Title: An Ecosystem Service-Dominant Logic? – Integrating the ecosystem service approach and the service-dominant logic.

Corresponding Author:

Brent D. Matthies
University of Helsinki
P. O. Box 27
Helsinki, Finland
FI-00014
Email: brent.matthies@helsinki.fi

Co-Authors:

Dalia D'Amato
University of Helsinki
Email: dalia.damato@helsinki.fi

Dr. Sami Berghäll
University of Helsinki
Email: sami.berghall@helsinki.fi

Dr. Tommi Ekholm
VTT Technical Research Centre of Finland
P.O. Box 1000
VTT, Finland
FI-02044
Email: tommi.ekholm@vtt.fi

Dr. Hans Fredrik Hoen
Norwegian University of Life Sciences
Universitetstunet 3
1430 Ås, Norway
Email: hans.hoen@nmbu.no

Jani Holopainen
University of Helsinki
Email: jani.m.holopainen@helsinki.fi

Jaana E. Korhonen
University of Helsinki
Email: jaana.e.korhonen@helsinki.fi

Dr. Katja Lähtinen
University of Helsinki
Email: katja.lahtinen@helsinki.fi

Dr. Osmo Mattila
University of Helsinki
Email: osmo.mattila@helsinki.fi

Dr. Anne Toppinen
University of Helsinki
Email: anne.toppinen@helsinki.fi

Dr. Lauri Valsta
University of Helsinki
Email: lauri.valsta@helsinki.fi

Dr. Lei Wang
Zhejiang Agriculture and Forestry University
Email: waleland@foxmail.com

Dr. Rasoul Yousefpour
University of Freiburg
Tennenbacher Str. 4 (2. OG)
Freiburg, Germany
D-79106
Email: rasoul.yousefpour@ife.uni-freiburg.de

Abstract:

Natural and business ecosystems are complex and dynamic service systems that interact through the utilization of ecosystem service offerings for human well-being. Currently, natural and business sciences have not developed a shared and common set of service-based terms or concepts for discussing ecosystem service offerings in the process of value co-creation. In this study, the ecosystem service approach was compared with marketing science's service-dominant logic. The terminology and concepts were harmonized, and the two approaches were then integrated into a service-dominant value creation (SVC) framework. The incorporation of natural ecosystems includes accounting for the flow of positive and negative impacts through associated value networks. Therefore, the term *value-in-impact* was proposed to describe these value flows. A case study of the global forest-based sector was then presented, demonstrating how to discuss current research challenges using the proposed framework. In conclusion, a shared service-dominant approach provides an opportunity for deeper inter-disciplinary discussion between natural and business sciences. This study represents a contribution towards the development of a holistic service science that includes consideration for natural ecosystems. The SVC framework also addresses many of the multidimensional challenges noted by previous sustainability frameworks.

Keywords

Service-dominant; Ecosystem service; Service science; Value creation; Ecosystem; Ecosystem service cascade

1. Introduction

Numerous acute global change pressures are currently being exerted on natural ecosystems (Rockström et al., 2009). These pressures originate from and are driven by the economic activities of human societies, and threaten the value co-creation processes between firms and their beneficiaries

(i.e., customers) (Carpenter et al., 2009). Within natural sciences, the Ecosystem Service (ES) approach has emerged to describe the benefits that humans obtain from natural and, in some cases, semi-natural ecosystems[1] for human well-being (de Groot et al., 2002; Fisher et al. 2009). According to this concept, natural ecosystems perform several functions that are useful to humans (e.g., provisioning of food, biomass, regulating water flows, global and local climate, and contributing to cultural values).

Notwithstanding the use of the term 'ecosystem services,' the ES approach has still largely failed to develop into a truly service-based on the concept. The ES literature defines 'service' as "an ecological function or process that is considered useful to human beings" (Haines-Young and Potschin, 2010). In service and marketing sciences, the definition of 'service' is "the process of doing something beneficial for and in conjunction with some entity" (Vargo and Lusch, 2008a). Both of these definitions are highly complementary, and suggest that the ES approach is potentially an extension of service sciences. Berghäll et al. (2014) and Lusch and Vargo (2014) have previously identified this connection by noting the similarities between the ES approach and marketing sciences' service-dominant (SD) logic.

The SD logic reinterprets the process of value creation and co-creation, by shifting away from a goods-dominant (GD) (i.e., neo-classical, production-oriented) view to one based on service value creation (Vargo and Lusch, 2004). The GD logic view on value creation focuses on a firm embedding "value in 'goods' or 'services,' [and] value is 'added' by enhancing or increasing attributes" to the 'good' or 'services' (Vargo and Lusch, 2008a). In the GD view, value is measured in terms of nominal value exchanged (i.e., price for the 'services' or value-in-exchange). By contrast, the SD logic argues that value is co-created between all human actors (i.e., firms, individuals) through the value of using a 'service' (i.e., utilization or value-in-use) and determined individually through experience of the beneficiary (i.e., phenomenologically determined).

The ES approach has also sought to recognize a broader definition of value beyond only the monetary valuation of 'goods and services' (e.g., Polasky and Segerson, 2009; Spangenburg et al., 2014). Thus, the SD logic and ES approaches appear highly complementary; the main difference being the differing focus on service value flows. Within the ES approach, the focus is placed on flows between natural ecosystems and socio-economic networks, while the SD logic focuses largely on flows within socio-economic networks. Despite the similarities between the two approaches, the ES

[1] This distinction has been made given that this study also incorporates business literature where it has become common to use the terms "ecosystem" to refer to a 'service ecosystem' or a 'business ecosystem'.

literature often adopts a GD logic view on value creation to address service provisioning challenges. For example, ES offerings are frequently referred to as ecosystem 'goods and services' (e.g., Wilson and Hoehn, 2006; Müller and Burkhard, 2012). Alternatively, the lack of an ES contribution to the ongoing discourse in service sciences means that the complex socio-ecological relationship tends to become oversimplified within the SD logic (e.g., Lusch and Vargo, 2006; 2011).

Bridging these two bodies of literature is timely and important. A common set of terminology and concepts could facilitate a shared approach to addressing the impacts of companies on ES offerings, and improve their value co-creation processes (Whiteman et al., 2013; Waage and Kester, 2014; D'Amato et al., 2014). A shared lexicon would also facilitate the discussion about ES trade-offs and multi-level governance challenges that firms and ecosystem managers both face (Heuer, 2011; Whiteman et al., 2013).

The purpose of this study, therefore, is to establish a service-based understanding of value creation with respect to ES offerings. To start, a review of the SD logic and ES approaches is given in Section 2, and conflicts and gaps in terminology and concepts are resolved. The two approaches are then integrated into a conceptual framework for service value flows between the economy, society, and the environment in Section 3. The proposed service-dominant value creation (SVC) framework acts as a guide for future inter-disciplinary discourse on the ES value creation processes. The multidimensional (i.e., temporal and spatial) nature of the SVC framework made it difficult to ignore the obvious connection to sustainability science (i.e., sustainable development) (e.g., Lozano, 2008). Therefore, the implications that a SD approach has for that field of study are also discussed. Also, in Section 3 the term v*alue-in-impact* is proposed for discussing the positive and negative ES provisioning impacts throughout business ecosystems and value networks. Finally, a case application of the SVC framework is provided for the global forest-based sector in Section 4. A perspective from this sector is highly applicable, as it offers cases of environmental self-regulation and a history of continuous engagement and integration of stakeholder groups (Aaltonen and Kujala, 2010; Prakash and Potoski, 2012; Toppinen et al., 2014).

2. Harmonizing the Ecosystem Service and Service-Dominant Approaches

By harmonizing the language used in business and natural sciences, there is an increased opportunity for collaboration and communication between those fields of study. To facilitate this process for readers unfamiliar with one or both of those approaches, a brief overview of the differences between the GD and SD logics and the ES cascade framework are provided. It is not

158 possible, however, to extensively summarize each of the approaches here. A more in-depth overview
159 of the SD logic is provided by Lusch and Vargo (2014). Moreover, Fisher et al. (2009) and Haines-
160 Young and Potschin (2010; 2011) both provide important discussions on the definition and
161 classification of ES. For ease of reference, all acronyms and terms that were used throughout this
162 article have been compiled in Tables 1 and 2 respectively.

163 **Table 1. A list of acronyms used in this article.**

Acronym	Term
CSR/CR/CS	Corporate Social Responsibility/Corporate Responsibility/Corporate Sustainability
CSV	Creating Shared Value
DPSIR	*D*rivers, *P*ressures, *S*tate, *I*mpact, *R*esponse
EIA	Environmental Impact Assessment
ES	Ecosystem service
GD	Goods-Dominant
GISCAME	*G*eographic *I*nformation *S*ystem, *C*ellular *A*utomation, *M*ulti *C*riteria *E*valuation
PES	Payments for Ecosystem Services
SD	Service-Dominant

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165 **Table 2. A list of key terminology and definitions from the Ecosystem Service and Service-**
166 **Dominant approaches.**

Term	Definition	Source
Service	*From ES approach:* An ecological function or process that is considered useful to human beings. *From SD approach:* The application of specialized competences by one entity through deeds, processes, and performances to create benefit for the entity itself or another entity. The singular term 'service' is used to reflect "the process of doing something beneficial for and in conjunction with some entity". This contrasts with the plural form 'services' (see next definition).	Haines-Young and Potschin, 2010; Vargo and Lusch, 2008a
Services	The "intangible output of the firm" or "intangible goods". Commonly used in the GD logic.	Vargo and Lusch, 2008a
Service System	Dynamic and self-reconfiguring system, interacting over various different temporal and spatial scales, loosely arranged using either hard and/or soft contracts, and entailing both value co-creation and -integration by different actors and their natural environment.	Vargo and Lusch, 2011
Sustainability	"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Depending on the classification and definition, it consists of three or four dimensions: economic, environmental, social, and cultural.	WCED, 1987
Creation of Shared Value (CSV)	"Generating economic value in a way that also produces value for society by addressing its challenges… by reconceiving products and markets, redefining productivity in the value chain, and building supportive industry clusters at the company's locations."	Porter and Kramer, 2011
Ecosystem Service Approach		
Natural ecosystem	"A dynamic complex of plant, animal and microorganism communities and their nonliving environment interacting as a functional unit."	MA, 2003
Natural capital	"The stock that yields the flow of natural resources." We augment this definition in Section 3 to be: the stock of potential value held by natural ecosystems for human utilization.	Daly, 1994
Biological diversity (i.e., biodiversity)	The "variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems."	Convention on Biological Diversity, 1992

Ecosystem service(s)	Benefit(s) obtained by people from natural or semi-natural ecosystems that contribute to human well-being.	Fisher et al., 2009; Haines-Young and Potschin, 2010
Ecosphere	The "sum total of life on earth together with the global environment and the earth's total resources" or "that part of our sphere in which there is life together with the living organisms it contains."	Cole, 1958; Gillard, 1969
Service-Dominant Approach		
Business ecosystem	A complex network of relationships based on service flows and organizational evolution (i.e., a whole ecosystem influencing/interacting with the actors – extension to the Service System definition).	Moore, 1996; Iansiti and Levien, 2004
Operand resource	Those resources that are acted upon – e.g., wood.	Vargo and Lusch, 2004
Operant resource	Those resources that act upon other resources – e.g., knowledge and skills.	Vargo and Lusch, 2004
Resource Integration	Application of operant resources or competencies to operand resources via four resource categories: people, technology, value propositions connecting internal and external service systems, and shared information (e.g. language, laws, measures, and methods).	Vargo and Lusch, 2004; Spohrer et al., 2007
Service ecosystem	A "relatively self-contained, self-adjusting system of resource-integrating actors that are connected by shared institutional, logical, and mutual value creation through service exchange."	Lusch and Vargo, 2014
Value network	Any purposeful group of people or organizations creating social and economic good through complex dynamic exchanges of value. Also referred to as a value constellation.	Normann and Ramirez, 1993; Allee, 2009
Value-in-exchange	"Is required for value creation" and acts to mediate and monitor value-in-use. It provides a "way of measuring relative value within a context of surrounding systems."	Vargo et al., 2008
Value-in-use	"Value is always uniquely and phenomenologically determined by the beneficiary" leading to a more holistic recognition, collection and definition of value originating from the interaction of different service systems.	Vargo and Lusch, 2006
Value-in-impact	**A spatially and temporally dynamic component embedded in value-in-use and exchange, which represents the co-creation and co-destruction of potential value (positive and negative impact) attributed by actors to how ES are managed, facilitated, and utilized by human-based service systems in the value network.**	**Presented in this study.**

The four axioms and six additional foundational premises of the SD logic (Vargo and Lusch, 2004, 2008b; Lusch and Vargo, 2014) state that:

1. "Service is the fundamental basis of exchange"
    a. "Indirect exchange masks the fundamental basis of exchange"
    b. Goods are a vehicle or "distribution mechanism for service provision"
    c. "Operant resources are the fundamental source of competitive advantage"
    d. "All economies are service economies"
2. "The customer is always a co-creator of value"
    a. "The enterprise can only make value propositions"
    b. "A service-centered view is customer oriented and relational"
3. "All economic and social actors are resource integrators"
4. "Value is always uniquely and phenomenologically determined by the beneficiary"

These axioms contrast with the GD logic, where value-in-exchange is the basis for estimating the value of 'goods' or 'services' and value is produced by firms and brought to a market through the

exchange of other goods or money (Table 3) (Vargo et al., 2008). The GD logic identifies 'final' customers as the receivers of value, and interactions in the market occur mainly between 'producers' and 'consumers' (Lusch and Vargo, 2014). Value is embedded in a produced good, and the focus is on the supply and demand of goods via price (Vargo and Lusch, 2011). Therefore, value is created by firms (i.e., production) and destroyed (i.e., consumed) by the 'consumer' (Plé and Chumpitaz Cáceres, 2010).

Table 3. A comparison of value creation concepts from the Goods-Dominant logic and the Service-Dominant logic (Adapted from Vargo et al. (2008)).

	GD Logic	SD Logic
Value driver	Value-in-exchange	Value-in-use or value-in-context
Creator of value	Firm, often with input from firms in a supply chain	Firm, network partners, and beneficiaries*
Process of value creation	Firms embed value in "goods" or "services", value is "added" by enhancing or increasing attributes	Firms propose value through market offerings, beneficiaries* continue value-creation process through use
Purpose of value	Increase wealth for the firm	Increase adaptability, survivability, and system well-being through service (applied knowledge and skills) of others
Measurement of value	The amount of nominal value, price received in exchange	The adaptability and survivability of the beneficiary system
Resources used	Primarily operand resources	Primarily operant resources, sometimes transferred by embedding them in operand resources (i.e., goods)
Role of firm	Produce and distribute value	Propose and co-create value, provide service
Role of goods	Units of output, operand resources are embedded with value	Vehicle for operant resources, enables access to benefits of firm competences
Role of customers	To 'use up' or 'destroy' value created by the firm	Co-create value through the integration of firm-provided resources with other private and public resources

*Vargo et al. (2008) use 'customers' here, but we have changed this to beneficiaries.

The process of value creation and purpose of that value, in the context of the SD logic, is described as created jointly, or co-created, by service systems either for or with beneficiary systems (Table 3) (Vargo et al., 2008). This is done through a network constituting of interactive sets of experiences and activities (i.e., interactions and resource integration between different individuals and firms) to improve the beneficiaries' well-being (Maglio and Spohrer, 2008; Spohrer et al., 2008; Grönroos, 2008). The interactions are based on voluntary mutual exchange between different service systems (Payne et al., 2008).

Co-creation of potential value is accomplished via four resource categories: people, technology, value propositions connecting internal and external service systems, and shared information (e.g., language, laws, measures, and methods) (Spohrer et al., 2007). Resource integration involves applying operant resources or competencies to operand resources (Vargo and Lusch, 2004). This network of value co-creators can be referred to as a 'value network' of 'service systems' (i.e.,

individuals, firms, actors) (Table 2). In the value network, there are only actor-to-actor interactions where human actors can form their own service system or contribute towards a larger multi-individual service system (i.e., employees in a firm) (Ramirez, 1999; Peppard and Ryland, 2006).

Furthermore, value is perceived by the beneficiary based on the processes that contribute towards the potential value of a given service. If a firm tries to maximize "the lifetime value" of its beneficiaries, then superior value propositions must be provisioned to maximize the total potential value that is co-created with them (Payne and Frow, 2005; Payne et al., 2008). Lifetime value is derivative of superior knowledge of the beneficiaries' value creation process, which requires understanding of the structure of those processes.

Total potential value of a service is comprised of two components: value-in-exchange and value-in-use. These components represent value that is actualized by facilitating the service offering to the beneficiary and their subsequent utilization of it (Gummesson, 2007; Grönroos and Voima, 2013). Transfers of value are formalized in the market through value-in-exchange (i.e., exchange of money), which can exist as "multiple singular entities" throughout the value creation process (Grönroos and Voima, 2013). These exchanges mediate and monitor the value creation process that evolves within value-in-use (Grönroos, 2008). Value-in-use "is always uniquely and phenomenologically determined by the beneficiary;" making value idiosyncratically created and evaluated by the beneficiary (Vargo and Lusch, 2006; Lusch and Vargo, 2014).

Value-in-use is based on the collective or individual value of a beneficiary's utilization preferences (Vargo and Lusch, 2008b). Given that human experiences can be realized over multiple temporal and spatial dimensions; the inclusion of value-in-use is an important part of determining the lifetime value of a beneficiary. Full value-in-use may only be actualized long after the value-in-exchange is fully realized or occur far away from the physical point of exchange (Payne et al., 2008; Bocken et al., 2015). Moreover, value creation is a non-linear interactive and dynamic process (Payne et al., 2008). Experiences can lead to value-in-use that is positive or negative (i.e., greater or lesser well-being) (Grönroos and Voima, 2013). Thus, value creation by one service system results in potential value that can be utilized, missed or destroyed by various other actors, processes, and resources that are part of a service system's value network (Maglio and Spohrer, 2008; Bocken et al., 2015).

In the SD view, value co-destruction occurs through "interactional process between service systems that results in a decline in at least one of the systems' well-being" (Plé and Chumpitaz Cáceres, 2010). Therefore, value destruction is a consequence of misuse of operant or operand

resources and not what is ‘expected’ or ‘appropriate’ according to another service system (e.g., the beneficiary system). Misuse can be accidental or intentional, and lead to adverse outcomes for some or all service systems in the value network (Plé and Chumpitaz Cáceres, 2010).

Many of the foundational concepts of the SD logic are found implicitly within the ES approach. Gómez-Baggethun et al., (2010) note that the terms value-in-use and value-in-exchange have a long history as part of the debate about the societal value of natural ecosystem functions. Ricardo (1871) discussed that natural ecosystem functions as ‘serviceable’ to human service-systems through value-in-use. Similar views on ecosystems’ value were also forwarded by Marx (1891), who stated that both labor and nature were the source of use value, though neither economist suggested that nature contributed to exchange value (Gómez-Baggethun et al., 2010). In the early 20th century, the discussion shifted to one focused on the value-in-exchange due through the emergence of the neo-classical economic paradigm. Pigou (1920) noted that “the range of our inquiry becomes restricted to that part of social welfare that can be put directly or indirectly into relation with the measuring rod of money.” This shift in the view on ES value creation severely restricted subsequent analyses to only those service offerings that had a monetary value (i.e., price) and excluded non-market service offerings (e.g., regulating ES).

More recently, there has been a shift in economics towards a more holistic recognition of ES offerings using monetary valuation methods (e.g., willingness-to-pay) (Gómez-Baggethun et al., 2010). The aim of monetization is to price non-market ES offerings and account for them through various schemes (e.g., payments for ecosystem services (PES)). Still, the use of these policies only expresses priced service offerings through the exchange value of the service. The recognition of ES offerings’ value only through market prices often excludes value-in-use. This restricts both the maximum value potential that is recognized by firms and other resource integrators value co-creation opportunities.

The holistic recognition of both value-in-use and exchange for ES offerings has important implications for the decisions by human-based service systems to utilize, miss, or destroy value throughout the network. These missed opportunities can be extended to the creation and destruction of value from natural ecosystems (i.e., trade-offs between ES offerings resulting from natural ecosystem utilization and management). By extending the SD approach to ES offerings, then ES are service offerings that form part of the value creation processes of value networks and are impacted by resource integration processes over the network. Fully understanding the impacts of resource integration on the value potential of ES offerings is important. To start, ES offerings should be

classified in a manner that facilitates accurate measurement and accounting of their role in value creation.

The ES cascade was developed (see, Haines Young and Potschin 2010, 2011) for accounting and classifying ES (Fig. 1). The cascade describes the integration of resources required to produce service offerings by a given natural ecosystem (i.e., natural ecosystem functions and processes). It references value creation through both value-in-exchange (e.g., "willingness-to-pay") and value-in-use (e.g., "what values…social, moral, or aesthetic") between natural ecosystems and beneficiaries. In the cascade framework, the maximum potential value of ES offerings that is available to humans from natural ecosystems is constrained based on the sum of pressures on the system. For these reasons, the cascade has become an integrated component for various ES and environmental impact modeling frameworks that guide natural ecosystem management decisions. These models range from spatial impact assessment models (e.g., GISCAME – see Table 1) to the *DPSIR* (*D*rivers, *P*ressures, *S*tate, *I*mpact, *R*esponse) conceptual model for ecosystem management and communication (Müller and Burkhard, 2012; Kelble et al., 2013). The exact nature of the aforementioned models is not important for this study, but the integration of the ES cascade into planning models does indicate its operational potential and adaptability.

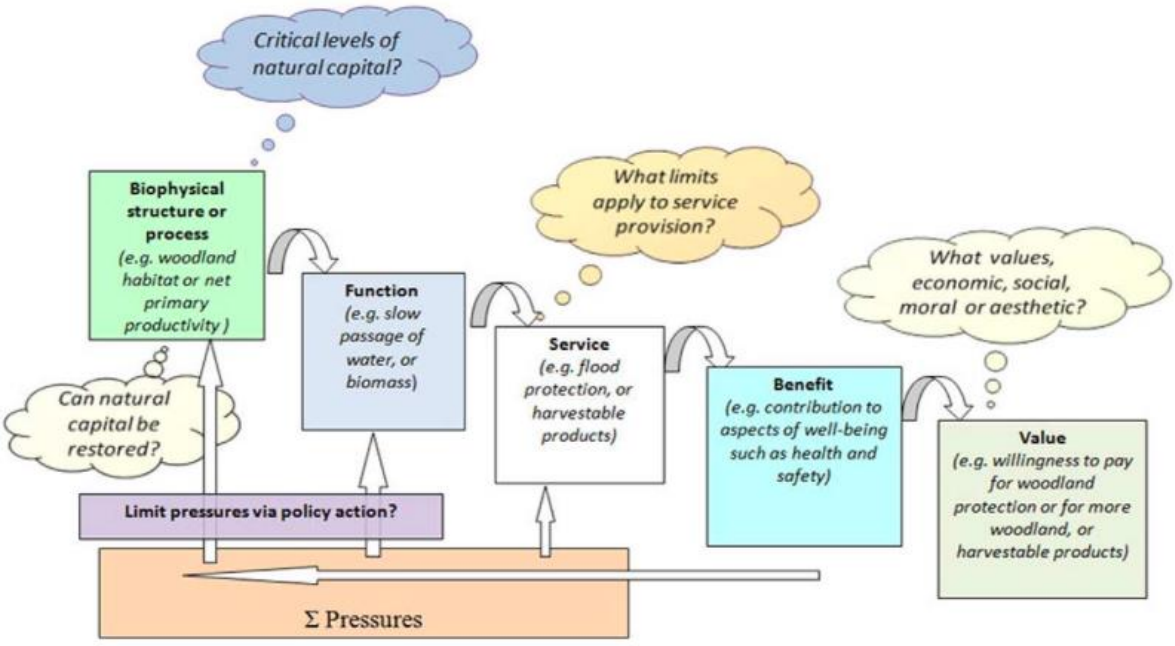


Fig. 1. The Ecosystem Service cascade framework adopted from Haines-Young and Potschin (2010).

Within the cascade, 'function' refers to the "capacity or capability of the ecosystem to do something that is potentially useful to people," indicating the role of the natural ecosystem as a service

287 system providing offerings with potential value (de Groot, 1992; de Groot et al., 2002). In this study,
288 the term 'function' is used to refer to those natural ecosystem processes that lead to service offerings
289 and well-being for human-beings[2]. Fisher et al. (2008; 2009) regard biophysical structures and
290 ecological processes or functions (i.e., biocentric part of the cascade starting on the left side) to be
291 moving from 'intermediate services' into 'final services' and their associated benefits (i.e.,
292 anthropocentric part of the cascade starting on the right side). That progression is generally viewed
293 as a continuum within Fig. 1. Final service offerings directly contribute to an individuals' well-being,
294 and 'intermediate' service offerings (e.g., primary productivity) enhance well-being indirectly
295 through a 'final' service offering (e.g., constant stream flow) (Johnston and Russell, 2011). The
296 cascade framework aims to remove the risk of double-counting in ES analysis by only accounting for
297 service offerings when they are utilized by another service system (Fisher et al., 2009).

298 Having summarized the main concepts and terms, it is important to note that there are still gaps
299 and conflicts between the SD logic and ES approaches. To address these gaps and conflicts some of
300 the current terminology and concepts in both approaches need to be re-evaluated. Four necessary
301 shifts were identified that are foundational to harmonizing the ES and SD logic approaches.

302 First, the SD logic makes a clear distinction between the use of the singular term 'service' and
303 GD logic-based 'services' (Table 2). Vargo and Lusch (2008a) provide an in-depth discussion of the
304 similarity of usage between these two terms. They define service offerings as the outcome of applying
305 "specialized competences" or operant resources "through deeds, processes, and performances for the
306 benefit of another entity or the entity itself" (Table 2). We believe that this is the intended definition
307 of ecosystem 'services' given by Fisher et al. (2009) and applied in the various ES classification
308 schemes. In the current ES literature, the plural of 'service' or 'services' is used interchangeably with
309 the GD 'services,' but these two terms have very different meanings within the discussion on value
310 creation. They are not interchangeable, but rather the same term for two definitions. Therefore, we
311 adopt the singular form 'service,' and the plural form 'service offerings,' throughout the remainder
312 of this text to avoid confusion and draw the distinction with the GD 'services'. However, we
313 acknowledge that the use of 'services' is well-established within the ES literature. Clarification of the
314 meaning of 'services,' though challenging, is important and will require further efforts and discussion.

315 Second, based on the definition of service system given in Table 2 the natural environment is a
316 contextual part of, or even a basis of, the definition of service systems (i.e., the term 'entity' refers to

[2] Fisher et al. (2009) note that there is an important distinction between ecosystem 'function' (anthropocentrically derived) and 'functioning' (biocentrically derived). Value creation is an anthropocentric concept, which justifies our used of 'function' over 'functioning'.

all organisms involved in the value creation process). Despite some supportive discussion, the integration of natural ecosystems as a macro service system within the value network is not a widely accepted view within the SD logic. The economy, in the hierarchy of embedded service systems, has previously been identified as the largest service system by Maglio and Spohrer (2008). We propose instead that the ecosphere is the largest service system and an actor in the value creation process that human-based service systems interact with and act upon. It would be impossible for any of the other service systems to integrate resources or co-create value without this system, and human societies and economies would not exist without the environment that they have evolved within and from. The ecosphere integrates resources based on competencies that exist through complex ecosystem functions, which lead to value propositions (i.e., ES offerings) that other service systems utilize and value.

Third, the use of 'natural resources' is currently and persistently used to refer to natural ecosystems' service offerings in the service literature (e.g., Porter and Kramer, 2011; Grönroos and Voima, 2013). This term is largely obsolete within the ES literature. The term 'operand resources' is used within the SD logic to describe those 'natural resources' that "require some action to be performed on them to have value;" further potential value and value-in-use are created by human-based service systems integrating these operand resources (Lusch and Vargo, 2011). The reliance on further processing of the 'natural resource' base, with the intention to utilize potential value, is in opposition with the ecosphere being the largest macro service system. Rather than being described as 'natural resources,' we propose that ES offerings' contributions to human well-being mean that they have potential value regardless of further processing (i.e., by firms or individuals). Then natural ecosystems can be viewed as actors within the value network rather than commodity repositories. Value potential that is created by natural ecosystems can then be attributed to them rather than attributed to firms and individuals who are only facilitating or utilizing those ES offerings.

Finally, there needs to be a clear amendment to how service offerings from natural ecosystems are described and discussed in the ES literature. The terminology 'goods and services' is frequently used despite the widespread use of a 'service' approach (e.g., Polasky and Segerson, 2009; Johnston and Russell, 2011). The lack of a clear SD approach in the discussion of ES, despite the large amount of service science literature available, impedes debate between natural and business sciences. It also inhibits the development of a holistic discourse with the ES literature regarding the service value of ES offerings. As a result, emphasis is often placed only on the exchange value of ES; even though many authors note the limitations of this approach when discussing the opportunity costs of ES provisioning (e.g., Wilson and Hoehn, 2006; Spangenberg et al., 2014). Natural ecosystems only

provision service offerings and not 'goods and services,' which act as the basis of exchange with other human-based service systems. This means that the focus in the ES literature should shift towards a holistic view on ES value creation. This viewpoint is not expressly new. The desire for a more balanced approach to estimating and describing the potential value of ES offerings has been called for and demonstrated by others (e.g., de Groot et al., 2010; Potschin and Haines-Young, 2011).

3. Towards an integrated Service-Dominant Value Creation Framework

Harmonization of the ES and SD logic terminology and concepts provides the basis for creating the SVC framework for discussing service value creation. The two approaches together consider value creation across all three macro service systems or dimensions of sustainability (i.e., economy, society, and environment). The purpose of their harmonization is, ultimately, to address the global change pressures being exerted on natural ecosystems, and the associated negative value creation (i.e., value destruction of ES through adverse trade-offs). Therefore, it is sensible to also note the main overlaps between the SVC framework and other frameworks proposed within sustainability science.

The ES literature describes the socio-ecological system as functioning through a complex and dynamic set of 'demand-supply' relationships based on non-linearities, thresholds, and the influence of external pressures (Anderies et al., 2004; Folke, 2007). Fig. 2 moves away from that 'demand-supply' relationship found in the ES cascade framework, towards one based on value creation within a set of dynamic and complex value networks. For example, all aspects of value creation are emphasized (i.e., use and exchange) rather than only those related to the exchange value (i.e., price) of ES offerings[3]. Delimiting value assessments into stated monetary preferences (e.g., willingness-to-pay) that represent total value of the services (i.e., GD logic of value) are not sufficient to comprehensively communicate about ES value-in-use. As a distinction to Haines-Young and Potschin's (2010; 2011) ES cascade framework, a greater emphasis is placed on the value-in-use and phenomenological determination of value by beneficiaries. The SVC framework better accounts for value creation by addressing the complex value creation interactions within business ecosystems, between society and the economy, and between human-based service systems and natural ecosystems.

[3] We base this assessment on the discussion by Vargo and Lusch (2008a), who provide a detailed comparison of the terms 'value-in-use' and 'utility' from economic sciences. Those authors state that in the shift from Adam Smith's economic philosophy (where he presented the term 'value-in-use') to the concept of economic science (based on embedded 'utility'), means that "value-in-use has been dwarfed and 'utility' has morphed into value-in-exchange." We do not take on this debate in this study, and instead accept Vargo and Lusch's (2008a) assessment of the difference of these two terms in presenting our integrated approach.

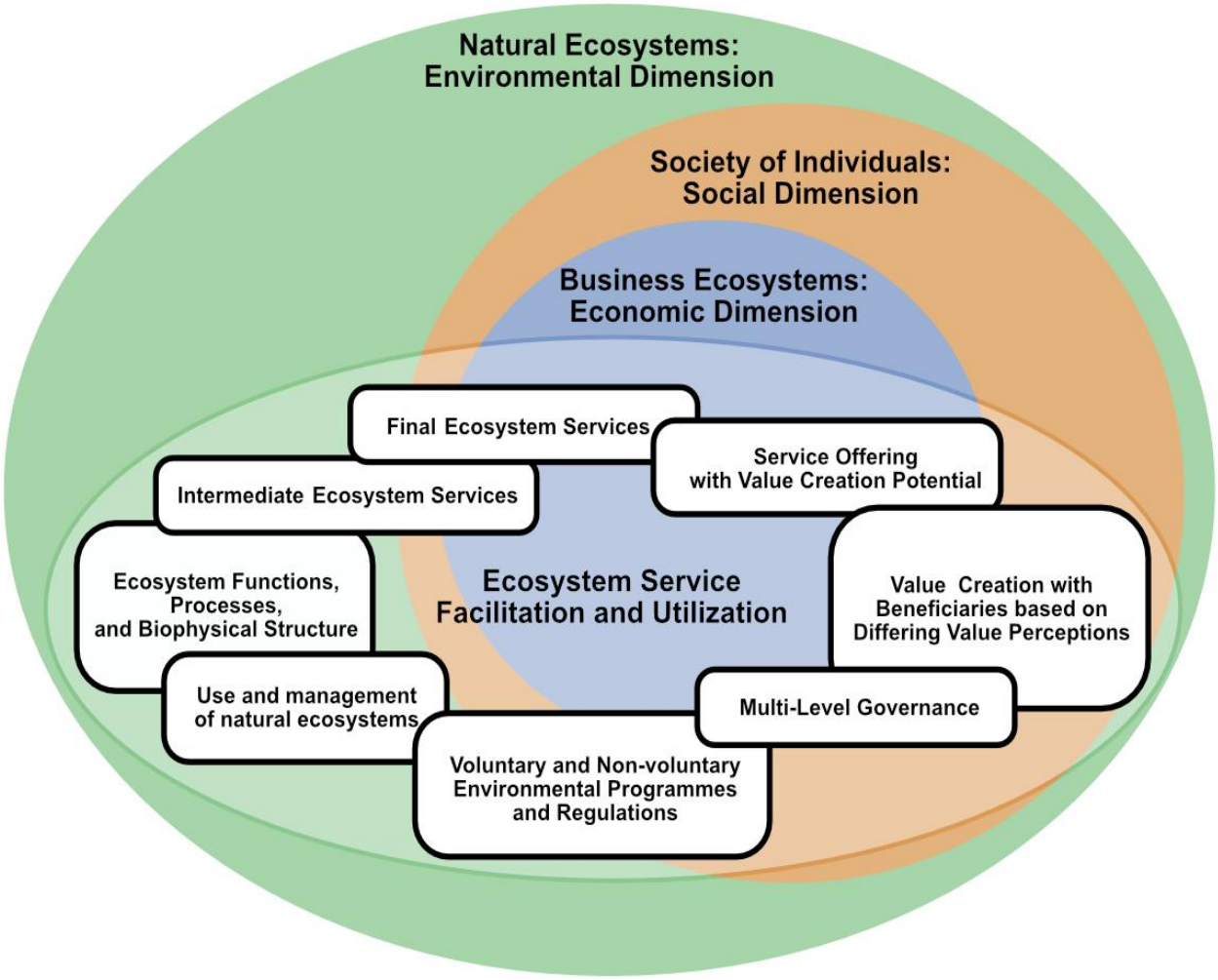


Fig. 2. A service-dominant value creation (SVC) framework for ecosystem service offerings in value co-creation within the socio-ecological system.

An embedded non-concentric circles approach is applied in Fig. 2 to demonstrate the dependent relationship between the macro service systems. By placing the macro service systems of society and economy within the environment, the reliance of human well-being and societal development are intrinsically linked to natural ecosystems (Carter and Moir, 2012; Costanza et al., 2014). In Fig. 2, interactions between service systems occur in a bi-directional and non-circular manner. The overlapping 'process' boxes represent the flow of potential ES value through the macro service systems (i.e., economy, society, and the environment).

Each of the three dimensions is interlinked through a constellation of dynamic and co-current value networks. In each network, economic and social service systems fluidly co-create value with each other through voluntary exchanges. Temporally (e.g., intergenerational, over time) and spatially (e.g., between service systems, over geographical distance) dynamic interactions are accounted for

through the facilitation (i.e., exchange) and utilization of phenomenologically determined potential value. This flow of service offerings between the three dimensions overcomes the previous critiques of the embedded circles approach: lack of multidimensionality (i.e., temporal – intergenerational) and interconnectedness (i.e., spatial – connections between the three dimensions) (Lozano, 2008). Therefore, we consider an integrated and intergenerational perspective between the dimensions through the process of value creation.

An individual can be both a social and economic service system during the same value creation processes, and the economy is naturally embedded in the society. Human-based service systems rely on the exploitation of natural capital for continued value creation. The ES cascade overlaps with human-based macro service systems (i.e., economy and society), and the determination of 'intermediate' and 'final' ES offerings is dependent on the level of connectivity to other service systems and utilization by the beneficiary (Turner and Daily, 2008; Fisher et al., 2009). Moving clockwise, resource integration processes are applied by other service systems to those ES; aiming to maximize value co-creation. This means that value is co-created by utilizing and managing potential value of ES offerings, and by integrating resources to create further value propositions. Therefore, human-based service systems are co-creators and co-destroyers of potential ES value through exchanges and interventions with natural ecosystems. Consequently, natural capital represents the stock of potential value held by natural ecosystems. By integrating natural ecosystems in this way, positive and negative impacts on ES value creation are accounted for the over an entire value network.

Service offerings then directly or indirectly benefit individuals, and a feedback of impacts on natural ecosystems occurs. These impacts can affect natural ecosystem resilience, which is an indication of their ability to continue providing further potential value (i.e., co-destruction by human-based service systems with natural ecosystems). All natural ecosystem management by human-based service systems constrains the provisioning of some ES over others; potentially resulting in adverse trade-offs (Polasky and Segerson, 2009).

Trade-offs have a pivotal role in value creation for both individual and total service system well-being (Carpenter et al., 2009; Howe et al., 2014). A change in the level of provisioning for one service may negatively affect the level of provisioning of another, which often occurs when human-based service systems are competing for value co-creation opportunities with natural ecosystems (Rodriguez et al., 2006; McShane et al., 2011). Trade-offs, and the associated ecological impacts, are particularly important for the management of natural ecosystems, which provision multiple ES simultaneously (Polasky and Segerson, 2009). Given that both exchange and use values are intrinsic

to the concept of ES, all changes to ES provisioning levels are implicitly value-laden (Brauman et al., 2007, Diaz et al., 2011).

Currently there are no commonly accepted terms or concepts in service science related to the identification and discussion of co-creation or co-destruction of natural ecosystem's service offerings. Consequently, the new concept of *value-in-impact* is introduced to account for and discuss their role in value creation. *Value-in-impact* is a spatially and temporally dynamic component of value-in-use and value-in-exchange, which represents the co-creation and co-destruction of potential value (i.e., positive and negative impact) attributed by actors to how ES are managed, facilitated, and utilized by human-based service systems (Fig. 3). It represents the value potential available to and phenomenologically determined by the beneficiaries of ES offerings over the value network. Total potential value is constrained based on scarcity of ES provisioning in the socio-ecological system. One approach to addressing thresholds in the socio-ecological system is evaluating essentiality and environmental impact of a firm's offering through a sustainable development orientation (Heikkurinen and Bonnedahl, 2013; Nunes et al., 2015).

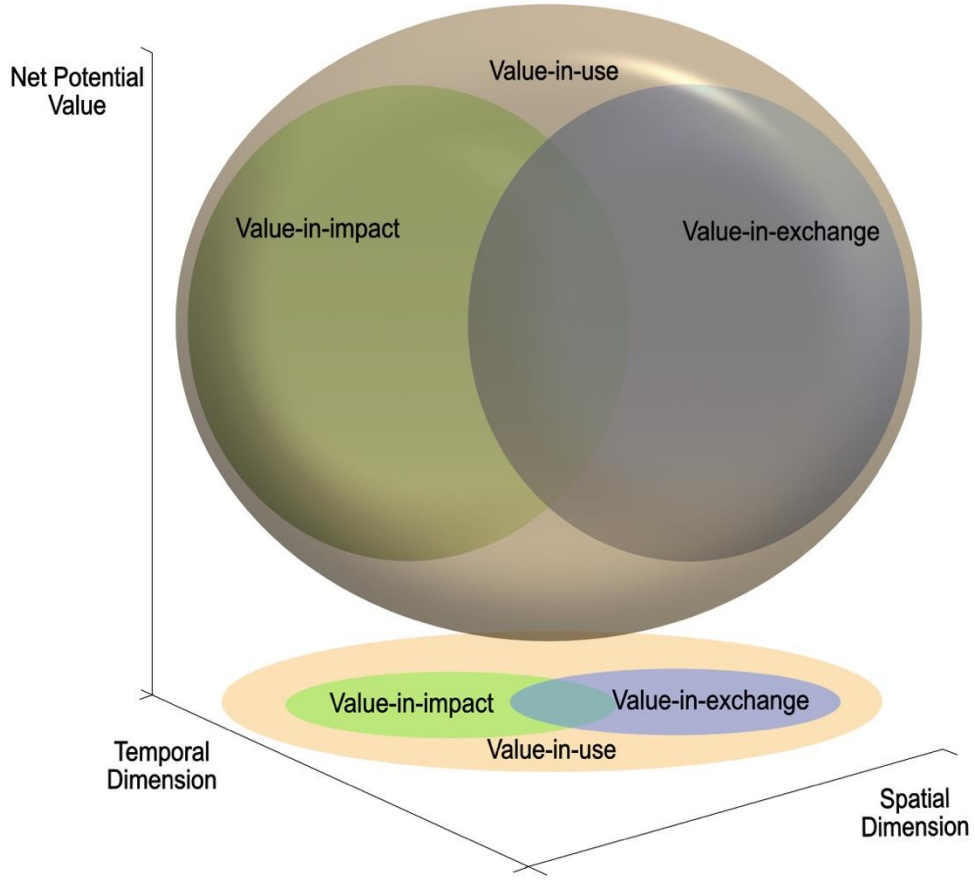


Fig. 3. A graphical conceptualization of the *value-in-impact* concept represented as a portion of the value-in-use and value-in-exchange of a service offering. *Value-in-impact* is both spatially and temporally dynamic, and can be either part of the positive or negative impacts on maximum potential value over the value network. A two-dimensional reflection of the value space is shown below to demonstrate the interdependency between the three components of value.

In Fig. 3, the net value potential, spatial, and temporal dimensions represent the total potential and phenomenologically-determined value for a beneficiary. Knowing that total potential value is the sum of value-in-use and value-in-exchange, *value-in-impact* is a part of both use and exchange value and does not constitute the entire potential of either. Actions across the value network constrain value potential by carrying out value destruction; thereby, limiting the net potential value that is available over spatial and temporal dimensions. Value-in-use is a requirement for an exchange of value to occur, which is the basis for representing value-in-exchange non-linearly within value-in-use. The maximum and minimum of all value dimensions are undefined (i.e., they are phenomenologically determined by the beneficiary and constrained over the value network).

By placing *value-in-impact* in the context of ES trade-offs within the SVC framework, actions by other service systems can result in trade-offs that create or destroy value potential associated with natural capital. For example, negative value or the destruction of potential value for beneficiaries can emerge as a result of a firm's impacts on natural ecosystems. Some trade-offs, occurring over spatially and temporally diverse dimensions, may be irreversible leading directly or indirectly to adverse impacts on value flows (Howe et al., 2014). The resulting impacts could be an aggregated loss in value for some beneficiaries or an entire set of beneficiary service systems. The amount of net potential value still available from utilizing ES offerings represents the impact on value co-creation by a service system's resource integration processes. These impacts can affect both the lifetime value of and potential value for a firm's beneficiaries. This provides a more inclusive approach to studying the relationship between the damage, replacement and avoidance costs noted by Spangenberg et al. (2014), and their impact on human well-being.

Value-in-impact can facilitate understanding of how to maximize the potential societal value, associated with the facilitation and utilization of ES, over the value network (i.e., the economy is considered to be one aspect of societal organization). Discussing and identifying the maximum potential societal value associated with *value-in-impact* requires knowledge of ES indicators, impacts of processing, and trade-offs of ES offerings throughout the value network. There are already various different decision-making methods that can be used to account for these impacts with differing outcomes (e.g., Environmental Impact Assessment (EIA)). The purpose of *value-in-impact* is not to create another method or replace existing methods. Rather, it provides service sciences with a

474 contextually appropriate term to discuss ES trade-offs and utilization impacts linked to beneficiaries'
475 value creation processes.

476 A considerable amount of research on how beneficiaries' value structures are related to their
477 views on ecological impacts has already been conducted (Stern et al., 1993; Schwartz, 1994; Stern
478 and Dietz, 1994). The manner in which impacts on ES service provisioning are perceived by
479 individuals, either more or less positively or negatively, is connected to the value orientations of their
480 environmental concern: biocentrism, humanism altruism[4], and egoism. This is a reflection of how
481 adverse impacts on natural ecosystems, resulting from choices by other service systems within the
482 value network, ultimately affect those individuals both directly and indirectly (Dietz et al., 2009). The
483 three dimensional aspect of environmental concern differs between beneficiaries. That difference
484 ultimately results in diversity in the desirable end states of or behaviors towards value creation
485 (preferences) and service provisioning. In-order to prevent value destruction, firms need to better
486 understand how individual beneficiaries' value creation processes are structured.

487 As noted earlier, *value-in-impact* is a temporally dynamic part of value and value structures are
488 not fixed. Managing the change in lifetime value that emerges due to changes in an individual's
489 preferences is a value creation risk for firms. Increased awareness of ES impacts for a given service
490 offering means that *value-in-impact* could form an increasing share of the value creation opportunities
491 between a beneficiary and other service systems (Dietz et al., 2005). As a result, the shifting value
492 orientations of beneficiaries are important and should be recognized; something that is increasingly
493 acknowledged by many firms (The Economist, 2015).

494 Within Fig. 2, trade-offs between different ES and impacts are considered by the connection of
495 service systems at multiple levels of governance. Multi-level governance interventions aim to address
496 value destruction and alleviate pressures from managing the provisioning ES offerings. The
497 governance element is a key component of the ES cascade and earlier ES frameworks (e.g., Turner
498 and Daily, 2008; Polasky and Segerson, 2009). Policies regarding environmental programs and
499 regulations, voluntary or mandatory, should act to dictate a safe minimum level of service
500 provisioning required throughout the value network (Segerson, 2013). Carbon emission controls via
501 taxes or cap-and-trade, obligatory resource management laws, and corporate sustainability reporting
502 are a few examples of possible instruments (Gray, 2010; Prakash and Potoski, 2012; Segerson, 2013).
503 Policies reflect use (e.g., corporate sustainability disclosure based on GRI standards) or exchange

[4] Altruism is defined by Dietz et al. (2009) as the value of others, including humans and other ecosystems/species. Human altruism can also be referred to as social altruism and environmental altruism can also be referred to as biocentrism (Dietz et al., 2009).

(e.g., PES) values attributed to ES (Matthies et al., 2016). Policy makers must evaluate the minimum service provisioning levels required to maximize value over all of the individual value chains that constitute the value network (Balmford et al., 2011). A holistic integration of the SD logic in the ES approach provides for the inclusion of all social and ecological actors to be considered as endogenous components of the value creation process (Vargo et al., 2008).

4. Applications of the SVC framework to the global forest-based sector

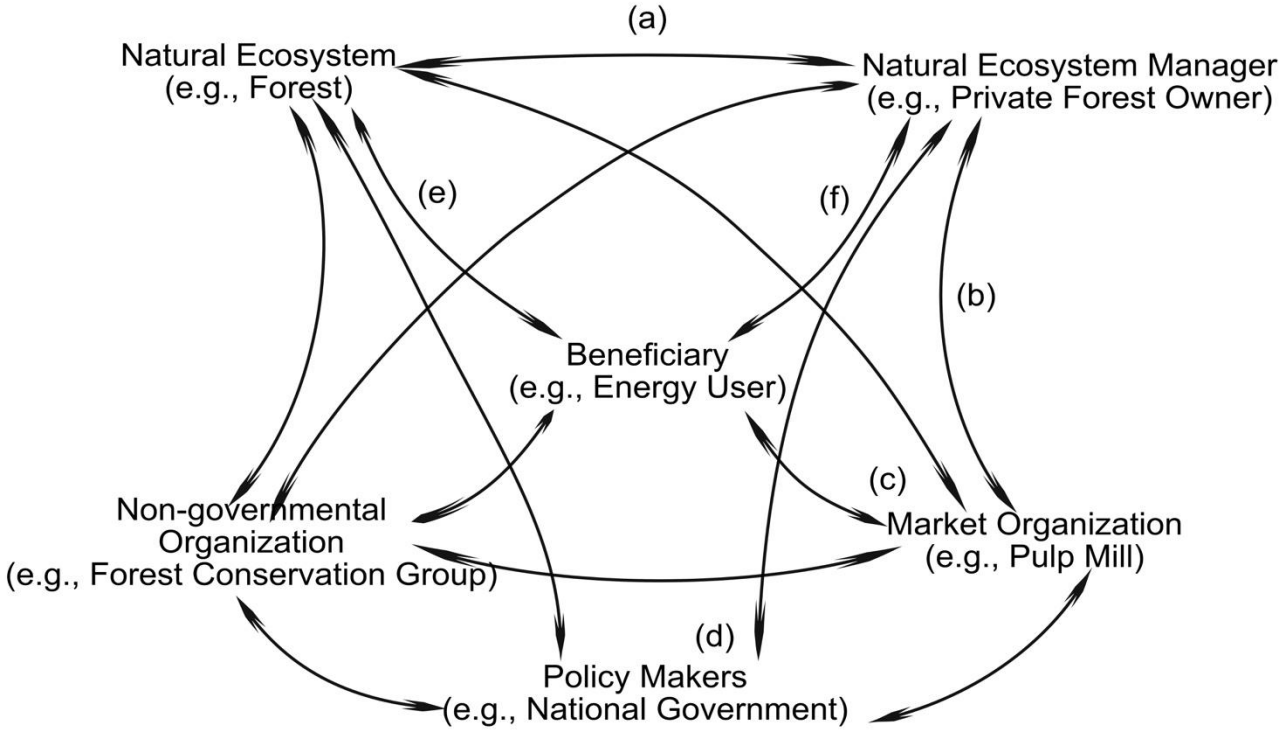
We now provide a case application of the SVC framework, and associated shifts in terminology, for the global forest-based sector. Although we highlight forestry, the concepts presented in this study are likely to be applicable across a wide range of sectors reliant on interactions with the natural environment.

The global forest-based sector (e.g., forestry producing biomass – e.g., round wood – and industries processing harvested biomass – e.g., into pulp and paper or dimension lumber) faces numerous obstacles in accounting for impacts on forested ecosystems. The service systems or actors involved in value co-creation are both direct (e.g., foragers, recreationalists) and indirect beneficiaries (e.g., multinational corporations processing pulp and paper for individual utilization). Many strategic shifts are currently occurring due to societal (e.g., urbanization, technology) and policy changes (e.g., sustainable forest management certification) that have had important implications on the types and volume of ES available from forested ecosystems (Fisher et al, 2008). These factors, along with the wide range of developmental and sociological contexts that the sector operates in, makes the associated value networks dynamic, complex and increasingly service oriented (Toppinen et al., 2013).

Arnold (2015) notes that by evaluating all of the stakeholders in the value network, co-creation processes can be integrated throughout the entire value chain to "minimize negative social and ecological impacts" or *value-in-impact*. Fig. 4 gives a graphical example of a forest-based value network map. It includes actors spanning the environment, society, and the economy, which interact over time and space to co-create value. Below the figure the interactions are discussed using the previously discussed terms and concepts.

Starting at the forested landscape level, ecosystem management with competing objectives can lead to adverse trade-offs between ES offerings. Depending upon the value structure of the beneficiaries and their understanding of the resulting trade-offs, the potential value available to them may also be affected. For those individuals who manage or use the forest directly (e.g., private forest

owners), their highly variable ownership objectives, values, and attitudes can have a significant impact on the provisioning of different ES and associated value creation opportunities (e.g., Wiersum et al., 2005; Häyrinen et al. 2014).



(a) An ecosystem manager's objectives act to support or constrain the provisioning of ES offerings from the natural ecosystem. Managers can both co-create value with the ecosystem directly or utilize the ES offerings to co-create value within the value network with other service systems. Therefore, they can be both a beneficiary and a resource integrator.
(b) Exchanges between the ecosystem manager and the firm. Value is co-created and potential value of ES offerings is facilitated to the firm. Firms apply operant resources to the operand resources with the aim to maximize the lifetime value of the beneficiary. Firm's resource integration processes affect the positive and negative impacts on natural ecosystems, and the potential for value destruction results from those actions.
(c) Exchange between the firm and beneficiaries is a value co-creation opportunity. The beneficiary system utilizes the potential value of the service offering. This includes both the aspects of the potential value associated with ES and those associated with the application of operant resources by the firm. The aspects associated with the value of ES can be viewed as the value-in-impact component. The destruction of potential value by the firm, through their impact on natural ecosystems, is transferred to the beneficiary.
(d) Policy makers are one service system that can determine if governance changes are need to limit value destruction with the macro service system (i.e., economy). Some aims of improved governance are the reduction in trade-offs from natural ecosystem management decisions and the communication of impacts to beneficiaries.
(e) Interactions between beneficiaries and natural ecosystems can result in direct exchanges of ES between the two service systems.
(f) The beneficiary and the natural ecosystem manager can be the same actor and service system, which demonstrates the non-linear and dynamic nature of the value network.

Fig. 4. An example of a value network map for the global forest-based sector explained using service-based terminology and concepts.

For example, emphasis on economic management objectives can have a negative impact on the provisioning of ES related to biodiversity or climate change mitigation (Bonan, 2008; Yousefpour and Hanewinkel, 2009). This can reduce the value potential available for recreational use of forests

or culturally important landscapes, of which the same managers may also be beneficiaries (Pröbstl et al., 2010; Lähtinen and Myllyviita, 2015). Impacts and trade-offs are then transferred further throughout the value network. As a consequence, the increasing societal demands for greater accountability and protection of forest ES offerings are a fundamental challenge (Lähtinen et al., 2014).

Managing the positive and negative impacts of land-use is increasingly complex for all human-based service systems (e.g., individuals, firms). The value-in-use of provisioning of climatic benefits might be experienced by beneficiaries well into the future, providing a large lifetime value for the firm, but only providing a minimal value-in-exchange currently. Also, the purchase of ES offerings in one country can lead to negative value realization for local communities due to losses in livelihood opportunities. Nevertheless, it may also lead to value creation opportunities when those service offerings are utilized and exchanged with beneficiaries in another country. Consequently, spatial and temporal aspects are important considerations. The breadth of these challenges demonstrates the importance of a comprehensive view on value creation to allow the firm to better manage opportunities in their value network.

In Fig. 5, one portion of the value network was isolated in a highly simplified example of a wooden table. The natural ecosystem (forest) provides intermediate ES offerings of climate regulation through the (a) sequestration and storage of carbon away from the atmosphere. This service is based on the functions and processes of the natural ecosystem, which are (b) utilized by firms, individuals, and humanity to improve well-being and allow for the continuation of other service systems (i.e., the economy, society). When biomass is removed from the natural ecosystem, the (c) regulating service (e.g., stored carbon) is embedded within the operand resource (i.e., timber)[5]. The timber acts as a vehicle (i.e., distribution mechanism), but has no value alone without a use by a beneficiary. The firm or resource integrator applies knowledge and skills to (d) embed further value potential in the 'good' (table) for the beneficiary. The firm also acts as a value co-creator (e) by facilitating the use of wood through: the exchange of the table and customer interactions (i.e., value-in-exchange), interactions with the beneficiary through table assembly support, climate regulation service offerings (e.g., carbon storage, substitution effects), and all current and future use value of the table for the family (e.g., for eating, design, as a gathering point for meals).

[5] We acknowledge that this is a gross simplification of carbon accounting in forest management. However, for the sake of the example we exclude further climatic and accounting interactions.

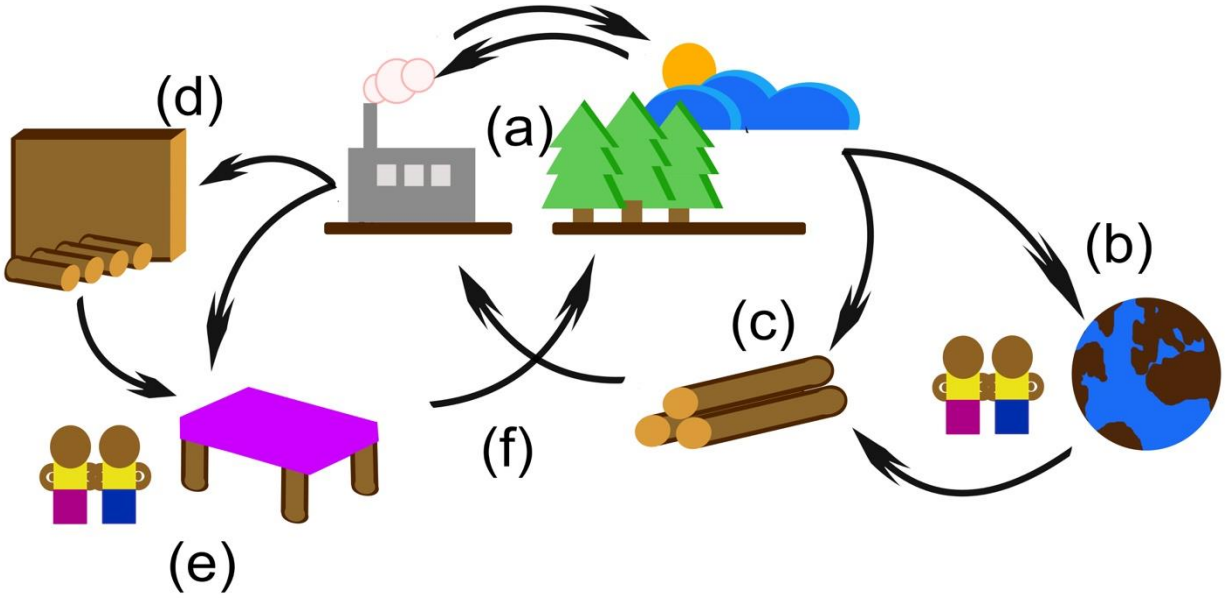


Fig. 5. A simplified diagram of a harmonized service-dominant approach to ecosystem service offerings.

The firm affects the total potential value that can be co-created by managing the environmental impacts of their processes (i.e., *value-in-impact*). The type of material that is processed (e.g.., wood versus steal), its associated ecosystem management (e.g.., sustainable management of the forest), and the firm's greenhouse gas emissions are all a part of the impact on net potential value. The flow of and trade-offs between ES offerings can then be addressed (f) by beneficiaries making alternative value propositions (e.g., shifting to value networks where sustainably managed ecosystems are ensured through certification).

The challenge in accounting for and communicating these impacts highlights the importance of multi-level governance. Its role is to provide a means of communicating the impacts to beneficiaries who phenomenologically determine the net positive or negative potential value that they perceive for a given service offering. Beneficiaries then provide feedback through exchanges with other service systems, and support efforts to enforce changes in the governance of interactions between natural ecosystems and other service systems.

One effort to communicate and regulate impacts, and address the resulting trade-offs is through forest management certification (e.g., Forest Stewardship Council and Programme for Endorsement of Forest Certification). Certification is an example of market-based private governance that aims to reduce value destruction by ensuring the same ecological management standards across globalized value networks (Humphreys, 2006; Cashore et al., 2007). Evidence suggests that some beneficiaries are willing to pay 'premium profits' or price premiums for the assurances of certification (Russo and

Fouts, 1997; Pitelis, 2009). Premiums are realized through value-in-exchange and -use, and can be an important component in building a competitive advantage (York, 2009; Cai and Aguilar, 2013). Thus, value creation extends beyond the 'price effect' to include use value. This value-in-use is realized by choosing a service with a relatively higher net *value-in-impact* than alternatives offer (Toppinen et al., 2014).

Accounting and disclosure of the environmental impacts by firms is another means of providing beneficiaries with knowledge, which can affect their perception value creation opportunities. This phenomenological determination of value includes the total net potential value associated with the *value-in-impact*. Most of the current tools used to account for and report impacts require some form of qualitative and quantitative indicators of economic or social and environmental performance (EC, 2013). Voluntary guidelines for stakeholder communication and sustainability disclosure exist (e.g., Account Ability, 2011; GRI, 2015, ISO 26000), which can be important tools to monitor the sustainability of the business processes. Strategic benefits of reporting include: enhancing business opportunities, acquiring responsibility-driven customers and financers, managing risks with a social license to operate, and improving a firm's reputation (Li and Toppinen, 2011; Lozano and Huisingh, 2011).

These strategic actions aim to build up a firms' sustainable competitive advantage and are based on the value co-creation organizational competencies (i.e., "organizational capabilities necessary to execute S-D logic in practice") noted by Karpen et al. (2011). Better consideration for communication about ES offerings and value co-creation with a firm's stakeholders and beneficiaries has been suggested to contribute towards increased overall stakeholder value and to build a basis for a sustainable competitive advantage (Borck and Coglianese, 2009; Porter and Kramer, 2011; Karpen et al., 2011). Firms that shift towards a holistic (non-linear) SD approach could benefit from the complementarity of holistic service thinking and sustainability. Skålén and Edvardsson (2015) and Pinho et al. (2014) provide two examples of research related to switching from a GD to SD logic within a firm and within a complex value network respectively.

5. Discussion

Both the ES and SD logic approaches aim to enhance the general understanding of what a service is and how service value is created. These complimentary approaches have been partially harmonized in this study to address oversimplification of natural ecosystems in service sciences and encourage interdisciplinary discussion on ES value creation. A harmonized approach should better facilitate

interdisciplinary research between natural and business sciences. It should also clarify the service orientation of the ES approach. Many of the large gaps between the ES and SD logic approaches have now been addressed, but there is still a need for further research.

For example, harmonization of existing ES classification(s) (e.g., the Common International Classification of Ecosystem Services (CICES)) with the SD logic would be an important starting point. Other areas include the service science definitions of 'service' or the role of resource integrators (e.g., Vargo and Lusch, 2008a; Edvardsson et al., 2014). Changing all terms in ES and SD research was deemed beyond the scope of this study. However, small semantic changes can be made by other authors in an effort to achieve an appropriate lexicon for discussing ES (Matthies et al., 2015).

Shifts in terminology will be challenging and require input from both business and natural sciences. This is due to the complexity of natural ecosystems, and their differences when compared other service systems. For example, the term 'offering' still represents the proposition of value based on intent. This is suitable if service offerings from natural ecosystems are regarded as 'natural resources' or they are otherwise ignored. However, the ecosphere, as the largest service system, does not intend to provide other service systems with value propositions. Also, the ecosphere is not bound by the same institutional constraints (i.e., normative, regulative, cognitive) as human-based service systems. It is rather humans managing and utilizing the potential value provided by natural ecosystems that drive the value co-creation processes with natural ecosystems. This brief example suggests that not all service systems are governed by the same logics of service value co-creation, and a more environmentally inclusive conceptualization may be necessary.

In order to achieve balanced input from many disciplines, it will also be necessary to address the connections between this research and other existing approaches. The SD approach to value creation shares many similarities with the concept of Creating Shared Value (CSV), Corporate Sustainability (CS), and other similar fields of study (Porter and Kramer, 2011; Amini and Bienstock, 2014). In accounting for ES trade-offs and the integration of the firm-wide impacts of their utilization, some of the limitations of the CSV approach noted by Crane et al. (2014) have been addressed in this study. By not specifically integrating and discussing those concepts, this article did not mean to challenge or ignore them. Rather the aim of this study was to specifically harmonize the ES and SD approaches.

6. Conclusions

In summary, the authors of this article call for the current SD logic to consider the interrelated system of reciprocal service provisioning between natural ecosystems and human-based service

systems. The article also reveals that there are individuals within the ES community who both understand the evolving SD logic and aim to join the discourse. Table 4 synthetizes the changes that were identified in this article for achieving a harmonized service-dominant approach.

Table 4. A summary of the suggested terminological and conceptual adjustments to create a harmonized service-dominant approach.

Adjustment of…	Current approach	Proposed Integrated approach
Ecosystem Service	'Ecosystem goods and services are the basis of exchange'	Ecosystem service offerings are the basis of exchange, where firms/individuals co-create value with natural ecosystems.
	'Value for ecosystem service offerings is determined through value-in-exchange'	Value for ecosystem service offerings is the total potential value, exchange, use, and impact value, perceived and realized by each service system through voluntary exchanges.
Natural Capital	'The stock that yields the flow of natural resources.'	'The stock of potential value held by natural ecosystems for human utilization.'
Service-Dominant Logic	'The largest service system is the global economy'	The ecosphere is the largest service system and an actor in the value creation process that human service systems interact with and act upon
	'Natural resources are operand resources to be integrated by service systems'	Natural ecosystems provide service offerings with potential value that are utilized or facilitated by other human-based service systems.
	'Service systems integrate natural resources'	Service systems realize and utilize, create further value from, and/or destroy the potential value that is created by natural ecosystems.
Value Network	'Any purposeful group of people or organizations creating social and economic good through complex dynamic exchanges of value.'	'Any purposeful group of people, organizations, or natural ecosystems that create benefit for human well-being through complex dynamic exchanges of value.'
Both approaches	N/A	*Value-in-impact* as a conceptual tool for discussing the positive and negative ES provisioning impacts throughout the value creation process

There are numerous benefits of developing a multidisciplinary set of terms and concepts to address ES value creation. The most obvious are the inter-disciplinary applications within the two respective fields of study. The interaction between natural and business ecosystems is indissoluble, and should be a vital component of any theory regarding the facilitation, utilization, and provisioning of value through service offerings.

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