How to Generate Sustainable Services?

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Abstract

Sustainability is a service that should be produced and delivered in any process that generates tangible or intangible values and that should be incorporated into each phase of the value chain. Moreover, sustainability should also be an essential part of value co-creation, the process of which eventually recruits the customer as a provider of sustainability to current and future generations. In so doing, the value co-creation process and subsequent propagation of sustainability can mimic the cyclic and evolutionary aspects of nature.

Keywords

Sustainability • Life cycle • CleanServ • Service science

1 Introduction

Any action or process creates value, and its undertaking simultaneously affects global sustainability, for better or for worse. In general, a value or a product can be tangible, i.e., a good, or intangible, i.e., a service, and it is transferred from a provider to a customer. The sustainability of the product, therefore, depends not only on the production process but also on both the provider and the customer individually and on the interactions of the two (Wolfson et al. 2015).

One of the most important challenges humanity faces today is in the development of methodologies for the design of more sustainable processes (in terms of the production of goods and the design of services) that satisfy the needs of today's customers without sacrificing the ability of future generations to satisfy their own needs (Dresner 2008; Dryzek 1997; Edwards 2005). However, the implementation of the general concept of sustainability requires a novel cognitive and behavioral approach that integrates environmental, social, and economic elements, but that is difficult to break down into its fundamental parts. The successful implementation of more sustainable processes, therefore, dictates a modus operandi based equally on a rational use of physical resources that yields efficient processes and prevents and/or reduces the discharge of harmful effluents to the environment and on the responsible design and operation of the process, integral to which is cooperation between people, i.e., nonphysical resources (Prakash 2000; Druckrey 1998).

The economy can be described generally as based on the three sectors of manufacturing and agriculture, both of which produce tangible values, i.e., goods and services, which deliver intangible values (Wolfson et al. 2015). Besides their difference in terms of tangibility, services and goods differ in several other respects:

1. Inseparability – services are simultaneously delivered and consumed, while the purchase of goods can be (and is typically) completely separate from their production.
2. Perishability – unlike goods, services cannot be stored or returned, i.e., they are not reversible.
3. Inconsistency – while the same good can be produced at the same quality in different places and at different times, the production and delivery of a service can never be

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Y. Sawatani et al. (eds.), *Serviceology for Smart Service System*, DOI 10.1007/978-4-431-56074-6_9

repeated in exactly the same way, as the supplier, the customer, and the place and time change from one delivery of service to the next.
4. Co-creation – service production and delivery requires client participation in the process, but the customer can purchase goods without meeting the producers of those goods. Therefore, in the production of goods, the producer is actually a supplier and the client is a consumer. In service delivery, on the other hand, the producer becomes a provider and the client is a customer.

In 2004 Vargo and Lusch suggested a new paradigm for thinking about commerce, marketing, and exchange. Known as "service-dominant logic," it overcomes the limitations of the "goods-dominant logic" mindset (Vargo and Lusch 2004; Lusch and Vargo 2006). In their paper, Vargo and Lusch proposed that the traditional market's focus on the exchange of products or goods should be shifted to that of services. Moreover, they claimed that all exchanges between producers and consumers are actually based on service. At about the same time, Spohrer and Maglio from the IBM Almaden Research Center foresaw a need for a new discipline, appropriately named "service science," that would be a platform for systematic service innovation (Maglio and Spohrer 2007a, b; Maglio et al. 2010). Later these two novel concepts, both of which highlighted the importance of the value co-creation process, were synchronized (Vargo and Akaka 2009; Lusch et al. 2008).

Value co-creation entails processes in which the value is designed, delivered, and used jointly and reciprocally by the provider and the customer via the exploitation of a constellation of integrated resources and capabilities that are shared, combined, and renewed by provider and customer (Vargo et al. 2008). In general, four types of co-creation can be generated (Wolfson et al. 2015, Kuusisto and Päällysaho 2008):

1. Consume – the customer exploits a service and passively co-creates by their perception of the value.
2. Co-perform – the customer performs some of the tasks of a service.
3. Co-produce – the customer uses resources, such as information from a service, in the process creating the service's value.
4. Co-design – a dialog between customers and providers provides the framework for the types and forms of service desired. In addition, the combination of new technologies and the co-creation of innovation also spawned the development of new service modes, such as "super-service," a service that is mainly performed by the supplier, and "self-service," wherein the customer assumes an active part – and invests knowledge, skills, and facilities – in execution of the service (Campbell et al. 2011).

The need to develop more sustainable production systems and services is a universal concern that can be accomplished via the rational use of resources, the exploitation of cleaner technologies (Cleantech), and the creation of more sustainable services. Two related routes to achieve the goal of sustainability that differ in focus comprise the production and delivery of "environmental services" and of "green" or "environmentally friendly services." The core of the former is in the creation of complementary and novel environmentally related values that are added to existing processes aimed at benefiting the environment. One example of an environmental service entails the measurement of environmental damage (to air, water, and soil as well as that related to waste, noise, biodiversity, and landscapes) with the goals of eventual control, through treatment and restoration, and ultimately the prevention or minimization of additional environmental damage. An environmentally friendly service, on the other hand, is concentrated on delivering the same value using a more environmentally sound method by organizing and managing the resources used in its creation differently, i.e., making existing processes, both service delivery and goods production, greener. Yet in general, the focus of environmentally friendly services is mainly on the physical resources of the process.

As every product usually entails an element of service and every service is likewise typically based on the use of products, another way to increase the sustainability of a process is to approach its value generation process from a product-service system perspective (Sakao and Lindahl 2009; Beuren et al. 2013; Tukker 2015). By fulfilling customer demand more efficiently with respect to the use of physical resources, a product-service system can generate the same solution more sustainably. However, servicizing, which refers to the intensification of the service component of a product-service system, also changes the nonphysical resources of the process, as the provider now offers functionality rather than a product and the consumer, who does not necessarily assume ownership of the product, co-creates the value with the provider. Thus, product-service systems are also referred to as eco-efficient services.

In the same context, we recently offered a new framework, termed CleanServs (i.e., clean services), for thinking about and generating sustainability innovation in the service sector (Druckrey 1998; Wolfson et al. 2013a, 2014). The overarching aim of a CleanServ is in the delivery of solutions that are based exclusively or mainly on services. It can be accomplished by providing a service that is competitive with, if not superior to, its conventional, tangible counterparts and one that reduces, for example, the energy consumption of its related production processes and cuts or eliminates emissions and wastes. CleanServs can be described according to the five categories of prevention, reduction, replacement, efficiency, and offset.

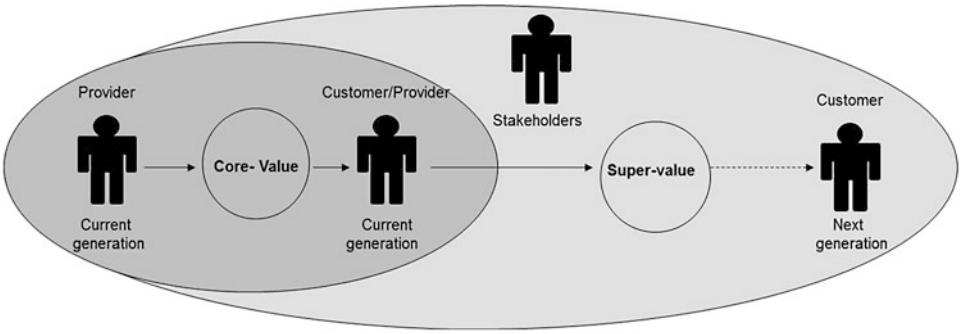

Fig. 1 Sustainable service

We recently offered a new model of "sustainable services" that perceives of sustainability as a basic value and as an essential part of each process. Moreover, it is based on the integration of tangible and intangible resources to create a new value that provides the customer with a solution that meets the customer's demands more sustainably (Wolfson et al. 2010, 2013b, 2015). In addition, a sustainable service is one that improves the operational performance and efficiency of the value production and delivery process. As such, it not only reduces the consumption of materials and energy and the discharge of waste and pollution to the environment, it also fundamentally changes how the provider and the customer engage in co-creating the service "core value," i.e., the essence of the service. We also suggested that a sustainable service should be designed not only with the value of the whole service chain as well as that of the service's customers in mind, but also with the understanding that as a sustainable service it obliges all stakeholders to provide sustainability as a "super-service" (Fig. 1). In addition, we proposed that performing the service in an alternative mode, such as "self-service," can also affect the service's sustainability (Wolfson et al. 2012). Lastly, in addition to the prerequisite that it be based on environmental and social awareness, the rational use of natural resources, and efficient operation and co-creation processes, a sustainable service must also extend the provision of immediate and personal customer demands to the extent that it can continue to fulfill those demands for extended periods of time without negatively affecting either the natural or social environment.

2 Discussion

2.1 Natural Mimicry Approach

Nature supplies many services that promote and sustain ecosystems and that benefit humans, i.e., "ecosystem services" (Costanza et al. 1997). Ecosystem services can be roughly divided between those that provide goods, like food, fibers, and fuels, and those that perform services, such as cleansing of the water and the air and temperature control. Inherently efficient, all natural processes are also characterized by (1) a future-oriented perspective that ensures the continuity of every ecosystem and, therefore, of life; (2) efficient use of the material and energy resources available on Earth; (3) process cyclicity, which accounts for the renewability of resources; and (4) a dynamism that ensures that processes can evolve to adapt to changes. Nature can therefore be used as a blueprint according to which unnatural processes can be imbued with sustainability (Wolfson et al. 2011).

2.2 Sustainability as Service

The generation of any value can be set in motion by a customer with needs that can be supplied by the value provider, by a provider that offers a particular solution to the customer, or through a combination of the two. Yet to provide the value, the provider relies on a variety of supplies, such as natural resources, knowledge, and technologies, while the customer might or must add its own skills and resources. In addition, while generating the main or the core value of the process, other values are usually also produced as part of a super-value of the process and of the interactions with other processes. Furthermore, every process also has indirect stakeholders, from employees to shareholders, and its effect on the social and natural environments should also be considered.

As sustainability should be an integral and essential part of the core- and super-value of each process – and therefore, it should be incorporated into each stage of the process value chain – it is in fact a value in and of itself. Moreover, because sustainability is intangible, inseparable, nonperishable, and non-heterogeneous and it should be produced and delivered via a co-creation process, it can (and should) actually be defined as a service. Defining sustainability as a service is in line with service-dominant logic, in which the emphasis on sustainability extends the relation between sustainability and service beyond the incorporation of sustainability into the production of goods and services to the production of goods and services that is guided by the philosophy of

sustainability. This approach ensures that sustainability will be incorporated into any process by all of the process' direct and indirect providers and customers, who do so via the exploitation of both physical and nonphysical resources.

As previously mentioned, a process can be described as a set of activities that are organized in a value chain and whose performance should deliver a value from a provider to a customer. In general, the value chain of a process comprises the innovation stage (i.e., the design and development of the value), the operation stage (the production, marketing, and delivery of the value), and the final stage, the use of the value (Fig. 2a). Each phase of the value chain of a process involves materials and energy as well as nonphysical resources (e.g., knowledge and effort), and the activities of each phase may

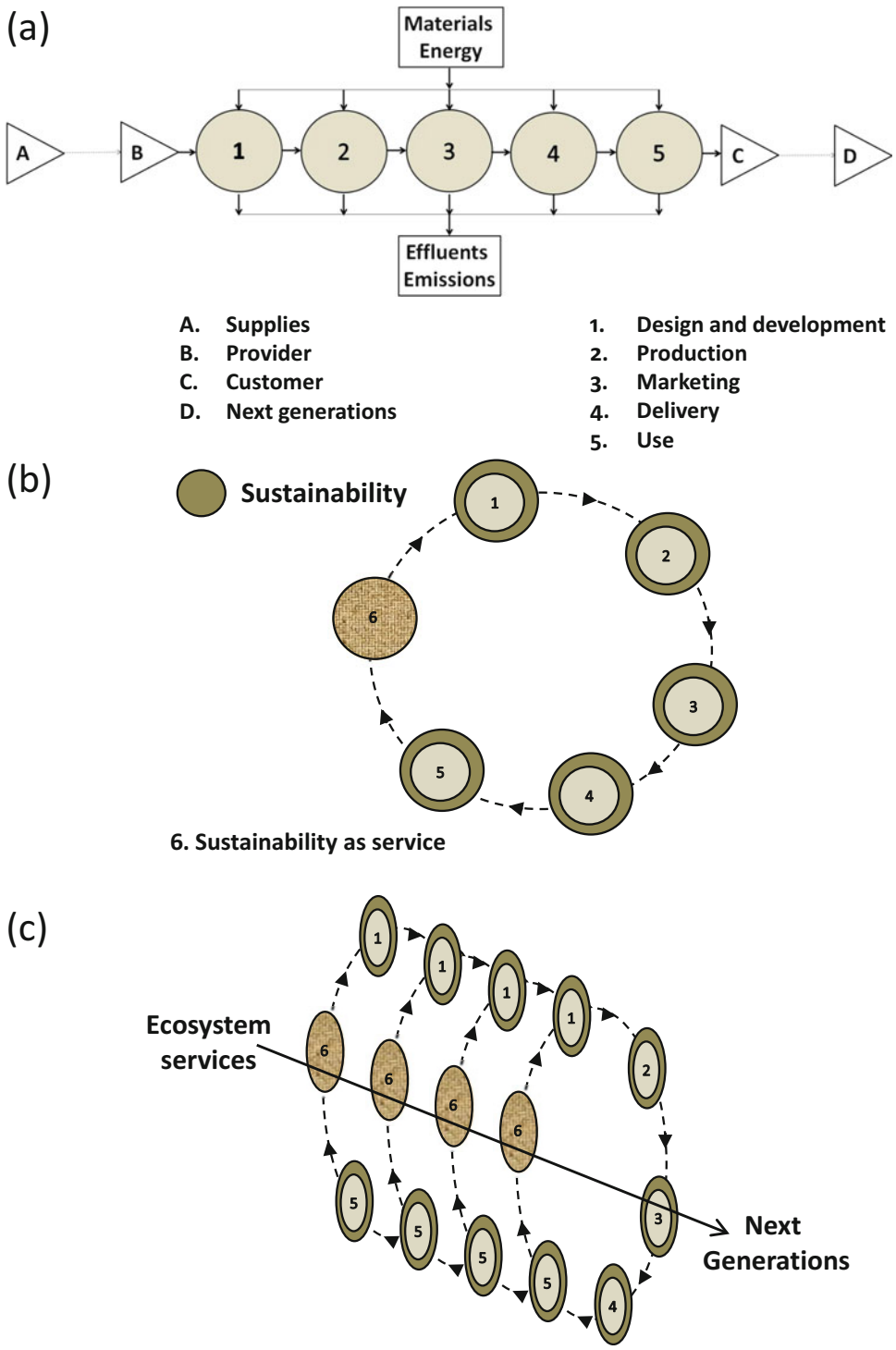

Fig. 2 Illustrations of the (**a**) value chain, (**b**) sustainable value life cycle, and (**c**) evolutionary sustainable value perspective of a process

generate effluents and/or other types of discharge to the environment.

The goal of increasing the sustainability of a process' value chain should consider each of the stages in that chain and can be achieved via different routes. One way is through a reliance on a more efficient use of natural resources, e.g., materials and energy, and less discharge from the production process to the environment while emphasizing more efficient use of the product itself. Alternatively, the sustainability of the value chain can be improved by designing a product that will be more efficient or redesigning and delivering the product using different methods. In addition, it can be accomplished by dividing the responsibilities for the resources and the capabilities differently between the provider and the customer and shifting the service boundary either to that which is operated mainly by the supplier, i.e., a super-service, or to a service that is fully operated by the customer, i.e., a self-service (Campbell et al. 2011). Finally, the value chain can also be imbued with sustainability by adding to it new supporting and complementary values.

To ensure that the process will be sustainable, however, the value chain should be designed as a closed, cyclic system in which both physical and nonphysical resources are renewed; in short, it should adopt a natural mimicry approach. As such, closure of the cycle is done by adding sustainable values that assure the reuse and regeneration of physical resources but also that facilitate changes in habits, ways of thinking, and behavior that will, over time, engender an increase in global sustainability, i.e., the super-value (Fig. 2b). Moreover, the implementation of this approach ultimately recruits the customer as a provider of sustainability to the next generation.

Finally, because the process should also match and adapt to changes in the market and in the social and natural environments while preserving the rights of the next generation, it should also be evolutionary (Fig. 2c). Thus, a new value should be generated to guarantee that when a certain product or service reaches the end of its life, its effect on the next generation will endure.

2.3 Examples

Recall that a value chain comprises a series of activities that are performed to produce and deliver a core-value – which can be either tangible or intangible, but more often, it is a combination of the two – from a provider to a customer (Fig. 2); fulfillment of the core-value of a value chain is also associated with the generation of other values, i.e., super-value, and it involves additional suppliers and customers. In addition, any value chain involves the sharing and exchange of physical and nonphysical resources, e.g., materials, energy, knowledge, and capabilities.

To demonstrate how sustainability can be produced and delivered as an integral part of any process, three examples are given below: (1) the production and delivery of an electric device, such as a domestic cooking oven, which emphasizes the more sustainable use of a physical resource; (2) the production and delivery of education as a service, with a focus on the nonphysical elements of sustainability; and (3) the entire value chain of a good, a half-liter PET bottle of Coca-Cola.

The sustainability of any electric device can be increased during both its production and use steps via the rational use of natural resources and the reduction of discharge to the environment, e.g., implementation of an energy-saving program at the factory and a change in the behavior of the customer, who cooks only when the oven is full. In addition, sustainability can be further increased by exploiting recycled materials in the production of the device and by recycling the appliance itself at the end of its life, which creates a closed material life cycle. However, sustainability can also be added to the product by addition of new supporting and complementary services – such as repair services or redesign and replacement of the original oven door so that it will suit a new kitchen design – that can prevent prematurely exchanging the device for a new model.

In contrast to the manufacture and use of an electrical appliance, school education is a service that holds as it core values the knowledge, methods, and tools that are used to teach the pupils productive ways of thinking and behaving. From this perspective, school education is an intangible value, and therefore, it does not involve the use of any direct physical resources. The sustainability of the service can be increased, for example, by its customers, i.e., the children, who, in learning about sustainability, can effect change in their habits at school and/or at home accordingly. To create a closed service life cycle that improves sustainability, however, the children should also function as "agents of change" in their families and in society, ultimately helping to perpetuate the service's sustainability in the long term. Taken another step further, the children receiving educations today will be the citizens, teachers, engineers, and elected officials of tomorrow, and therefore, they will be equipped with the tools and know-how to shape the social environment and manage the natural environment more sustainably.

The last example will trace the entire value chain of a good, a half-liter PET bottle of Coca-Cola. For some people, the purchase of beverages is almost a daily activity that they do without really considering the value chain and its consequences and that can become embedded in their behavior as a habit. However, what is the core value of this process? Is it the bottle of Coca-Cola, i.e., the good, or is it a service that delivers values like fun, pleasure, and feelings of belongingness vis-à-vis groups like family or friends? Alternatively, perhaps is it a product-service system? Its

super-value, on the other hand, accounts for environmental values such as water and energy use, greenhouse gas emissions, and effluents, social values such as fair employment policies and promotion of the local economy, and economic values like the price of the beverage.

A value-chain assessment of the entire process used by Coca-Cola in the production of a half-liter bottle of its product examines several phases and steps (Coca-Cola Europe 2010b), from production (the production and delivery of ingredients, like sugar and water, and the manufacture of the drink) through delivery (production and filling of bottles or cans and distribution of the product, including its transportation) to the eventual use of the product (storage and refrigeration by the retailer, operation of refrigerated vending machines, and consumer use and disposal).

The value chain can also undergo a physical resources assessment that accounts for energy and water utilization, from the growth of the ingredients and production of the raw materials, through the production of the beverage and its packaging to the delivery, use, and recycling of the package. These were considered by the Coca-Cola company, which they expressed as the carbon footprint (CFP) and the water footprint (WFP, Table 1).

As previously mentioned, the sustainability of the value chain can be increased by adding complementary services and values to each step and by changing the value co-creation process. From the perspective of physical resources, the issue of sustainability is rather straightforward. In addition, the awareness of many companies (providers) today of sustainability is much higher, and many have adapted their performance accordingly. Indeed, the strict regulations in place today and the need to remain competitive in the market, on the one hand, vs. the simple fact that the rational use of resources also leads to a reduction in production costs, on the other hand, has led many companies to make their processes more efficient and treat their emissions and effluents, thereby increasing their sustainability.

With regard to the customers, they can promote and propagate sustainability by reducing physical resources during their use of the product and by recycling unused resources at the end of the product's life. However, in this respect, despite the increased awareness of people over the world of the numerous environmental crises with which humanity is contending today, there is still room for improvement. The provider, too, is obligated to actively influence both its suppliers and customers to behave more sustainably. Thus, the value co-creation process dictates that to achieve the goal of sustainability in the service-dominant framework, both the customer and the provider must assume new, collaborative roles.

Table 1 Breakdown of the carbon footprint (CFP) and water footprint (WFP) of a half-liter bottle of Coca-Cola

Phase	Step	CFP (gCO_2eq)[a]	WFP (Liter)[b]
Production	Ingredients	33.6	28
	Manufacturing	26.4	0.4
Delivery	Packaging	103.4	7
	Distribution	16.1	–
	Refrigeration	58.8	–
Use	Drinking and disposal	1.7	–
Total		240	35.4

[a](Coca-Cola 2009), [b](Coca-Cola 2010a)

In the case of Coca-Cola, the dissection of the CFP and WFP of its value chain for the production of a half-liter bottle shows that all the resources involved – i.e., from the supplies used for the production and delivery of the raw materials to the production, packaging, and delivery of the beverage – are ascribed to the provider. Thus, from the provider's perspective, the sustainability of its product, i.e., a full bottle of Coca-Cola, can first of all be dramatically changed by instituting innovative design concepts. These could include, for example, replacing the conventional, petroleum-based plastic used in its bottle with a sugar-based biodegradable plastic or changing the shape of its plastic bottle to streamline packaging and make the bottle more compatible with recycling. The Coca-Cola Company can also increase its efficiency with respect to resource use. The production process could thus be redesigned to use less energy or renewable energy sources in at least some of the production steps. Likewise, its production plants could recycle the water used in the manufacturing process and offset its fresh water needs by using gray water (kitchen sink, shower, and laundry water) in the agricultural production of its raw materials. These are just some of the viable opportunities open to a company to reduce both its CFP and its WFP. The corresponding reductions in wastewater volumes and greenhouse gas emissions to the surroundings will increase the environmental value of the entire process.

Resources can also be cut by the provider by using a service that manages the distribution of the product, which would manage the distribution by only sending trucks that are full to reduce the fuel used. However, resource reduction should also be the responsibility of the customer who, by disposing of empty bottles at a recycling center or in dedicated recycling bins, will help close the value chain cycle with respect to the plastic. Even though the bottle recycling step is performed by the customer, the provider still bears the responsibility of ensuring that its customers use the recycling service by informing and even educating them about how that is done and why it is important and by ensuring not only that the dedicated recycling bins will be accessible and visible but also that their contents will be collected when the bins are full. Likewise, the provider is also obligated to insure that the bottles collected will be recycled and used again in the market.

Finally, although the ultimate consumers of the bottles of Coca-Cola are not directly accountable for the majority of the resources that were consumed throughout the product's value chain cycle, those consumers can effectively reduce the amounts of resources used by changing their behavior. For example, the customers can change their preferences and buy only larger bottles of Coca-Cola that are composed of less plastic per liter of beverage and that, therefore, require less energy per liter to produce. On the other hand, consumers can switch to another brand of beverage whose CFP is lower. In fact, the CFP and WFP measures can also be used to increase beverage market competitiveness, thereby generating extra value. In this scenario, companies like Coca-Cola can add a carbon and water labeling service (Wolfson et al. 2015) to their products. Labeling the bottle with the product's footprints would allow customer to choose their preferred beverages based not only on taste and price or on the number of calories but also on the CFP and WFP values of the product.

In summary, the sustainabilities of both the core-value and the super-value of the process can be increased by reducing the use of physical resources throughout the value chain – from the supplies, through the provider, and on to the customer. However, sustainable services must also consider non-physical resources, and in this respect, new intangible values should be generated. As previously mentioned, although Coca-Cola is fundamentally a beverage company involved in production and delivery, it is also selling a brand that is associated with nonphysical values like joy and happiness as well as togetherness. Thus, any attempt to improve the sustainability of its value chain must be connected with these values. This starts through the company's adoption of "corporate social responsibility" (McWilliams and Siegel 2001) or "responsible care" (Givel 2007) policies and practices that incorporate ethics and international morals and laws and that promote improvements in health, safety, and environmental performance while upholding open and transparent communication with the stakeholders. Finally, sustainability can and should be combined with the core-value itself. For example, joy and pleasure are also associated with health, which is affected by the state of the environment, e.g., air quality, while values that are connected to being part of a group can be translated in the long term into greater values that promote social and environment justice.

3 Summary

The sustainability of any good or service value chain can be increased by adding new values to the core- or super-value, by considering the numerous stakeholders and by redesigning the co-creation process. It begins by defining sustainability itself as an intangible value, i.e., a service, and by implementing a rational use of resources. But it can only be achieved by designing the value chain as a closed cycle that operates in an evolutionary fashion and by recruiting the customer to become a provider of sustainability to the current and the next generation.

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