

Service recycling and ecosystems: an intriguing similarity

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Abstract

Purpose – The purpose of this paper is to introduce the practice of service recycling. There is an end of life to every product. At this stage, recycling is one option: it is the process of converting waste materials into new products or raw materials. There is also an end of life to every service, which generally coincides with the end of service delivery. However, services are not made of materials or components that can be recovered or converted, so can they be recycled? If the concept of product recycling is something well established, then that of service recycling has not yet been sufficiently investigated.

Design/methodology/approach – This paper introduces the perspective of service recycling, analyzing the modalities in which a service can be recycled by using an analogy with natural ecosystems. Some examples are also proposed to support this new vision.

Findings – This paper purports to formalize the practice of service recycling: recycling a service means recovering all the intangibles and tangibles resulting from the provision of a service that still may have a residual value. This practice may potentially lead to an increase in profits.

Originality/value – Although there are several examples of close relationships between two (or more) different services in which one of the two benefits from the externalities of the other, the concept of service recycling has not yet been structurally defined, and the authors believe that interesting perspectives of research may follow from its formalization.

Keywords Service recycling, Service design, Service systems, Service ecosystems, Service science

Paper type Research paper

1. The concept of service recycling

The latest edition of the World Development Report specifies that the 74 per cent of euro area and the 70 per cent of world gross domestic product in 2012 is due to services (The World Bank, 2015). Despite this evidence, companies, governments and scholars still pay little attention to service research, innovation or quality if compared to the focus on tangible goods and technologies (IfM and IBM 2007; Bitner *et al.*, 2010; Ostrom *et al.*, 2015).

A service is an intangible commodity. It can be defined as a series of activities that take place in the interaction between customer and service provider, and that come as a solution to the problems of the customer. Five major features, often named the “Five I’s of Services”, can help to outline service properties (Quinn *et al.*, 1987; Franceschini and Rossetto, 1998; Wolak *et al.*, 1998; Suresh and Ravichandran, 2015):



- (1) *Intangibility*: Services are intangible and insubstantial: they cannot be touched, handled, transported or stocked.
- (2) *Inventory (Perishability)*: Services have little or no tangible components and therefore cannot be stored for future use. Services and related activities are typically delivered in the same moment they are consumed by the customer.
- (3) *Involvement*: The customer often has the opportunity to get the services modified according to specific requirements. There is consumer involvement as service delivery may require a high degree of interaction between service customer and provider.
- (4) *Inseparability*: Both service provider and customer are inseparable from service delivery: the former has to prepare and carry out service delivery, the latter is the consumer, i.e., the one that benefits from the delivery.
- (5) *Inconsistency (Variability)*: Each service is one-time generated, delivered and consumed and can never be exactly repeated, even if requested by the same customer. In other words, each service is unique.

Examples of services are business consulting, customer service, human resources management, childcare, cleaning, repair and maintenance services, education, entertainment (theatres, gambling, sport), financial services (banks, tax preparation, stock brokerages), health care, transport etc.

Typically, a single service may be part of a system when it interacts with other services (Riordan, 1962). In service systems, tangible and intangible elements resulting from the delivery of a service may be reused by the same or other services. In this framework, *service recycling* can be defined as the activity of recovering the “residual value” of a provided service.

This manuscript is aimed at exploring the concept of service recycling, analyzing when, where and why it can take place through its deep similarity with ecosystems. A taxonomy of possible configurations of service recycling is also proposed.

Service recycling can be stimulated by economic reasons. The increase in profits due to service recycling can come, directly, through the provision of services that generate new revenues for the enterprise, or indirectly, by providing services that do not directly produce profits but that, being offered together with other services, increase the perceived value of offered services, consequently generating new demand.

The benefit that comes from service recycling cannot be measured only in economic terms, as service recycling also means avoiding unnecessary wastes, optimizing material resources and therefore providing a more sustainable service. There are several practical examples in which the close relationship between different services allows a service to recover the residual value generated by other services. However, the concept of recycling service has not yet been structurally defined, and the authors believe that its formalization may open interesting perspectives of research. The design phase of a service could consider the possibility of recycling, as it happens for the design of a product. This perspective can lead the service designer toward a number of possible strategies such as:

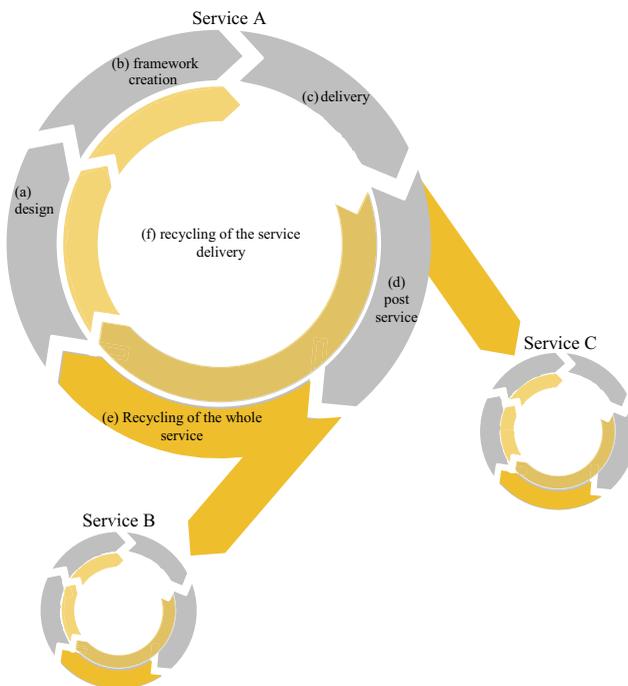
- the use of flexible and scalable resources that can be re-adapted for other uses;
- the design of information databases that can be of support to further development of the service;

- the acquisition of a wide pool of skills, able to allow a potential expansion of the portfolio of assets; and
- the creation of over-scalable infrastructures, capable to adapt and respond to workload changes due to the addition/integration of services, etc.

The remainder of this paper is structured as follows. Section 2 describes typical phases of a service life cycle. Section 3 proposes a strict analogy between ecosystems and the modalities of service recycling, proposing a classification of service recycling into three main categories: cooperative, competitive and asymmetric service recycling. The concluding section summarizes the original contributions of the paper, focusing on the benefits, limitations and possible future developments.

2. Service life cycle: what can be recycled by a service?

Figure 1 schematically shows the life cycle of a service. Typically, a service is first designed (planning and organizing people, infrastructure, communication and material components), and then it is operationalized by creating the framework for the



Note: After a phase of design (a), the framework for the service delivery is set up (b). Then the service is delivered to the customer (c). The post-service phase (d) is intended for the management of all the fringe activities that derive from the service provision. Service recycling may come either at the end of service delivery (f) or at the end of its life cycle (e)

Figure 1. Schematization of a service life cycle

subsequent service delivery. During the delivery phase, the service provider and the customer interface with each other and work directly.

With reference to the phases of service life cycle as shown in [Figure 1](#), a service can be recycled in two different moments:

- (1) At the end of service delivery, when, for example, data, information or feedbacks deriving from the delivery can be re-used for a subsequent delivery or transmitted to other services. We define this as *recycling of the service delivery*. As an example, consider the service offered by a Web search engine, which can reuse single query information to offer services such as advertising, push up notifications about the topic of interest, navigation information, etc.
- (2) At the end of its life cycle. In this case, the intangibles that derive from all individual deliveries are re-used for the improvement of the existing service or other services. We define this as *whole service recycling*. As an example, still consider the service offered by a Web search engine, which reuses the information on users' clicks to improve the results of subsequent searches.

[Figure 1](#) shows a schematic example of life cycle of a service (service A) that is part of a system including other services (B and C). Intangibles deriving from the delivery of service A may be either recycled within the same service or shared with other services of the system.

3. Service, recycling and ecosystems: a synecological view

In biology, an ecosystem is a community of living organisms in conjunction with the non-living components of their environment, interacting as a system. The biotic and abiotic components of ecosystems are regarded as linked together through nutrient cycles and energy flows.

We can trace a strong analogy between ecosystems and services: services rely on the “energy” provided by their customers, adapt to them and in some cases affect them, just as the biotic and abiotic components interact in an ecosystem.

Generally speaking, symbiosis is defined as the interaction among two or more individuals belonging to different biotic components of an ecosystem ([Martin and Schwalb 2012](#)). These interactions have been classified according to their impact. The main three are:

- (1) parasitism, i.e. a relationship in which one biotic component benefits while the other is harmed;
- (2) mutualism, i.e. a relationship in which both biotic components take advantage of the relationship; and
- (3) commensalism, i.e. a relationship in which one biotic component takes advantage of the other that is not significantly harmed or helped.

Also, service recycling can be seen as the result of a symbiosis, in this case, the mutual relationship between two or more services. While individuals belonging to different biotic components can exchange organic substances, protection and energy, different services can share intangibles, such as data, information, feedback, competence, expertise, etc., and tangibles such as machinery, equipment, facilities, people, etc.

These exchange can generate externalities[1]. Depending on the type of externalities, the three main forms of symbiosis can be read into the service context.

3.1 Parasitism: competitive recycling

Parasitism is a non-mutual symbiotic relationship between organisms, where one organism, the parasite, benefits at the expense of the other, the host.

Competitive service recycling is the situation in which a service that is part of a system benefits from the presence of another service that, on the contrary, is damaged by the relationship. In this specific situation, a service (the parasite) produces negative externalities, while the other (the host) generates positive externalities.

This type of recycling is competitive, as the two services are in competition with each other: the host service would benefit from a separation from the parasite that, on the contrary, has an interest in keeping the symbiosis with the host (Table I).

As an example of competitive service recycling, consider the relationship between a Web search engine and the related advertising services. The latter are services that enable advertisers to display brief advertising copy to Web users into the result page of the query, based in part on keywords, predefined by the advertisers. Advertisers pay when users divert their browsing to seek more information about the copy displayed.

On one hand, the advertising service benefits from the service provided by the Web search engine, taking advantage of the user’s search keywords; on the other hand, the Web search engine is damaged from the advertising, as the user is generally bothered by the advertising copy.

Unless introducing compensation mechanisms, competitive recycling is typically an unstable form of symbiosis due to the host service tendency to repel the parasite. In the exemplified context, it is generally either a single company that manages both the two services or a financial compensation that is awarded to the Web search engine to compensate for the negative externality received by the advertising service.

Parasitism vs competitive service recycling	Ecosystem	Service system
Definition	It is a non-mutual symbiotic relationship between organisms, where one organism, the parasite, benefits at the expense of the other, the host	It is the situation in which a service that is part of a system benefits from the presence of another service that is damaged by the relationship
Affinity	Diversity between the two organisms	Diversity between the two services
Reaction	Onset of physiological abnormalities in the host	The parasite service can shape its structure to take advantage of the relationship
Symbiosis tendency	Tendency to suppress the host or parasite	Tendency to suppress the host or the parasite. Alternatively, compensation mechanisms are required

Table I. Parallelism between parasitism and competitive service recycling

3.2 Commensalism: asymmetric recycling

Commensalism is a symbiotic relationship between two organisms, where one organism benefits from the other without either harming or benefiting the other.

Asymmetric service recycling is the situation in which a service that is part of a system benefits from the presence of another service without affecting it. In this specific situation, a service produces positive externalities while the other does not.

This type of recycling is asymmetric, as just one of the two services takes advantage of the recycling (Table II).

As an example of asymmetric service recycling, consider the relationship between the services offered in some post offices: in addition to the classic postal service (shipments, bill payment, financial services), these offices sell a selection of products ranging from books to common electronic devices at special prices. Unless in very special cases, customers do not go to the post office to buy books or electronics. Their action is dictated by the need to make use of conventional postal services. The postal service does not benefit from the sale service, while the sale service inside the post office cannot take place without the delivery of postal services.

3.3 Mutualism: cooperative recycling

Mutualism is the way two organisms exist in a relationship in which each individual benefits from the activity of the other. It is probably the most common form of symbiotic relationship.

Cooperative service recycling is the situation in which each of the two (or more) services benefits from the presence of the other(s). In this specific situation, each service produces a positive externality.

This recycling is cooperative, as the two services are cooperating with each other: the presence of each of the two (or more) services is helpful to the other(s) (Table III).

As an example of cooperative service recycling, consider catering service inside facilities offering entertainment services, such as cinemas, theatres, amusement parks, etc. The customer usually goes to these places for the entertainment service and sometimes also makes use of the catering service. Both services draw a positive benefit

Commensalism vs asymmetric service recycling

	Ecosystem	Service system
Definition	It is a symbiotic relationship between two organisms, where one organism benefits from the other without either harming or benefiting the other	It is a situation in which a service that is part of a system benefits from the presence of another service without affecting it
Affinity	No necessary diversity between the two organisms	No necessary diversity between the two services
Reaction	Possible bilateral specialization with morphogenetic effects	The two services may adapt their structure to better profit from the relationship
Symbiosis tendency	Tendency to preserve the balance of the relationship	Tendency to preserve the balance of the relationship

Table II.
Parallelism between asymmetric service recycling and commensalism

Table III.
Parallelism between
cooperative service
recycling and
mutualism

Mutualism vs cooperative service recycling	Ecosystem	Service system
Definition	It is the way two organisms exist in a relationship in which each individual benefits from the activity of the other	It is the situation in which each of the two (or more) services benefits from the presence of the other(s)
Affinity	No necessary diversity between the two organisms	No necessary diversity between the two services
Reaction	Possible unilateral specialization with morphogenetic effects	The benefiting service may adapt its structure to better profit from the relationship
Symbiosis tendency	Tendency to preserve the balance of the relationship	Tendency to preserve the balance of the relationship

from their joint presence in the same structure. The first benefits from the second, as a good catering service improves the overall customer experience, and the second takes advantage of the first because it produces a flow of customers that allows it to operate.

4. Conclusions and future developments

Product recycling is a common practice in most developed nations, aiming at reducing waste, manufacturing costs and generally optimizing available resources (Jambeck *et al.*, 2015; Yan and Chen, 2015). Nowadays, the term “product” no longer has its classical meaning of physical artefacts. Advanced manufacturing has been recently defined as “the creation of integrated solutions that require the production of physical artefact coupled with value-added services and software” (De Weck, Reed *et al.* 2014). For this reason, it sounds anachronistic to limit the focus of recycling to the sole material components.

This paper purports to formalize the practice of service recycling: recycling a service means recovering all the intangibles and tangibles resulting from the provision of a service that still may have a residual value. This practice may potentially lead to an increase in profits.

Although there are several examples of close relationships between two (or more) different services in which one of the two benefits from the externalities of the other, the concept of service recycling has not yet been structurally defined, and the authors believe that interesting perspectives of research may follow from its formalization.

In this sense, this work is just a first step. Further developments of this research may open some new research perspectives:

- How can service recycling influence the issue of a service design?
- Can evolutionary models that apply to ecosystems also be adapted to describe the evolution of service systems?
- Can other forms of relationship (such as antagonism, competition, predation, etc.) be found in service systems?
- Can we diagnose service organization issues as we do for biological systems?
- How can we stimulate the growth and design of economically, environmentally and socially sustainable service systems?

Note

1. The cost or benefit that affects a party who may not have chosen to incur that cost or benefit Buchanan and Stubblebine (1962).

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