Service recycling and ecosystems: an intriguing similarity

Service Recycling and Ecosystems: an Intriguing Similarity

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Abstract

Purpose

This paper introduces the perspective of service recycling, analysing throughout an analogy with natural ecosystems the modalities in which a service can be recycled.

Design/methodology/approach

There is an end-of-life to every product. At this stage, recycling is one option: it is the process to convert 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. Can Services be recycled? If the concept of product recycling is something well established, that of service recycling has not yet been sufficiently investigated.

Findings

Service recycling may open new research areas or perhaps new business opportunities. Some examples are proposed to support this new vision.

Originality/value

This paper purports to formalize the practice of service recycling, i.e. the practice of recovering all the intangibles and tangibles resulting from the provision of a service that still may have a residual value.

Keywords: *Service Recycling; Service design; System Service; Ecosystems; Service ecosystems*

1. The concept of service recycling

The latest edition of the World Development Report specifies that respectively the 74% of Euro area and the 70% of world Gross Domestic Product (GDP) 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, Zeithaml et al. 2010; Ostrom, Parasuraman et al. 2015).

A service is an intangible commodity. It can be defined as a series of activities, which 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, Baruch et al. 1987; Franceschini and Rossetto 1998; Wolak, Kalafatis et al. 1998; Suresh and Ravichandran 2015):

- *Intangibility*. Services are intangible and insubstantial: they cannot be touched, handled, transported, or stocked.
- *Inventory* (Perishability). Services have little or no tangible components and therefore cannot be stored for a future use. Services and related activities are typically delivered in the same moment they are consumed by the customer.
- *Involvement*. The customer has often 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.
- *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.
- *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, analysing 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, 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, since 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: (i) the use of flexible and scalable resources that can be re-adapted for other uses; (ii) the design of information databases that can be of support to further development of the service (iii) the acquisition of a wide pool of skills, able to allow a potential expansion of the portfolio of assets; (iv) 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?

Fig.1 schematically shows the lifecycle of a service. Typically, a service is first designed (planning and organizing people, infrastructure, communication and material components), then it is operationalized by creating the framework for the subsequent service delivery. During the delivery phase, service provider and customer interface with each other and work directly.

With reference to the phases of service lifecycle as shown in Fig. 1, a service can be recycled in two different moments:

- 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 the single query information to offer services such as advertising, push up notifications about the topic of interest, navigation information, etc.

- at the end of its lifecycle. 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.

Fig. 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 the other services of the system.

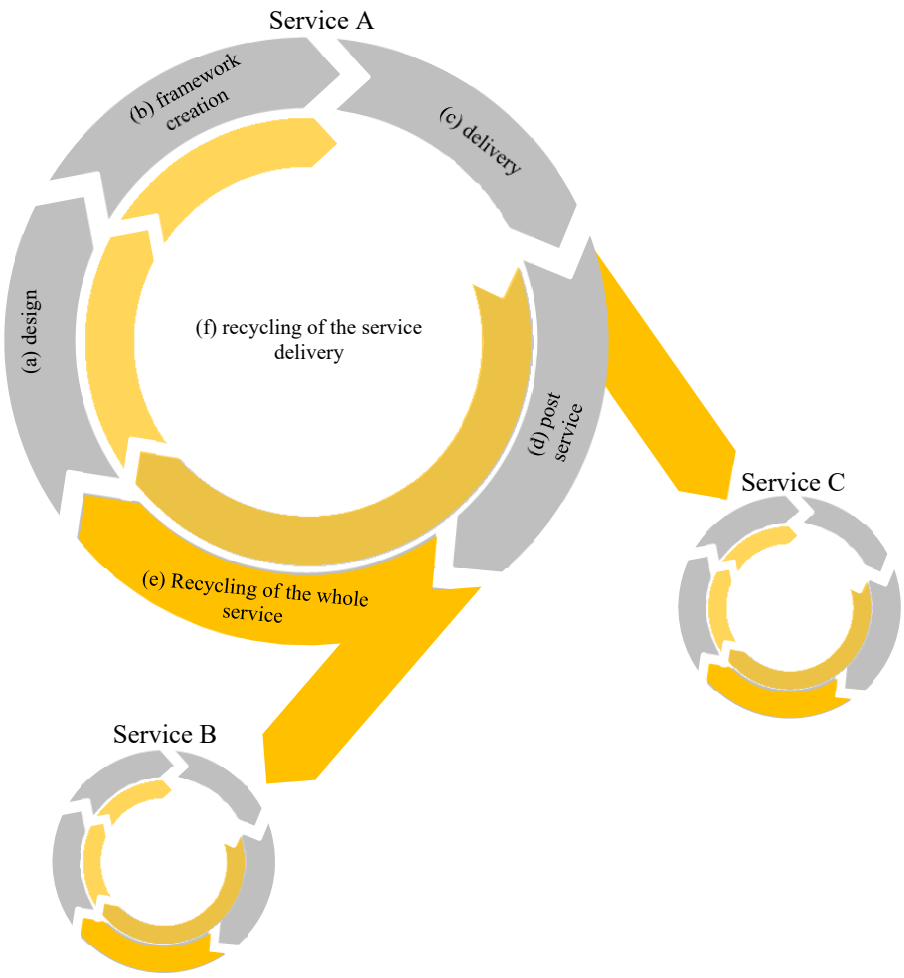

Figure 1. Schematization of a service life cycle. After a phase of design (a), the framework for the service delivery is set up (b). Then the service is delivered to the customer (c). The post-service phase (d) is intended for the management of all the fringe activities that derive from the service provision. Service recycling may come either at the end of service delivery (f) or at the end of its lifecycle (e).

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 (i) parasitism, i.e. a relationship in which one biotic component benefits while the other is harmed (ii) mutualism, i.e. a relationship in which both biotic components take advantage of the relationship and (iii) 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.

We define as competitive service recycling 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 since 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.

[1] the cost or benefit that affects a party who may not have chosen to incur that cost or benefit Buchanan, J. M. and W. C. Stubblebine (1962). "Externality." Economica **29**(116): 371-384 DOI: 10.2307/2551386.

Parasitism vs. Competitive service recycling

	Ecosystem	Service system
Definition	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 the suppression of the host or parasite.	Tendency to the suppression of the host or the parasite. Alternatively compensation mechanisms are required.

Tab 1. Parallelism between parasitism and competitive service recycling.

+/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 since 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 is awarded to the web search engine in order to compensate for the negative externality received by the advertising service.

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 since just one of the two services takes advantage of the recycling.

Commensalism vs. Asymmetric service recycling

	Ecosystem	Service system
Definition	Symbiotic relationship between two organisms, where one organism benefits from the other without either harming or benefiting the other.	It is the 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 of the relationship
Symbiosis Tendency	Tendency to preserve the balance of the relationships	Tendency to preserve the balance of the relationships

Tab 2. Parallelism between asymmetric service recycling and commensalism.

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 sale a selection of products ranging from books to common electronic devices at special prices. Unless 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 could not 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 since the two services are cooperating with each other: the presence of each of the two (or more) services is helpful to the other(s).

Mutualism vs. Cooperative Service Recycling

	Ecosystem	Service system
Definition	Mutualism 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 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 of the relationship
Symbiosis Tendency	Tendency to preserve the balance of the relationships	Tendency to preserve the balance of the relationships

Tab 3. Parallelism between cooperative service recycling and mutualism.

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 from their joint presence in the same structure. The first benefits from the second since a good catering service improves the overall customer experience, the second takes advantage from 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, Geyer 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: (i) how service recycling can influence the issue of a service design? (ii) can evolutionary models that apply to ecosystems also be adapted to describe the evolution of service systems? (iii) can other forms of relationship (such as antagonism, competition, predation, etc.) be found in service systems? (iv) can we diagnose service organisation issues as we do for biological systems? (v) how can we stimulate the growth and the design of economically, environmentally and socially sustainable service systems?

5. References

Bitner, M., V. Zeithaml and D. Gremler (2010). Technology's Impact on the Gaps Model of Service Quality. Handbook of Service Science. P. P. Maglio, C. A. Kieliszewski and J. C. Spohrer, Springer US**:** 197-218.

Buchanan, J. M. and W. C. Stubblebine (1962). "Externality." Economica **29**(116): 371-384 DOI: 10.2307/2551386.

De Weck, O., D. Reed, S. Sarma and M. Schmidt (2014). Trends in Advanced Manufacturing Technology Innovation. Production in the innovation economy. MIT Press Scholarship Online.

Franceschini, F. and S. Rossetto (1998). "On-line service quality control: The qualitometro method." Quality Engineering **10**(4): 633-643.

IfM and IBM (2007). Succeeding through service innovation: a discussion paper. Cambridge Service Science, Management and Engineering Symposium, Cambridge, UK, United Kingdom: University of Cambridge Institute for Manufacturing.

Jambeck, J. R., R. Geyer, C. Wilcox, T. R. Siegler, M. Perryman, A. Andrady, R. Narayan and K. L. Law (2015). "Plastic waste inputs from land into the ocean." Science **347**(6223): 768-771 DOI: 10.1126/science.1260352.

Martin, D. M. and E. Schwalb (2012). "Symbiosis: "Living Together" in Chaos " STUDIES IN HISTORY OF BIOLOGY **4**(4): 7-25

Ostrom, A. L., A. Parasuraman, D. E. Bowen, L. Patrício and C. A. Voss (2015). "Service Research Priorities in a Rapidly Changing Context." Journal of Service Research **18**(2): 127-159 DOI: 10.1177/1094670515576315.

Quinn, J. B., J. J. Baruch and P. C. Paquette (1987). "Technology in services." Sci. Am. **257**(6): 50-58 DOI: 10.1038/scientificamerican1287-50.

Riordan, J. (1962). Stochastic service systems, Wiley New York.

Suresh, S. and T. Ravichandran (2015). Firm Transitions from Products to Services and Mode of Entry. System Sciences (HICSS), 2015 48th Hawaii International Conference on, IEEE.

The World Bank. (2015). "Database." Retrieved March 2015, from http://data.worldbank.org/.

Wolak, R., S. Kalafatis and P. Harris (1998). "An investigation into four characteristics of services." Journal of Empirical Generalisations in Marketing Science **3**(2): 22-43.

Yan, N. and X. Chen (2015). "Sustainability: Don't waste seafood waste." Nature **524**(7564): 155-157 DOI: 10.1038/524155a.