$$

The thresholds and formulas presented in this section are not a formal proposal for the calculation of consumable mass resource efficiency thresholds, but an example of already available requirements that may have been included in the VA 2021.

## 6.6.6 Patents and intellectual property

### Description

Section 9.9 of the VA 2021 states that

*Nothing in this Voluntary Agreement shall be construed or applied so as to limit OEM Signatories' or Supporting Signatories' obligations to comply with the law relating to Intellectual Property or construed or applied to prevent OEM Signatories or Supporting Signatories from or to limit them in taking legal action to protect their Intellectual Property.*

As already indicated in Section 4.3.5 of this report, one of the main legal barriers affecting cartridge reuse is related to copyright and patent issues. Fundamentally, the inappropriate granting of patents on non-innovative aspects of printer cartridge design and on the remanufacturing process itself (Waugh et al, 2018).

The VA 2021 does not include any specific commitment to avoid the use of inappropriate patents.

### Stakeholder feedback

In their annual report (ETIRA, 2021), the association of cartridge remanufacturers address the issue of patents. They point out that most OEMs have registered thousands of national and EU-wide patents on parts of, or on the entire cartridge, which can make (re)manufacturing that cartridge illegal. Very often, the patents concern in particular those parts of the cartridge that are subject to wear and tear, which makes it impossible to legally exchange these parts, yet is needed in order to produce a quality alternative product.

They add that patents on remanufacturing are a permanent problem for their industry. They state that some OEMs apply for patents which merely seek to render the activity of remanufacturing OEM cartridges impossible, even when they do not remanufacture cartridges themselves. Thus, they pro-actively prevent the environmentally friendly reuse of their product, only for commercial reasons. In their view, the European Patent Office EPO grants patents too easily.

This topic was also mentioned in the report by Huang et al (2019) as a potential improvement for the VA 2021:

*Disclosure of patents on any consumables which may restrict third party remanufacturing.*

*Disclosure of any legal actions taken against third party remanufacturers for breaching intellectual property rights that cover any aspect of remanufacturing.*

### VA rationale

OEMs do not recognize this as an issue. In their view, the purpose of the patent system is to encourage innovation. In order to be awarded a patent, the applicant must demonstrate to the relevant patent office that the invention is novel and involves what is known as an "inventive step." In other words, the invention must be new and not obvious in view of what has been done before. Therefore, there is no concern that OEMs could

have been granted patents for non-innovative aspects. They consider that the European Patent Office (EPO) has a reputation of being competent and thorough in making its assessments of when to grant patents.

OEMs add that the purpose of the patent system is to protect inventions. Without this the incentive to invest and innovate is undermined. Those who do invest and innovate would have their inventions immediately copied at lower cost by competitors. So, patents are an essential part of modern economies and legal systems. A patent is a form of property ("intellectual property"). Requesting OEMs to not enforce patents that they have been legally granted would be a major departure from the philosophy and legal reason for having a patent system. In their view, it is essentially a request that the OEMs forfeit rights that they have been legally granted by government patent offices.

### Assessment

Although this topic has been highlighted as a relevant issue by some stakeholders, the JRC considers that there is not sufficient information available to judge whether inappropriate patents have been widely awarded in the imaging equipment sector. It is out of the scope of this assessment to evaluate the work conducted by the European Patent Office in this sector.

If any inappropriate patents have been awarded in some products, there are other regulatory instruments that can deal with these type of issues, which cannot be addressed by neither a voluntary agreement nor with ecodesign implementing measures.

This aspect is considered compliant with self-regulation criteria of Annex VIII of ecodesign Directive.

## 6.6.7 Cartridge reuse targets

In Section 9.10 of VA 2021, reuse rate targets are established for Signatories, as well as an accounting methodology and a reporting system. A number of concerns have been identified regarding reuse rate targets and the methodology to evaluate them. These aspects will be evaluated in the following sub-sections.

### 6.6.7.1 *Ambition level of reuse rate targets*

#### Description

In the VA proposal, the below reuse targets are established:

*Reuse rate targets:*

*Toner cartridges and containers: 40%*

*Ink cartridges and containers: 14%*

Proposed reuse rates targets may not be ambitious enough to change the business-as-usual current practice, which might be in conflict with criteria in Annex VIII of ecodesign Directive on Added value.

#### Stakeholder feedback

Reuse targets have been extensively discussed in specific meetings with different members of the industry prior to the development of this report (Target subgroup meetings, minutes available in EuroVAPrint website).

A Member State representative involved in those conversations is in favour of having reuse targets for cartridges and containers. While their inclusion can be seen as an improvement in VA 2021, the level of ambition of these targets is seen as insufficient. In the view of this Member State representative, a reuse target should drive a significant shift in businesses models towards reuse of cartridges and containers (despite challenges related to logistics and customer confidence), but the proposed targets will not change current situation, as they can be easily met. A more reasonable target according to this MS representative would be: 60% for toner cartridges and 40% for ink cartridges.

Another MS representative suggests that that the proposed targets could be more ambitious, and recommends raising them to 49% for toner and 18% for ink.

According to NGOs, the targets are unlikely to have any genuine impact on the manufacturing market in Europe. This view is shared by some members of the remanufacturing industry, which recommend that a clear and ambitious reuse target must be set: 45% within two years and 60% within four years. They add that without fixed targets, reuse of cartridges will not grow. They add that 80% reuse targets are feasible (as it is stated in Waugh et al, 2018). They acknowledge this target will not be easy achieve and that drastic changes would be needed.

## VA rationale

Manufacturers consider that the VA 2021 includes meaningful incentives for cartridge reuse. It contains binding targets to increase remanufacturing rates significantly by 2025.

In the target subgroup, EVAP and the remanufacturers shared and discussed the available data and industry experience and concluded that the best available baseline estimate is a remanufacturing rate of 7% for ink cartridges and 27% for toner cartridges.

EVAP and the remanufacturers agreed in the targets subgroup that an appropriately ambitious goal would be to increase remanufacturing rates to 14% for ink and 40% for toner by 2025.

The subgroup discussed in detail the factors that contribute to remanufacturing rates and concluded that the primary issues are the rates of collection for empty cartridges and market factors of clone cartridges eroding the price to a point where remanufactured cartridges cannot compete. Remanufacturers also confirmed in the subgroup meetings that they do not remanufacture clone cartridges due to their low quality, inconsistency and concerns over substances they may contain.

For clarification, OEMs provide data on the factors used to calculate current reuse rates and the subsequent targets (Table 12).

**Table 12. Factors used to estimate reuse rates**

		Collection rate	Viable percentage	Remanufacturing rate	Reuse rate
Toner	Waugh et al (2018)	25%	86%	92%	20%
	OEMs estimate 2021	70%	50%	76%	27%
	Target 2025	80%	65%	78%	40%
Ink	Waugh et al (2018)	18%	84%	87%	13%
	OEMs estimate 2021	15%	70%	68%	7%
	Target 2025	25%	80%	70%	14%

Collection rate: Estimate of percentage of cartridges collected through recognized collection processes.

Viable percentage: Estimate of percentage collected or purchased by anticipated Signatories and considered viable for reuse. It takes into account cartridges life cycle factors and market factors.

Remanufacturing rate: Estimate reflecting losses due to damaged cartridges or losses in production process.

Reuse rate: Collection rate X Viable percentage X Remanufacturing rate

## Assessment

In the absence of reliable data in parameters such as collection rate, viable percentage and remanufacturing rate, the JRC realises that it is complex to establish fair and ambitious reuse targets. In any case, based on available literature and the general feedback collected, it appears that the reuse rates proposed (14% for ink and 40% for toner) are not sufficiently ambitious.

As it can be seen in Table 12, the reuse rate factors proposed for the VA are directly related to the low collection rates, viable percentages and remanufacturing rates currently assumed by OEMs. Based on their figures, current reuse rates are 27% for toner and 7% for ink. In their view, the targets proposed (40% for toner and 14% for ink) are ambitious enough considering current these low reuse rates.

However, in Article 7 of the WEEE Directive, it is stated that

*From 2019, the minimum collection rate to be achieved annually shall be 65% of the average weight of EEE placed on the market in the three preceding years in the Member State concerned*

Therefore, the collection rates considered –particularly for ink- to calculate the reuse rate targets, are well below the minimum required in the WEEE Directive. Considering data from Waugh et al (2018) in terms of

viable percentage and remanufacturing rate, together with the minimum collection rate stipulated by the WEEE directive, more ambitious reuse targets could be:

*Toner: 65% collection rate x 86% viable percentage x 92% remanufacturing rate = 51%*

*Ink: 65% collection rate x 84% viable percentage x 87% remanufacturing rate = 47%*

These targets are closer in terms of ambition level to the ones recommended by the Member States (between 49-60% for toner and between 18-40% for ink).

Therefore, this aspect is considered non-compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Added value.

#### 6.6.7.2 The Mc factor

##### Description

In the VA proposal, the Reuse Rate (RR) shall be calculated for each Signatory as follows

$$RR = \frac{B/Mc}{A + (B/Mc)}$$

*A = all new OEM Cartridges, new OEM Containers, Newbuild Cartridges and Newbuild Containers made available on the EU market during the relevant calendar year by a Signatory*

*B = All Remanufactured Cartridges, Remanufactured Containers, Refilled Cartridges and Refilled Containers made available during the relevant calendar year that were originally made available by the same Signatory referred to in A.*

*Mc = the % of the market for Remanufactured Cartridges, Refilled Cartridges, Remanufactured Containers and Refilled Containers that is participating in the VA.*

An adjustment factor has been included in the formula to take into account that, for a specific Signatory, not all the remanufacturing takes place within the VA (the Mc factor). This factor is estimated based on data provided by a 3<sup>rd</sup> party market research firm on a yearly basis. Based on this estimation, data reported on Reuse Rates might be inaccurate, which might be in conflict with criteria in Annex VIII of ecodesign Directive on Quantified and staged objectives, which state that

*It must be possible to monitor compliance with objectives and (interim) targets in an affordable and credible way using clear and reliable indicators. Research information and scientific and technological background data must facilitate the development of these indicators.*

Moreover, it is unclear if the formula to calculate RR including this factor sends the right incentives to the industry.

##### Stakeholder feedback

In terms of the methodology, a MS representative considers that the formula used to calculate the reuse rate of a company should not include the Mc factor, since it should consider the whole market. They add that it could create a negative incentive in terms of the number of cartridges covered under the VA. In contrast, another MS representative is not against the Mc factor, provided that always around 75% of the remanufacturing market is covered

NGOs consider that by introducing a correction factor for the percentage of the market, the proposed target might be met without significant changes to current design practices. They agree with some of the MS representatives in the potential introduction of negative incentives.

##### VA rationale

In terms of the calculation methodology, according to OEMs, the targets rely on reporting data on new cartridges and remanufactured cartridges made available by the signatories. If an OEM reports all its new cartridges and 100% of the remanufacturing market is represented in the VA and reports all cartridges of that OEM that are remanufactured, then the remanufacturing rate can be calculated directly.

However, if only 80% of the remanufacturing market is represented, then the real remanufacturing rate cannot be measured because the data collected would not represent all the remanufacturing of the OEM cartridges that is taking place.

In order to function properly, either the target would need to be reduced by an equivalent factor or the results adjusted up to represent 100% of the remanufacturing market. This seems preferable to making yearly adjustments to the targets throughout the life of the VA. The VA provides that progress towards the targets will be set out in the Annual Compliance Report, including the adjustment factor.

OEMs recognise  $M_c$  is an estimate and therefore, it will include some inaccuracy. The lower the  $M_c$  factor, then the greater the effect of that inaccuracy on the reuse rate. They add that the inaccuracy could work in favour of OEMs or against OEMs (depending on how much remanufacturing takes place in or out of the VA, for each of them).

### Assessment

In terms of the calculation method, to calculate the Reuse Rate an estimation is needed for the number of cartridges remanufactured by companies that are not a signatory to the VA. This estimation is done with the  $M_c$  factor.

Feedback from remanufacturers indicates that the current Supporting Signatories cover around 5% of the remanufacturing sector. This means that, for each OEM, a substantial part of the remanufacturing needs to be estimated. With such an estimation, targets cannot be monitored in an affordable and credible way using clear and reliable indicators, as required by admissibility criteria. Therefore, this aspect is considered non-compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Quantified and staged objectives.

#### 6.6.7.3 *Monitoring and reporting of compliance*

##### Description

In order to enable the calculation of the reuse rate, each Signatory must report the following data to the independent inspector each year:

*Number of units and weight:*

- (a) OEM Cartridges,*
- (b) OEM Containers,*
- (c) Newbuild Cartridges, and/or*
- (d) Newbuild Containers*

*that the Signatory has made available on the EU market during the relevant calendar year. The data for (a) – (d) shall be further subdivided into data for ink and toner.*

*Number of units and weight:*

- (e) Remanufactured Cartridges,*
- (f) Remanufactured Containers,*
- (g) Refilled Cartridges and/or*
- (h) Refilled Containers*

*that the Signatory has made available on the EU market during the relevant calendar year. The data for (e) – (h) shall be further subdivided into data for ink and toner and for the Signatory that originally made them available. Where the Signatory that originally made them available on the EU market cannot be identified data for (e) to (h) shall be separately reported as “unknown new” or “unknown reman”.*

*In addition to the reporting under Paragraph 4 above, the Signatories shall report separately for ink and toner the following data to the Independent Inspector for Cartridges and Container also identifying to the extent information is available the Signatory that originally made them available on the market:*

- units and weight collected;*
- units and weight exported;*
- units and weight recycled;*



- units and weight sent to energy recovery; and
- units and weight disposed of.

The level of detail of the data that Signatories must provide might not be sufficient to understand the performance of the whole collection, remanufacturing and reuse system. With the information provided by Signatories, the independent inspector might not have the ability to check that reuse rates reported are accurate.

### Stakeholder feedback

In this case, stakeholder feedback is based on recommendations from reference literature. Regarding the reporting methodology, in Huang et al (2019), the authors recommend

*The inclusion of criteria which identify the numbers and total weights of consumables collected through take back programmes and the inclusion of criteria which require reporting on the amounts of collected consumable material sent to the following end of life options: Reuse, Recycling, Waste to energy incineration, Incineration, Storage, Landfill.*

In Waugh et al (2018), the authors highlight that in the previous version of the VA (VA 2015)

*There are no explicit measures of performance in take-back, reuse or recycling of cartridges. There is no obligation to report progress on the impact of measures that could promote take-back, assist reuse and monitor recovery rates of un-reusable fractions in the way that, for example, energy use targets are, and these might usefully be addressed in revisions to the terms of the Voluntary Agreement.*

*A further area of potential lies in producers individually or collectively instituting, promoting and reporting on measures which could improve collection rates and the quality collection conditions to enable preparation for reuse activities.*

*Most OEMs use these collected items as feedstock for recycling and recovery operations including energy recovery from waste, along with a proportion of items that cannot be reused. It is the case, however, that statistics on the return rates, reuse rates and recovery rates of take-back cartridges are not published by the sector under the Voluntary Agreement, and this may be a potential area of improvement.*

### Assessment

The market of new and remanufactured cartridges is a very complex system, with plenty of actors operating a variety of activities: manufacture, collection, repair, distribution, sale, etc. These activities are conducted in different locations, including out of the EU.

For the assessment of compliance with cartridge reuse rates, Signatories provide data to the independent inspector, who evaluates it and decides whether targets are met or not. Due to the complexity of this market, it remains unclear whether the independent inspector can make an accurate and informed decision regarding the compliance of reuse rate targets.

#### *6.6.7.4 Overall assessment of reuse rate targets*

In summary, considering that reuse rates targets proposed do not seem to have the appropriate level of ambition, that reported reuse rates will in part be based on estimates, and that there will be limited verification mechanisms for those reuse rates, this section of the VA proposal does not seem to address appropriately the issue of low cartridge reuse.

This aspect is considered non-compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Added value and Quantified and staged objectives.

## **6.7 Verification, Reporting and Organizational aspects**

### **6.7.1 Resource efficiency report**

#### Description

In Section 11.2 of the VA 2021, it is stated that

*The Signatories are to ensure that EuroVAprint publishes once a year on its website an energy consumption report that is prepared by the Independent Inspector*

Cartridge reuse has been identified as one of the main areas to be addressed by the VA. However, the report published on the website only includes information on energy efficiency, which might be in conflict with the criteria listed in Annex VIII of ecodesign Directive, particularly in terms of Monitoring and Reporting:

*The plan for monitoring and reporting must be detailed, transparent and objective.*

#### Stakeholder feedback

There is no commitment to publish information on the website regarding other relevant environmental aspects of this product group, such as material efficiency of cartridges, reuse rates, etc.

#### VA rationale

OEMs do not agree that it would make more sense to publish wider sets of information. The draft VA already specifies where information will be published. This is the result of discussions throughout the revision process over the last three years and they do not think that additional reporting is needed.

#### Assessment

Taking into account that cartridge reuse is one of the main aspects that the VA 2021 is trying to address, it would be valuable if some information was reported regarding the performance of the whole collection and reuse system. In addition to that, energy consumption is not the main environmental hotspot in this product group and the gains to obtain are almost marginal, so publishing a report on energy consumption has limited value today, compared to a hypothetical report on cartridge resource efficiency. This aspect could be considered as a potential improvement for a potential next version of the VA.

Therefore, this aspect is considered non-compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Monitoring and Reporting.

### 6.7.2 Voting rules

In Section 14.3 of the VA 2021, it is stated that

*Where a call is made to follow the decision-making procedure set out in this 14.3 a subcommittee shall be appointed to consider the issue and make a recommendation. The subcommittee shall consist of 5 OEM Signatories in the case of matters relating to Sections 5 to 8 of the Voluntary Agreement and shall consist of 5 OEM Signatories and 5 Supporting Signatories in case of matters relating to Section 1 to 4 and 9 to 18 of the Voluntary Agreement*

#### Description

There is a risk of non-balanced voting with current numbers of Signatories and Supporting Signatories in the VA, which might be in conflict with criteria in Annex VIII of ecodesign Directive on Involvement of civil society.

#### Stakeholder feedback

NGOs highlight that the previously existing equal voting rights among signatories have been replaced with a procedure to establish a subcommittee. Considering the limited number of remanufacturers that are currently signatories to the proposed VA, this would mean that the OEMs would in the foreseeable future always have a majority in case of disagreement.

#### VA rationale

OEMs argue that having different parts of the industry represented in the VA creates a challenge for ensuring fair decision-making processes under the VA. It was recognized that there would, most likely, always be one industry group outnumbering the other. This was the reason for creating a sub-committee procedure involving equal numbers of OEM Signatories and Supporting Signatories.

OEMs expect that the eventual number of Supporting Signatories will exceed 5 and therefore a sub-committee of 5 OEM Signatories and 5 Supporting Signatories seemed reasonable. In the event that there is a VA with fewer than 5 Supporting Signatories common sense would dictate changing the numbers in any sub-committee to make it balanced.

#### Assessment

Section 3.5 of Self-Regulation Guidelines on Steering Committee state that

*The Steering Committee should consist of all signatories to the self-regulation measure and the Commission. Each of these should be represented by one member who all have equal voting rights*

The creation of a sub-committee of equal numbers for Signatories and Supporting Signatories seems a reasonable solution to reach consensus in the decision-making process.

This aspect is considered compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Involvement of civil society.

## 6.8 Other aspects not included in VA

This section includes aspects that have not been included in the current proposal of VA.

### 6.8.1 Hazardous substances

#### Description

VA 2021 does not have specific restrictions on hazardous material content in toners and inks. Similarly, the VA 2021 does not include any requirement on halogenated flame retardants, which might be in conflict with criteria in Annex VIII of ecodesign Directive on Added value.

#### Stakeholder feedback

An example of application of a similar requirements on specific restrictions on hazardous substances can be found in the Green Public Procurement for Imaging Equipment (Kaps et al, 2020), in Technical Specification 18 (Consumable hazardous substance content):

*Colourants such as toners, inks, solid inks and the like must not contain substances as intentionally added constituents which meet the conditions set out in the table below (see GPP document for reference table).*

*In addition, colourants must not contain substances as intentionally added constituents which require labelling of the mixture with the H phrases according to Annex 1 of Regulation (EC) No. 1272/2008 or which meet the criteria of the related classification (see GPP document for reference table).*

*Consumables must also meet the following hazardous material requirements:*

*Not contain any additional REACH candidate list substances at a concentration greater than 0.1% (by weight)*

*Toners and inks must not contain any intentionally added mercury, cadmium, lead, nickel or chromium-VI-compounds. Complex nickel compounds of high molecular weight used as colourants are exempted.*

*Toner and inks must not contain azo dyes (dyes or pigments) that can release carcinogenic aromatic amines listed in Regulation (EC) 1907/2006 (REACH Regulation), Annex XVII, Appendix 8.*

*No biocides must be added to toners or inks unless an active substance dossier, as defined under the Biocidal Product Regulation (BPR, Regulation (EU) 528/2012) for preservatives for products during storage (product type 6), has been submitted. Substances must not be used where they have been rejected from inclusion in the list of approved substances for product type 6.*

*Photoconductor drums must not contain intentionally added selenium, lead, mercury or cadmium (or any of their compounds).*

NGOs also highlighted that contrary to the existing ecodesign rules for electronic displays, the VA does not include any restriction on the use of halogenated flame retardants or other additives in printer enclosures in order to facilitate their recycling. An example of application of this type of requirement can be found in the Green Public Procurement for Imaging Equipment (Kaps et al, 2020), in Technical Specification 12 (Hazardous substance content):

*Halogenated polymers and halogenated organic compounds for their use as flame retardants are not permitted.*

The inclusion of a requirement on hazardous substances for consumables was also recommended by Huang et al (2019) in their report:

*Hazardous substances in toner cartridges shall be declared by Signatories as Safety Data Sheets in the official language of each Member State in freely accessible websites or another readily accessible form for customers.*

#### VA rationale

OEMs highlight that inks and toners are mixtures of substances under EU chemicals legislation. The EU already has a comprehensive set of legislation addressing substances and mixtures including the ability to impose restrictions where necessary. This is a highly complex topic and any legal restrictions have to go through detailed scientific assessments.

They add that the topic of ink and toner formulations is also highly sensitive from a competitive perspective. Companies work very hard to develop their ink and toner formulations for performance, hazard and other characteristics and consider the information to be extremely confidential. OEMs note that the VA (and ecodesign legislation) is not an appropriate vehicle for including requirements on ink and toner formulations. Nevertheless, the VA does include a commitment to comply with all such legislation (Section 9.7 of the VA).

#### Assessment

The JRC agrees with EVAP on the fact that this is a highly complex topic and that legal restrictions have to go through detailed scientific assessments. At this point, there is no available information to suggest that inks and toners should have additional substance restrictions beyond the already covered by generic regulation mentioned in the VA 2021. The complexity of this topic also suggests that a VA is not the appropriate instrument to regulate it.

This aspect is considered compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Added value.

### 6.8.2 Cartridge print quality

#### Description

Print quality is a parameter that can influence on one of the environmental hotspots in this product group: paper consumption. It can also help to differentiate products that have been manufactured with ambitious standards in terms of quality, environment and safety, from those products which have not.

The VA 2021 does not include any minimum requirement in terms of printing quality, which might be in conflict with criteria in Annex VIII of ecodesign Directive on Added value.

#### Stakeholder feedback

An example of application of this type of requirement can be seen in the Green Public Procurement for Imaging Equipment (Kaps et al, 2020), in Technical Specification 20 (Consumable quality):

*Any cartridges or containers must meet all requirements behind at least one widely recognised cartridge/container quality standard.*

The inclusion of a requirement on cartridge print quality was also recommended by Huang et al (2019) in their report.

#### VA rationale

The industry's view is that cartridge print quality is not one of the priorities for progressing the industry towards a circular economy. Moreover, they consider print quality a competitive aspect of cartridges for which it would not make sense to regulate.

#### Assessment

The purpose of these type of thresholds on minimum quality is to remove the lowest performing products in the market. However, this measure would only make sense on a regulatory measure. The manufacturers of

clone cartridges are not and will likely never be a VA signatory. Therefore, a VA would not be able to take these type of cartridges out of the market.

Therefore, this aspect is considered compliant with self-regulation criteria of Annex VIII of ecodesign Directive, particularly in terms of Added value.

### 6.8.3 Additional resource efficiency requirements for cartridges

#### Description

The VA 2021 lacks resource efficiency requirements applicable to cartridges in terms of parts marking, repair instructions or limitations on material use, which may be in conflict with criteria in Annex VIII of ecodesign Directive on Added value.

#### Stakeholder feedback

Considering the large quantities of cartridges entering the EU market yearly and current low reuse rates, it might be relevant to include commitments for cartridges regarding:

- parts marking: mark all plastic parts above certain mass and dimension, according to ISO 11469 and ISO 1043;
- replacement instructions of spare parts;
- limit the variety of materials used, plastic casing parts with a mass greater than 100 g.

The inclusion of such requirements was also recommended by Huang et al (2019) and Waugh et al (2018) in their reports.

#### VA rationale

The industry's view is that additional resource efficiency requirements for cartridges are not a priority for progressing the industry towards a circular economy.

#### Assessment

These additional resource efficiency requirements have not been highlighted by the remanufacturing industry as a priority, or as an aspect that would help them increase the total amount of reused cartridges. Moreover, requirements on parts marking are more related to recycling than to reuse. Therefore, it does not seem a priority to include commitments on these aspects.

This aspect is considered to be compliant with self-regulation criteria of Annex VIII of ecodesign Directive.

### 6.8.4 Internal power supplies

#### Description

The VA 2021 does not include any requirement on minimum performance of internal power supplies, which may be in conflict with criteria in Annex VIII of ecodesign Directive on Added value.

#### Stakeholder feedback

NGOs highlight that internal power supply efficiency requirements should be introduced.

The inclusion of this requirement was also recommended by Huang et al (2019):

*Signatories shall publish the nameplate rated output power and efficiency levels of any power supply included within, or supplied for use with, all imaging equipment within scope of the VA.*

#### VA rationale

OEMs argue that ENERGY STAR efficiency approaches (OM and TEC) have already driven internal power supply efficiency to levels where any further gains that could be achieved would be marginal. Separate internal power supply efficiency requirements are unnecessary and would be redundant.

#### Assessment

Considering the marginal gains that could be obtained by introducing commitments on internal power supplies, taking into account that energy consumption is not a priority in the context of this product group, it does not seem necessary to include additional commitments on this topic.

This aspect is considered compliant with self-regulation criteria of Annex VIII of ecodesign Directive.

#### 6.8.5 Noise emissions

##### Description

The VA 2021 does not include any requirement on noise emissions for imaging equipment products, which may be in conflict with criteria in Annex VIII of ecodesign Directive on Added value.

##### Stakeholder feedback

An example of application of this type of requirement can be found in the Green Public Procurement for Imaging Equipment (Kaps et al, 2020), in Technical Specification 10 (Noise emissions):

*The A-weighted sound power level  $LWA$  must be determined according to ISO 7779. Devices capable of colour printing must be tested in both monochrome mode ( $LWA,M$ ) and colour mode ( $LWA,F$ ).*

The inclusion of a requirement on noise emissions was also recommended by Huang et al (2019) in their report.

##### VA rationale

OEMs argue that the main reference point used by the industry is the criteria set out in ecolabels such as the Blue Angel. Ecolabels are generally designed to set ambitious targets that are not necessarily achievable for all products and all companies and are used by industry as competitive differentiators.

##### Assessment

Although noise emissions has not been highlighted as a priority by stakeholders, it seems that it could become an important topic in a work environment where printers are used extensively. The JRC agrees that threshold on noise emissions are more relevant in an ecolabel than in an ecodesign Directive. However, a potential improvement on this topic for future versions of the VA would be to include an information requirement on the noise level of the printer.

This aspect is considered compliant with self-regulation criteria of Annex VIII of ecodesign Directive.

#### 6.8.6 Air emissions

##### Description

The VA 2021 does not include any requirement on air emissions of imaging equipment products, which may be in conflict with criteria in Annex VIII of ecodesign Directive on Added value.

##### Stakeholder feedback

This was highlighted by NGOs, which indicated that there should be some commitments on the emission rate by the imaging equipment of substances such as volatile organic compounds, particulate matter, benzene, styrene, ozone or dust.

An example of application of this type of requirement can be found in the Green Public Procurement for Imaging Equipment (Kaps et al, 2020), in Technical Specification 9 (Substance emissions):

*Imaging equipment (tested with the OEM cartridge) must meet the following substance emission rate requirements when measured according to the test procedure detailed in Blue Angel specification RAL-UZ 205 (See GPP criteria for reference)*

This was also recommended by Huang et al (2019) in their report:

*For all laser equipment models placed on the market after 1 Jan 2020 and tested with a specific toner cartridge according to Blue Angel current test procedure, emissions shall not exceed limit values regarding the release of TVOCs, undefined VOCs, Styrene, Benzene, ozone, dust and ultrafine particles as defined by Blue Angel RAL-UZ-206.*

##### VA rationale

OEMs argue that the main reference point used by the industry in terms of substance emissions are the criteria set out in the Blue Angel Ecolabel. In their view, ecolabels are generally designed to set ambitious targets that are not necessarily achievable for all products and all companies.

#### Assessment

Similarly to noise emissions, air emissions has not been highlighted as a priority by stakeholders. However it also seems that it could become an important topic in a work environment where printers are used extensively. The JRC agrees that threshold on air emissions are more relevant in an ecolabel than in an ecodesign Directive. However, a potential improvement on this topic for future versions of the VA would be to include an information requirement on the level of air emissions of the printer.

This aspect is considered compliant with self-regulation criteria of Annex VIII of ecodesign Directive.

## 6.9 Summary of assessment

Table 13 provides a summary of the aspects that have been identified as non-compliant with self-regulation criteria of Annex VIII of ecodesign Directive.

**Table 13. Summary of issues identified in VA 2021**

Issue	Description	Assessment of compliance <sup>(1)</sup>
Exemption for printers <300 EUR	A large market share of printers is exempt from providing spare parts to consumers.	Non-compliant with Quantified and staged objectives
Polymer composition	The exclusion of OM products from the commitments on polymer composition has not been justified, and might affect the 90% applicability rule	Non-compliant with Quantified and staged objectives
Cartridge and printer design commitments	The commitments in Sections 9.1 and 9.3 are only applicable if the cartridge has been remanufactured by a Supporting Signatory.	Non-compliant with Quantified and staged objectives
Bilateral arrangements	<p>The provided solutions are restricted to specific confidential arrangements, only available to supporting signatories of the VA.</p> <p>The ability to enter into such arrangements does not seem to be based on technical competences as a precondition.</p> <p>The provisions raise concerns over the ability of SMEs to gain access to bilateral arrangements.</p> <p>Bilateral arrangements are expected to be confidential.</p>	Non-compliant with Quantified and staged objectives, Added value
Exemptions on Subscription and Service models	A large proportion of the cartridges that an OEM produces are exempt of complying with the cartridge design commitments	Non-compliant with Quantified and staged objectives
Exemptions when customer agrees to use only OEM cartridges	A large proportion of the printer that an OEM produces are exempt of complying with the printer design commitments	Non-compliant with Quantified and staged objectives
Page yield	The absence of a minimum threshold in terms of page yield suggests that the level of ambition on	Non-compliant with Added value

	this topic is not sufficient.	
Cartridge reuse targets	<p>Proposed reuse rates targets may not be ambitious enough to change the business-as-usual current practice.</p> <p>To calculate the Reuse Rate an estimation is needed for the number of cartridges remanufactured by companies that are not a signatory to the VA. With such an estimation, targets cannot be monitored in an affordable and credible way using clear and reliable indicators</p> <p>There will be limited verification mechanisms for those reuse rates</p>	Non-compliant with Added value, Quantified and staged objectives
Resource efficiency report	Publishing a report on energy consumption has limited value today, compared to a hypothetical report on cartridge resource efficiency	Non-compliant with Monitoring and Reporting

(1) with admissibility criteria of Annex VIII of ecodesign regulation

A number of clauses have been introduced in the VA with the aim of prolonging average printer lifetime, mainly in sections 7.4 and 7.5 of the VA. The list of spare parts, the availability period of such spare parts and the delivery times seem to contribute effectively to printer lifetime extension. These aspects are also in line with similar products regulated under the ecodesign Directive.

However, section 7.4.6 includes the possibility of offering a “replace by refurbished” option rather than providing spare parts, for printers below 300EUR, if the OEM wishes to do so. The JRC considers that this option, without offering the possibility to buy spare parts, increases the risk of continuing with current trend of quick replacement cycles of printers.

In a “replaced by refurbished” scenario, the customer will need to pay for the replaced printer. If the price of this printer is not attractive, the customer might be inclined to purchase a new one. While the provision could facilitate the placing on the market of refurbished printers, it should complement the provisioning of spare parts rather than replacing it. The JRC considers that providing the spare parts indicated in the list of section 7.4.2 of the VA can contribute to average printer lifetime extension, if no exemptions are made.

The exemption in clause 7.4.6 is in conflict with criteria in Annex VIII of ecodesign Directive on Added value and Quantified and staged objectives. However, the issue of prolonging printer average lifetime would not be solved simply by removing this clause, as this issue is related to other factors (economical, educational) that are out of the scope of the Ecodesign Directive and particularly of a VA.

A number of clauses have been introduced in the VA with the aim of reducing cartridge waste, mainly in sections 9.1, 9.6 and 9.10.

The first commitment in the VA 2021 regarding cartridges is the cartridge design commitment (Section 9.1), which has the aim of reducing cartridge waste, by banning the use of technical barriers that prevent remanufactured cartridges from printing. This commitment is a step in the right direction to increase cartridge circularity. Ideally, this commitment should be applicable to every cartridge placed on the market. However, the VA includes several situations where this commitment does not apply:

- if the cartridge is sold under a subscription service model, it will be exempt from the design commitments;
- If the cartridge is sold on its own but it is not remanufactured by a Supporting Signatory, it would also be exempt from the design commitments.
- If the cartridge is remanufactured by a Supporting Signatory, only if the Supporting Signatory has reached a bilateral arrangement will be able to bring the cartridge back to its initial functionality.
- if a remanufactured cartridge with full functionality is used in a printer sold under a contract that locks the consumer to original cartridges, it may still not work.



In essence, there are several instances in which cartridges are allowed to have technical barriers that prevent their reuse or do not get full functionality. The scenario in which a depleted cartridge is remanufactured up to its initial functionalities seems like an exception, rather than the rule.

Bilateral arrangements are also an aspect of concern, which has been considered non-compliant with criteria in Annex VIII of Ecodesign Directive. There is clear interrelation between bilateral arrangements and cartridge design commitments. Bilateral arrangements have been presented as a solution for the lack of certain functionalities in remanufactured cartridges. However, this lack of functionality may have been intentionally caused by OEMs with technical barriers.

Another aspect that can contribute to reduce the generation of waste is the use of cartridges with higher page yield. In the VA proposal, the lack of commitment on a minimum page yield threshold allows placing in the market cartridges with a very low page yield, often with features that prevent easy remanufacturing, such as internal compartments to reduce ink/toner capacity (Figure 3).

Reuse rate targets proposed do not seem to have the right level of ambition. According to most of the stakeholders consulted, this may fail in stimulating OEMs to change current situation in terms of cartridge design, business models, collection systems, etc. Moreover, due to the complexity of this market, it remains unclear whether the independent inspector can make an accurate and informed decision regarding the compliance of reuse rate targets.

## 6.10 Request for amendments in the VA

The evaluation conducted in section 6 identified a few elements within the VA that are non-compliant with self-regulation guidelines or with the required level of ambition of the Circular Economy Action Plan (see Table 13). However, before proceeding with the final rejection of the VA proposal and formal inclusion in the Ecodesign Working Plan 2022-2024 (European Commission, 2022), the Commission suggested some final amendments to the text of the VA that would have solved the non-compliances in order to still allow the VA endorsement:

- Removal of clause 7.4.2. Spare parts should be provided for all printers placed on the market, instead of only for printers costing more than 300 EUR. It is acceptable to provide a tailored list for printers above and below 300 EUR.
- Modification of clause 7.6. Polymer composition commitments should be applicable for TEC and OM printers (the Commission clarified that this specific aspect was considered less relevant for the final endorsement decision).
- Modification of clause 9.1. The cartridge design commitment should apply to cartridges that have been remanufactured by any remanufacturer in the market and not only to Supporting Signatories. The reference to “produced by a Supporting Signatory” should be removed.
- Modification of clause 9.2. Cartridges sold under Subscription and Service models could be exempt of cartridge design commitments. However, every cartridge supplied under a Subscription and Service model should be collected and reused by the OEM. Recycling should only be allowed if remanufacturing is not technically feasible because the cartridge is damaged. In those cases, this should be appropriately justified in the reporting.
- Modification of clause 9.3. Printer design commitments should apply to cartridges that have been remanufactured by any remanufacturer in the market and not only to Supporting Signatories. The reference to “produced by a Supporting Signatory” should be removed.
- Removal of clause 9.4. Printer design commitments should apply to every cartridge in the market.
- Modification of clause 9.5. OEMs should commit to offer solutions for full functionality in remanufactured cartridges to every remanufacturer in the market, and not only to Supporting Signatories, on commercially reasonable terms.

- Modification of clause 9.8. A requirement on a minimum threshold on cartridge page yield should be included. This requirement can be based on TS17 of GPP Criteria (Kaps et al, 2020). A tiered and scaled approach might be followed.
- Removal of clause 9.10. Considering the lack of reliable data, the uncertainty of the indicators proposed and the monitoring and reporting methodology, it is unclear how reuse rate targets might help in reducing the amount of cartridge-related waste.

It is considered that a voluntary agreement with the modifications included in this section could bring significant benefits in terms of environmental performance and circularity in the imaging equipment sector. It would still allow OEMs to compete on different aspects such as printing quality, technical functionalities and price, while allowing the access of remanufacturing operators to used cartridges with full functionality, potentially increasing the total amount of reused cartridges and therefore reducing the amount of electronic waste generated. Modifying those elements of the VA would also solve the most relevant aspects of the VA that are non-compliant with criteria of ecodesign for admissibility of self-regulation. In essence, a VA with the suggested modifications would be more in line with similar product groups under the ecodesign Directive.

## 6.11 EVAP counterproposal and JRC re-assessment

EVAP provided a series of counterproposals to each of the aspects:

- Accepted the proposal to provide a list of 8 spare parts for printers <300 EUR. On top of that, EVAP proposed to remove the reference to the “replace by refurbished” option.
- Did not provide a counterproposal on making the polymer composition commitments applicable to both TEC and OM printers.
- Accepted the proposal to delete the references to “produced by a Supporting Signatory” in Section 9.1 and 9.3 of the VA.
- On the proposal to modify clause 9.2 by explicitly requiring the reuse of these collected consumables, leaving recycling as an option only if this is not possible because the consumables are damaged, EVAP proposed a different wording in their counterproposal, “the Signatory shall take back and remanufacture or recycle the cartridges prioritising reuse wherever possible” instead of referring to a specific condition “remanufacturing is not technically feasible because the cartridge is damaged” as suggested by the Commission.
- On the proposal to remove clause 9.4 on “the ability for printers to block reused consumables in case the customer has agreed to use only OEM consumables”, EVAP responded that EVAP members need this exemption in relation to business models that are already on the market and under which the customer decides to use only OEM cartridges. They added that these business models may also include cartridges that are remanufactured or refilled by or for the OEM, or that the OEM buys from remanufacturers. EVAP proposed to add a paragraph agreeing “to develop a solution or solutions so that any business models relying on Paragraph 9.4 can include remanufactured or refilled cartridges or containers in the future”
- On the proposal to modify clause 9.5 on returning cartridges to full initial functionality, EVAP did not agree to delete the references to Supporting Signatories and to confidential commercial arrangement with an OEM. They consider it reasonable and appropriate to maintain the existing wording and to encourage companies involved in remanufacturing to join the VA and sign up to the commitments set out in the VA in order to receive access to the benefits provided in Paragraph 9.5. They added that eliminating the reference to Supporting Signatory raises free rider concerns. The model underpinning the VA is to reward remanufacturers who join the VA, and who accept the attending obligations such as establishing or participating in take-back programs, by providing those signatory remanufacturers with added value under the Bilateral Arrangements. In their view, if remanufacturers could obtain access to the benefits of the Bilateral Arrangements without accepting the VA, remanufacturers who do not undertake the obligations under the VA would have a competitive advantage over those who do. They proposed to add specific additional features to the list in Paragraph 9.5 for new cartridge models first placed on the market beginning 24 months after reaching alignment with remanufacturers on the new features (6 additional months).

- On the proposal to add a minimum commitment on page yield, EVAP proposed that every Signatory that offers cartridges for a printer model shall offer at least one cartridge option that satisfies the GPP TS17 criterion. In their view, GPP TS17 was designed to be part of a bid process for public procurement where the customers typically expect to print a significant number of pages and therefore are likely to purchase high yield cartridges. The VA, on the other hand, covers all parts of the market where customer needs differ. Generally, across the market the number of pages being printed by consumers is falling. Nevertheless, people do still want, and need, access to a printer. Therefore, for a wide category of customers it is very much the norm for them to demand lower yield cartridges that will satisfy their printing needs for a long time.
- On the proposal to remove the reuse targets, EVAP proposed two options:
  - Option 1. To keep the reuse targets as committed in April 2021. In their view, while the targets that have been proposed are not perfect, they represent the result of unprecedented collaboration between industry players and Member States and will drive change.
  - Option 2. To remove the targets and focus on monitoring and reporting.

Based on EVAP counterproposal, JRC conducted a final assessment of the VA, considering again admissibility criteria for self-regulation and ambition level required by the Circular Economy Action Plan. A summary of this final assessment can be seen in Table 14.

**Table 14. Summary of assessment of EVAP counterproposal**

Non-compliant aspects identified by JRC	Requested amendment	EVAP amendment or counterproposal	Final assessment of compliance with SRG or CE
Exemption for printers < 300 EUR NON-COMPLIANT QUANTIFIED & STAGED OBJECTIVES Commitment not applicable to at least 90% of units	Provide list of spare parts for all printers in the market Acceptable to have tailored lists of spare parts for printers < & > 300 EUR	Spare parts available for all printers in the market Tailored list of spare parts for printers < & > 300 EUR	COMPLIANT QUANTIFIED & STAGED OBJECTIVES
Polymer composition NON-COMPLIANT QUANTIFIED & STAGED OBJECTIVES Commitment not applicable to at least 90% of units	Polymer composition commitment applicable for both TEC and OM printers	No counterproposal	NON-COMPLIANT QUANTIFIED & STAGED OBJECTIVES Commitment still not applicable to at least 90% of units (aspect not a priority from environmental point of view)
Cartridge and Printer design commitments NON-COMPLIANT QUANTIFIED & STAGED OBJECTIVES Commitments not applicable to at least 90% of units	Remove provisions that cartridge and printer design commitments to allow printing with reused consumables, only apply if they are supplied by a Supporting Signatory	Reference to “produced by a Supporting Signatory” removed in Paragraphs 9.1 and 9.3	COMPLIANT QUANTIFIED & STAGED OBJECTIVES

Non-compliant aspects identified by JRC	Requested amendment	EVAP amendment or counterproposal	Final assessment of compliance with SRG or CE
Exemption on Subscription models NON-COMPLIANT QUANTIFIED & STAGED OBJECTIVES Commitments not applicable to at least 90% of units	Exemption is acceptable due to Circularity benefits of subscription models, if reuse is clearly prioritised, leaving other options only for when the cartridge is damaged	Text of the VA modified “prioritising reuse wherever possible”	NON-COMPLIANT QUANTIFIED & STAGED OBJECTIVES Reuse has not been clearly prioritised based on objective technical aspects Commitment still not applicable to at least 90% of units
Exemption when customer agrees to use only OEM cartridges NON-COMPLIANT QUANTIFIED & STAGED OBJECTIVES Commitment not applicable to at least 90% of units	Remove this exemption that allows blocking the use non-original cartridges	Paragraph added, committing to develop solutions that enable use of remanufactured cartridges under these business models	NON-COMPLIANT QUANTIFIED & STAGED OBJECTIVES Still possible to block the use of remanufactured cartridges. Commitment not applicable to at least 90% of units.
Bilateral arrangements NON-COMPLIANT QUANTIFIED & STAGED OBJECTIVES Commitment not applicable to at least 90% of units (BA's only available to SS) NON-COMPLIANT ADDED VALUE BA's are confidential	Elements that enable to return consumables to their original functionality should be available for every remanufacturer that demonstrates technical competence (not restricted to SS only)	Restriction to SS not removed Proposal to identify additional elements that can be included as part of BA's, in 30 months.	NON-COMPLIANT QUANTIFIED & STAGED OBJECTIVES BA's only available to SS Commitment not applicable to at least 90% of units NON-COMPLIANT ADDED VALUE BA's are confidential
Page yield NON-COMPLIANT ADDED VALUE No significant changes from current situation. No commitment on minimum page yield.	Include a requirement on minimum page yield, aligned with EU GPP criteria Acceptable to have a delayed/tiered approach to provide time to adapt	Include a commitment aligned with EU GPP TS17, applicable to at least one cartridge option and printer model.	NON-COMPLIANT ADDED VALUE Ambition level not enough. NON-COMPLIANT QUANTIFIED & STAGED OBJECTIVES Commitment not applicable to at least 90% of units.
Reuse targets NON-COMPLIANT ADDED VALUE Low ambition targets. NON-COMPLIANT QUANTIFIED & STAGED OBJECTIVES RR based on estimates. Monitoring and reporting not reliable	Remove targets for consumable reuse Focus on monitoring and reporting obligations	Two options proposed: a) Keep proposed targets b) Remove targets and focus on monitoring and reporting	Option b preferred, as long as other requests are also accepted

Some of the amendments requested were accepted by EVAP, such as the removal of the exemption for printers below 300 EUR, or the reference to “produced by a Supporting Signatories” in Sections 9.1 and 9.3 of the VA.

In the exemption for cartridges sold under subscription and service models, reuse has not been clearly prioritised over recycling, with clear and objective technical aspects. The clause “reuse wherever possible” is open to interpretation and subjectivity. With the proposed new text (“reuse wherever possible”), it is not guaranteed that a significant amount of cartridges under these business models (at least 90%) will be reused.

The exemption when customer agrees to use only OEM cartridges has not been removed. This still makes it possible to design printers that can block remanufactured cartridges, when they are remanufactured by an independent operator. This clause does not provide any benefit in terms of circularity or reduced environmental impact. First of all, it reduces reuse opportunities for remanufactured cartridges. Secondly, this design practice can be associated with “razor and blade” business models that incentivise quick replacement cycles of printers, where remanufacturing is not really worthwhile from the economic point of view.

On bilateral arrangements, it is considered that opportunities for remanufacturing should not be restricted for reasons that are different from technical capabilities. A limitation to Supporting Signatories only could be an unjustified discrimination toward the remanufacturers not joining the VA. On top of that, these contractual arrangements are necessary to overcome a technical barrier that is intentionally added to the product. Signatories argue that bilateral arrangements are a way to create an incentive for remanufacturers to join the VA. However, joining the VA entails some costs for remanufacturers. One possible scenario is that an SME remanufacturer joins the VA, contributes to its costs, but still is unable to reach a bilateral arrangement. In this scenario, the SME would be paying to maintain the VA, without access to the only benefits (access to extra functionalities in cartridges).

In terms of page yield, a requirement on minimum page yield would only have meaningful results if it is applicable to every cartridge on the market, and not to a very restricted section of it. On top of the criteria of Added value, it could also be interpreted as non-compliant with the criteria of Quantified and Staged objectives (at least 90% or products). A commitment applicable to only one cartridge version per printer model would make it very difficult for market surveillance authorities or consumers organisation to verify compliance. This “high yield” cartridge could be sold at a significantly higher price than the “regular yield” ones. OEMs could also choose a cartridge model which is not a high seller, and still be compliant. Also it is important to keep in mind that usually cartridges with very low page yield are provided as “introductory cartridges” that are sold with the printer. Having a minimum page yield should at least address the issue of introductory cartridges.

Finally, in terms of reuse targets, Option B is the preferred one (focus on reporting without targets), due to the difficulties in tracking the targets and verifying compliance. For this option to work, very limited exemptions should be allowed in the rest of commitments, therefore the other requests should be accepted.

The final assessment on the EVAP counterproposals showed that some aspects that were initially identified as non-compliant with admissibility criteria, were still non-compliant despite the modifications proposed.

## 7 Conclusions and recommendations

Between 2019 and 2021, the imaging equipment industry has been working on a new VA proposal, to include commitments on cartridge design, as well as additional material efficiency requirements and reuse targets. This proposal has been evaluated by the JRC on behalf of DG ENV between May-December 2021, to assess compliance of the VA with the requirements for self-regulation, and ensure that the level of ambition of the commitments is in line with the Circular Economy Action Plan.

In the evaluation, the JRC identified various aspects that could be considered an improvement from the current VA, such as the inclusion of cartridges within the scope of the document and the enhancement of resource efficiency commitments applicable to printers, including design for dismantling rules and a comprehensive list of spare parts. Under the VA proposal, Signatories commit to design cartridges that, when they are remanufactured, will be able to print (cartridge design commitment). They also commit to design printers that will not prevent the use of remanufactured cartridges (printer design commitment). These commitments are steps in the right direction that have the potential to improve circularity in this sector.

However, several exemptions apply to these commitments that significantly reduce this potential. Cartridge and printer design commitments only apply when the cartridge has been remanufactured by a signatory of the VA. The commitments are also not applicable when cartridges are placed on the market through a subscription service. Finally, if a consumer has agreed contractually to use only original cartridges, the printer may use software updates to block remanufactured cartridges. On top of those exemptions, only remanufacturers that are signatories of the VA would have the ability to remanufacture a cartridge up to its initial condition (keeping all its original functionalities), after establishing a bilateral arrangement. In summary, with all these exemptions, the scenario in which a depleted cartridge could be remanufactured up to its initial condition seemed like an exception, rather than the rule. According to the ecodesign self-regulation guidelines, requirements should apply to at least 90% of the products placed on the market. In view of these exemptions, it is unlikely that the VA meets this criterion.

The VA proposal also contains reuse targets for ink (14%) and toner (40%) consumables. Particularly for ink, the proposed targets are based on the assumption of relatively low collection rates. Considering collection targets for electric and electronic waste under the WEEE Directive, this collection performance is not considered sufficiently ambitious, as also pointed out by consulted Member State and stakeholder representatives, some calling for at least a doubling of the target. It is also questioned whether a reuse target is an appropriate instrument in this context. Compliance with the target cannot be reliably verified and the calculation methodology, which is partially based on estimates, further limits confidence in figures that would be reported. Therefore, the added value of this proposal does not seem to reflect the ambition level expressed in the CEAP20.

Finally, increasing page yield can reduce the amount of cartridge waste. The assessment showed that some consumables are designed to have a very low page yield. However, the VA proposal does not include commitments to increase the page yield of consumables.

After identifying these non-compliant aspects, the Commission asked EVAP for a number of amendments to be included in the text, in order to still consider to endorse the VA proposal. EVAP accepted some of the changes proposed by the Commission, but not all of them. Therefore, some of the elements initially identified were still deemed as non-compliant with admissibility criteria for self-regulation and with the ambition level required by the CEAP20. Based on these elements, it was concluded that the VA proposal does not demonstrate its capacity to drive the market in the right direction or at an acceptable speed, in particular in the commitments that affected cartridge design and reuse and it is not likely to deliver the policy objectives faster or in a less costly manner than mandatory requirements under the Ecodesign Directive. Based on this conclusion, the preparation of regulatory measures for this product group has been announced in the Ecodesign Working Plan 2022-2024.

## References

- ADEME (2019). Evaluation économique de l'allongement de la durée d'usage de produits de consommation et biens d'équipement. <https://librairie.ademe.fr/dechets-economie-circulaire/126-evaluation-economique-de-l-allongement-de-la-duree-d-usage-de-produits-de-consommation-et-biens-d-equipement.html>
- AGCM (2020). HP fined 10 million Euros for misleading and aggressive commercial practices. Autorita Garante della Concorrenza e del Mercato. <https://en.agcm.it/en/media/press-releases/2020/12/PS11144>
- Badurdeen, F., Aydin, R., Brown, A. (2018). A multiple lifecycle-based approach to sustainable product configuration design. *Journal of Cleaner Production*. <https://www.sciencedirect.com/science/article/pii/S0959652618323060>
- Barthel, M., Fava, J., James, K., Hardwick, A., Khan, S. (2017). Hotspot analysis. An overarching methodological framework and guidance for product and sector level application. UN Environment.
- Bergling, J., Eriksoon, H. (2002). Life Cycle Assessment of Toner Cartridge HP C4127X. Department of Technology University of Kalmar, Sweden. <https://www.etira.org/wp-content/uploads/2013/07/LCA-Kalmar-Univ.pdf>
- Boorsma, N., Peck, D., Bakker, T., Bakker, C., Balkenende, R. (2022). The strategic value of design for remanufacturing: a case study of professional imaging equipment. *Journal of Remanufacturing*. <https://link.springer.com/article/10.1007/s13243-021-00107-0>
- Bozeman, M., Latko, W., DeVerno, A., Schafer, C., Makowski, D. (2011). Life Cycle Assessment of a Solid Ink MFP Compared with a Color Laser MFP. Xerox.
- Chung, J., Chung, H., Yu, T., Song, Y. (2013). An investigation into remanufactured toner cartridges vs OEM cartridges. *University of British Columbia*. <https://open.library.ubc.ca/soa/cIRcle/collections/undergraduateresearch/18861/items/1.0108784>
- Cordella, M., Alfieri, F., Clemm, C., Berwald, A. (2021). Durability of smartphones. A technical analysis of reliability and reparability aspects. *Journal of Cleaner Production*. <https://www.sciencedirect.com/science/article/pii/S0959652620354342>
- ECOS (2021). Comments on the proposed update to the industry voluntary agreement on imaging equipment. <https://www.coolproducts.eu/wp-content/uploads/2021/06/ECOS-eNGO-Comments-on-Imaging-Equipment-December-2020.pdf>
- Ellen Macarthur Foundation (2022). Bringing printing as a service to the home: HP Instant Ink. <https://ellenmacarthurfoundation.org/circular-examples/bringing-printing-as-a-service-to-the-home>
- ETIRA (2021). Activity Report 2021. [https://www.etira.org/wp-content/uploads/2021/02/ETIRA-Annual-Report\\_v2.pdf](https://www.etira.org/wp-content/uploads/2021/02/ETIRA-Annual-Report_v2.pdf)
- European Commission (2005). Directive 2005/29/EC Directive 2005/29/EC of the European Parliament and of the Council of 11 May 2005 concerning unfair business-to-consumer commercial practices in the internal market and amending Council Directive 84/450/EEC, Directives 97/7/EC, 98/27/EC and 2002/65/EC of the European Parliament and of the Council and Regulation (EC) No 2006/2004 of the European Parliament and of the Council (OJ L 149, 11.6.2005, p. 22).
- European Commission (2008). Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives.
- European Commission (2009). Directive 2009/125 establishing a framework for the setting of ecodesign requirements for energy-related products
- European Commission (2012) Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE).
- European Commission (2016). Commission Recommendation (EU) 2016/2125 of 30 November 2016 on guidelines for self-regulation measures concluded by industry under Directive 2009/125/EC of the European Parliament and of the Council.
- European Commission (2018). Directive (EU) 2018/851 of the European Parliament and of the Council of 30 of May 2018 amending Directive 2008/98 on waste.

European Commission (2020). COM (2020) 98. A new Circular Economy Action Plan for a cleaner and more competitive Europe.

European Commission (2022). COM(2022) 143 final. Proposal for amending Directives 2005/29/EC and 2011/83/EU as regards empowering consumers for the green transition through better protection against unfair practices and better information

European Commission (2022). Communication from the Commission - Ecodesign and Energy Labelling Working Plan 2022-2024 - C/2022/2026 final

Eurovaprint (2017). The environmental impact of reuse vs. recycling of toner and inkjet cartridges

Eurovaprint (2021). Industry Voluntary Agreement to improve the environmental performance of imaging equipment placed on the European market. Version 3. Draft FY20 v.5. [https://www.eurovaprint.eu/fileadmin/eurovaprint\\_files/Member\\_Only/VA\\_Revision/Joint\\_VA\\_2020/VA\\_Agreement\\_Imaging\\_Equipment\\_9\\_April\\_2021\\_FINAL\\_CLEAN.pdf](https://www.eurovaprint.eu/fileadmin/eurovaprint_files/Member_Only/VA_Revision/Joint_VA_2020/VA_Agreement_Imaging_Equipment_9_April_2021_FINAL_CLEAN.pdf)

Ferrari (2008). Studio life cycle assessment (LCA) del confronto tra una cartuccia originale HP 4000 e una cartuccia calligraphy rigenerata da Sapi srl. Università degli Studi di Modena e Reggio Emilia. <https://www.etira.org/wp-content/uploads/2013/07/LCA-SAPI.pdf>

First Environment (2004). Laserjet cartridge environmental comparison. A life cycle study of the HP96A print cartridge versus its remanufactured counterpart in North America. Hewlett-Packard Company. <http://www.etira.org/images/content/HPFirstEnvironmentreport%20Sept%202004.pdf>

Four Elements (2011). Life Cycle Environmental Impact Study HP LaserJet Toner Cartridges vs. Remanufactured Cartridges in Europe. <http://seeds4green.net/sites/default/files/LJ-LCA-EMEA.pdf>

Four Elements (2014). Life Cycle Environmental Impact Study HP LaserJet Toner Cartridges vs. Remanufactured Cartridges in Europe. <https://www8.hp.com/h20195/v2/GetPDF.aspx/c05379673.pdf>

Four Elements (2019). Life Cycle Environmental Impact Study for North America HP LaserJet Toner Cartridges vs. Remanufactured Cartridges. <https://h20195.www2.hp.com/v2/GetDocument.aspx?docname=c06433450>

Four Elements (2021). Life Cycle Environmental Impact Study on LaserJet Toner Cartridges HP Reused Cartridges vs. Remanufactured Cartridges. <https://www8.hp.com/h20195/v2/GetDocument.aspx?docname=c07814001>

Fraunhofer Umsicht (2019). Wiederverwendung von Tonerkartuschen spart Emissionen. <https://nachrichten.idw-online.de/2019/01/29/studie-wiederverwendung-von-tonerkartuschen-spart-emissionen/?groupcolor=>

Gell, M. (2008). Carbon Footprints and Ecodesign of toner printer cartridges. UK Cartridge Remanufacturers Association. <https://www.etira.org/wp-content/uploads/2013/07/Xanfeon.pdf>

Geursen (2013). The EFIM-case : no dominant position of printer manufacturers on ink cartridge aftermarket. <https://europeanlawblog.eu/2013/09/26/the-efim-case-no-dominant-position-of-printer-manufacturers-on-ink-cartridge-aftermarket/>

Goedkoop (2022). 5 roads to a circular economy – Part II: Product as a service. Pre-Sustainability. <https://pre-sustainability.com/articles/5-roads-to-circular-economy-part-ii-product-as-a-service/>

Han, J., Heshmati, A., Rashidghalam, M. (2020). Circular Economy business models with a focus on servitization. Sustainability. <https://www.mdpi.com/2071-1050/12/21/8799>

HOP (2017). Halte à l'obsolescence programmée. Imprimantes: cas d'école d'obsolescence programmée? Rapport d'enquêtes sur les enjeux et solutions en matière d'imprimantes et cartouches.

Huang, B., Martin, P., Skov, H., Maya-Drysdale, L., Wood, J. (2019). Revision of Voluntary Agreement of Imaging Equipment. Task 1-7. Final Report.

Industry Voluntary Agreement to improve the environmental performance of imaging equipment placed on the European market. VA v.5.2. April 2015.

Kaps, R., Vidal-Abarca-Garrido, C., Gama-Caldas, M., Maya-Drysdale, L., Viegand, J., Wood, J. (2020). Revision of the EU Green Public Procurement Criteria for imaging equipment. Final Technical Report. Final Criteria. Joint Research Centre, European Commission.



Kaps, R., Vidal-Abarca-Garrido, C., Gama-Caldas, M., Maya-Drysdale, L., Viegand, J., Wood, J., Brocklehurst, F. (2019). Revision of the EU Green Public Procurement Criteria for imaging equipment. Preliminary Report. Joint Research Centre, European Commission.

Kara (2010). Comparative carbon footprint analysis of new and remanufactured ink cartridges. Centre for Remanufacturing and Reuse, UK. [https://www.researchgate.net/publication/348234910\\_Comparative\\_Carbon\\_Footprint\\_Analysis\\_of\\_New\\_and\\_Remanufactured\\_Inkjet\\_Cartridges](https://www.researchgate.net/publication/348234910_Comparative_Carbon_Footprint_Analysis_of_New_and_Remanufactured_Inkjet_Cartridges)

Krystofik, M., Babbitt, C., Gaustad, G. (2014). When consumer behaviour dictates life cycle performance beyond the use phase. Case study of inkjet cartridge end of life management. International Journal of Life Cycle Assessment. [https://www.researchgate.net/publication/271918440\\_When\\_consumer\\_behavior\\_dictates\\_life\\_cycle\\_performance\\_beyond\\_the\\_use\\_phase\\_Case\\_study\\_of\\_inkjet\\_cartridge\\_end-of-life\\_management](https://www.researchgate.net/publication/271918440_When_consumer_behavior_dictates_life_cycle_performance_beyond_the_use_phase_Case_study_of_inkjet_cartridge_end-of-life_management)

Lieder, M., Rashid, A. (2016). Towards circular economy implementation: a comprehensive review in context of manufacturing industry. Journal of Cleaner Production. <https://www.sciencedirect.com/science/article/pii/S0959652615018661>

Oldyrevas, E. (2021). When empty promises won't do – Why regulation is needed to end built-in obsolescence of printers. ECOS. [https://ecostandard.org/news\\_events/when-empty-promises-wont-do-why-regulation-is-needed-to-end-built-in-obsolescence-of-printers/](https://ecostandard.org/news_events/when-empty-promises-wont-do-why-regulation-is-needed-to-end-built-in-obsolescence-of-printers/)

Open Repair Alliance (2021). Insights: Printers. <https://openrepair.org/open-data/insights/printers/>

Svensson-Hoglund, S., Richter, J., Maitre-Ekern, E., Russell, J., Pihlajarinne, T., Dalhammar, C. (2021). Barriers, enablers and market governance. A review of the policy landscape for repair of consumer electronics in the EU and the US. Journal of Cleaner Production. <https://www.sciencedirect.com/science/article/pii/S0959652620355347>

The Recycler, 2021. HP now has 10 million+ subscribers. <https://www.therecycler.com/posts/hp-now-has-10-million-subscribers/>

Wakefield, 2021. Printer ink pricier than champagne finds Which? BBC. <https://www.bbc.com/news/technology-57941625>

Waugh, R., Symington, H., Parker, D., Kling, M., Zotz, F. (2018). Study on the implementation of product design requirements set out in Article 4 of the WEEE Directive. The case of reusability of printer cartridges. Final Report.

Wilson (2021). The cheap ink that printer firms don't want you to use. Which? <https://www.which.co.uk/news/2021/07/the-cheap-ink-that-printer-firms-dont-want-you-to-use/> Badurdeen, F., Aydin, R., Brown, A. (2018) A multiple lifecycle-based approach to sustainable product configuration design. Journal of Cleaner Production.

## List of abbreviations and definitions

BPR – Biocidal Products Regulation  
CEAP – Circular Economy Action Plan  
EEE – Electrical and Electronic Equipment  
EP – Electro Photografic  
EPO – European Patent Office  
EU – European Union  
EUR – Euros  
GPP – Green Public Procurement  
HDD – Hard Disk Drive  
ICT – Information and Communications Technology  
IJ – Inkjet  
IP – Intellectual Property  
IT – Information & Technology  
LCA – Life Cycle Assessment  
MFD – Multi Functional Device  
MPS – Managed Print Services  
OEM – Original Equipment Manufacturer  
OM – Operational Mode  
PBDE – Polybrominated diphenyl ethers  
REACH – Registration, Evaluation, Authorisation and Restriction of Chemicals  
RR – Reuse Rate  
SI – Solid Ink  
SME – Small and Medium Enterprise  
SRG – Self Regulation Guidelines  
SS – Supporting Signatory  
SSD – Solid State Drive  
TEC – Typical Energy Consumption  
TS – Technical Specification  
UK – United Kingdom  
VA – Voluntary Agreement  
WEEE – Waste of Electrical and Electronic Equipment



## List of figures

Figure 1. Waste Hierarchy.....	6
Figure 2. Classification of business models in the imaging equipment market .....	11
Figure 3. Black/white cartridge with different levels of use of the available volumes .....	18
Figure 4. Colour cartridge with different levels of use of the available volume .....	19

## List of tables

Table 1. EU sales of imaging equipment .....	9
Table 2. EU sales of consumables.....	10
Table 3. Market share of consumables (Waugh et al, 2018).....	10
Table 4. Cartridge reuse potential .....	19
Table 5. Scope of VA 2021 .....	27
Table 6. Comparison VA 2015 and VA 2021 (Scope) .....	33
Table 7. Comparison VA 2015 and VA 2021 (Primary design requirements) .....	34
Table 8. Comparison VA 2015 and VA 2021 (Resource efficiency requirements) .....	35
Table 9. Comparison VA 2015 and VA 2021 (Information requirements) .....	36
Table 10. Comparison VA 2015 and VA 2021 (Cartridge requirements) .....	37
Table 11. Primary requirements for imaging equipment .....	43
Table 12. Factors used to estimate reuse rates.....	66
Table 13. Summary of issues identified in VA 2021 .....	75
Table 14. Summary of assessment of EVAP counterproposal .....	79

## GETTING IN TOUCH WITH THE EU

### In person

All over the European Union there are hundreds of Europe Direct information centres. You can find the address of the centre nearest you at: [https://europa.eu/european-union/contact\\_en](https://europa.eu/european-union/contact_en)

### On the phone or by email

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

- by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),
- at the following standard number: +32 22999696, or
- by electronic mail via: [https://europa.eu/european-union/contact\\_en](https://europa.eu/european-union/contact_en)

## FINDING INFORMATION ABOUT THE EU

### Online

Information about the European Union in all the official languages of the EU is available on the Europa website at: [https://europa.eu/european-union/index\\_en](https://europa.eu/european-union/index_en)

### EU publications

You can download or order free and priced EU publications from EU Bookshop at: <https://publications.europa.eu/en/publications>. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see [https://europa.eu/european-union/contact\\_en](https://europa.eu/european-union/contact_en)).

## The European Commission's science and knowledge service

Joint Research Centre

### JRC Mission

As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.



**EU Science Hub**  
[ec.europa.eu/jrc](https://ec.europa.eu/jrc)



@EU\_ScienceHub



EU Science Hub - Joint Research Centre



EU Science, Research and Innovation



EU Science Hub



Publications Office  
of the European Union

doi:10.2760/452358

ISBN 978-92-76-53091-6