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# Green Virtual Enterprise Breeding Environments Bag of Assets Management: A Contribution to the Sharing Economy

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**Abstract.** Green Virtual Enterprise Breeding Environments (GVBEs) are long-term strategic alliances of green enterprises and their related support institutions aimed at offering the necessary conditions to efficiently promote and establish common working and sharing principles with the intention of creating sustainable (shared) value in a collaborative way. The Sharing Economy (SE) is founded on the principle of maximising the utility of assets and other shareable resources by means of renting, lending, swapping, bartering and giving them away in order to avoid their idle existence, and is currently being facilitated by emerging collaborative business ICT infrastructures in the marketplace and society. The SE provides the ability to GVBE members to unlock the untapped social, economic and environmental value of their underutilised assets and other shareable resources towards higher resource efficiency. This paper explores the enabling role of the GVBE bag of assets as a virtual and physical warehouse, including collaborative procurement and shareable assets management strategies, in order to facilitate the sharing of tangible and intangible resources between GVBE members. The GVBE bag of assets is put forward as a novel internal sustainable business model, based on a conceptual framework, taking advantage of idle assets and other shareable resources within the breeding environment in order to save costs and generate new revenue streams (economic), make efficient use of resources (environment) and create deeper social connections – trust – among member enterprises (social).

**Keywords:** Collaborative Networks, Green Virtual Enterprises, Bag of Assets, Sharing Economy, Industrial Ecology, Sustainability, Shared Value.

## 1 Introduction

The *Sharing Economy* is founded on the principle of maximising the utility of assets and other shareable resources by means of renting, lending, swapping, bartering and giving them away in order to avoid their idle existence [1] and is currently being facilitated by emerging collaborative business ICT infrastructures in the marketplace [2] and society [3]. The *Sharing Economy* provides the ability to organisations and individuals to unlock the untapped social, economic and environmental value of their under-utilised assets and other shareable resources towards higher resources efficiency. Such resource efficiency strategies (e.g. virtuous business value cycles) are known as the *Circular Economy* [4] and *Collaborative Consumption* [1] by the economists, and as *Industrial Ecology* [5] by the engineers. Complementarily, these concepts

focus on enabling links/exchanges/sharing of information, materials, water, energy, technology, services and/or infrastructure, and any other possible tangible or intangible asset, including by-products, based on collaboration and sharing strategies supported by shared/communal use of assets, logistics, expertise and knowledge transfer within a collaborative network [6] [7].

This paper explores the enabling role of the *GVBE bag of assets* [6] [7] as a virtual and physical warehouse, including collaborative procurement and shareable assets<sup>1</sup> management strategies in order to facilitate the sharing of tangible and intangible resources between *GVBE members*. The *GVBE bag of assets* is put forward as a novel internal sustainable business model, based on a conceptual framework, taking advantage of idle assets and other shareable resources within the breeding environment in order to save costs and generate new revenue streams (economic), make efficient use of resources (environment), and create deeper social connections – trust – among member enterprises (social).

## 2 Green Virtual Enterprises and their Breeding Environments

A *Green Virtual Enterprise Breeding Environment (GVBE)* is a long-term strategic alliance of green enterprises<sup>2</sup> and their related support institutions aimed at offering the necessary conditions (human, financial, social, infrastructural and organisational) to efficiently promote and establish common working and sharing principles with the intention of creating sustainable (shared) value<sup>3</sup> in a collaborative way [6] [7] [8].

From a *functional* point of view, *GVBEs* focus on sharing information, resources, responsibilities, risks and rewards to jointly plan, implement and evaluate sustainable initiatives and collaborative endeavours [10]. From a *behavioural* point of view, *GVBEs* focus on adopting common governance rules and bylaws [11] and a common ontology [12] in order to reduce the barriers towards successful collaborations. From a *structural* and *componential* point of view, *GVBEs* focus on developing common interoperable infrastructures [2] and creating a resource pool (bag of assets) with different tangible and intangible shareable resources in order to eliminate redundant assets within the *GVBE* and manage their ownership costs in an efficient way [6] [7]. As a result, a *GVBE* can be considered as an intelligent network for competences and *resources (assets) management* contributed by various green enterprises aiming to combine their green capabilities in order to develop triple top-line<sup>4</sup> strategies for creating sustainable (shared) value – though *GVEs creation* [6] [7], as addressed below.

“*Green*” *VBEs* in particular are aimed at facilitating the sharing and recycling of assets and other resources with the intention of creating *industrial symbiosis* [5] links/exchanges and shared/communal use of assets between their members [6] [7].

A *Green Virtual Enterprise (GVE)* is a short-term and dynamic coalition of green enterprises that may be tailored within a *GVBE* to respond to a single sustainable value creation opportunity to deliver new green products to the market by means of dynamic forward supply networks creation (see F-GVEs [14]), or to capture the value that may exist in a product or by-product, by recovering it temporarily during its mid-life for service provisioning or at the end of its life for reuse, repair, remanufacturing, recycling or safe disposal by means of dynamic reverse supply networks (see R-GVEs [15]).

### 3 GVBE Bag of Assets and the Sharing Economy

The *GVBE bag of assets* provides collaborative procurement and shareable assets management services to the *GVBE members* in order to develop economies of scale and scope, and enable an 'inter-organisational' sharing economy (see Fig. 1).

*Collaborative procurement services* [16] aim to ensure GVBE members improved security of supply through aggregated buying power; exploit economies of scope within the breeding environment through bundling where there are significant costs common to different products or services in a supply chain; strengthen the negotiating position in contracting with suppliers; reduce prices through economies of scale; share procurement costs for buyers and reduced bidding costs for suppliers through a single tendering process; share the costs associated with gathering price and market information; facilitate improved management of suppliers and contracts at a strategic level for contracts agreed by the GVBE management and GVE coordinator(s); deliver service and process improvements through the adoption of best practice; reduce fragmentation, number of contracts and unnecessary complexity for the breeding environment; ensure all collaborative procurements adopt the highest standards in terms of safety and environmental protection; better decision making through cross-GVBE members and external price benchmarking; and more consistent application of best practice, innovation and enhanced opportunities for learning [adapted from 16].

Meanwhile, *shareable assets management services* aim to create a resource pool that in the sharing case of tangible assets may include transportation vehicles (e.g. collaborative logistics), physical spaces (e.g. shared warehouses, excess space), infrequent-use items (e.g. event equipment), durable goods (e.g. productive assets), etc., and in the sharing case of intangible assets, individuals' knowledge, skills and services (both business and software services), data, time and experiences, with the intention of maximising the return on capital investments and maintaining a shareable knowledge and skills base.

*Shareable assets* can have different dimensions according to [17], based on their nature and *lifecycles*, assets can be 'synchronously shared' when the GVBE members can rent, borrow, and use an item from the bag of assets and return it to the central pool when finished using it, 'asynchronously shared' when GVBE members pass off – gifted, traded, bartered, or resold – the item from one to the other for reuse, and 'collaboratively shared' when the item can be simultaneously shared; furthermore, when it comes to their *management* [17], shareable assets can be administrated within the breeding environment under a 'centralised model' where the GVBE manager (or lender) is responsible for providing access to the central resource pool (the bag of assets) and all GVBE members are renters or borrowers, or under a 'decentralised model' (e.g. peer-to-peer) where the GVBE members control their own assets and play the dual role of lenders and renters/borrowers within the networked community; lastly in regards to the shareable assets potential for 'value co-creation' [10], value is created through *interactions* [17] that enable the creation of financial capital (e.g. money) as well as social capital (e.g. reputation and social reach) for the GVBE and for its members [Adapted from 17].

As *shared value* increases within the breeding environment, GVBE members will discover new collaboration (business) opportunities to link/exchange/share their

assets and value-added activities to gain competitive advantage and sustainable organisational performance [18].

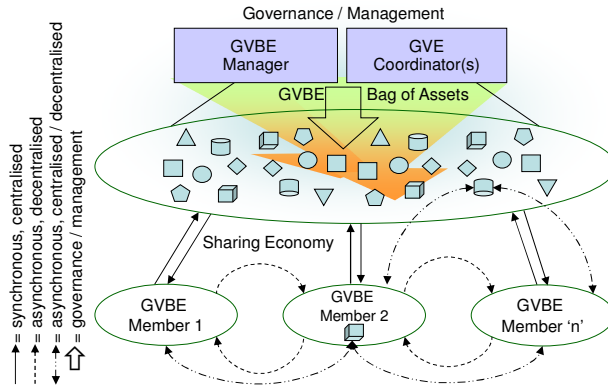


Fig. 1. GVBE Bag of Assets: A Sharing Economy Scenario

### 3.1 Towards a GVBE Bag of Assets Framework and Lifecycle

A *GVBE bag of assets* represents a new long-term collaboration (business) opportunity, namely: the *Sharing Economy* [1], aimed at making ‘business sense’ of the efficient use of common and shareable assets within the untapped internal B2B breeding environment sharing marketplace. Therefore, the *GVBE bag of assets creation* will be triggered as an internal collaboration (business) opportunity to create a resource pool that will be gradually built-up with the GVBE members’ shareable assets and joint purchases and investments in common assets.

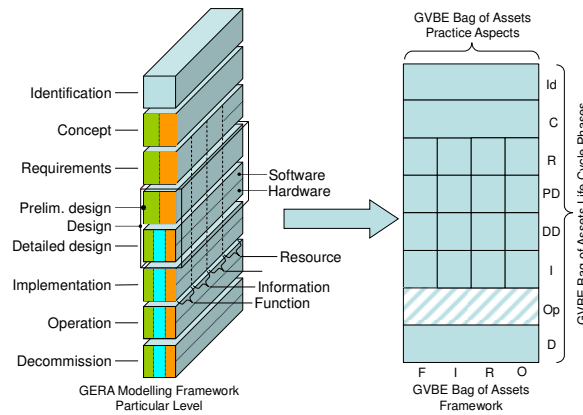
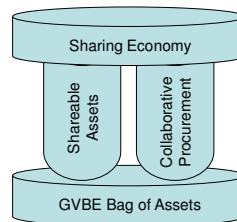


Fig. 2. Modelling Concept [6] [19] [20] for the GVBE Bag of Assets Framework

Similar to the GVE creation framework [6] [19] and according to GERAM - ISO/IS 15704 guidelines [20], the *GVBE bag of assets creation framework* (see Fig. 2 & 3), on its ‘shareable assets’ pillar, starts with the identification of a set of shareable assets

between the GVBE members within an open or predefined conceptualised scope that will trigger and justify the resource pool and its related services creation. Next, the collaboration (business) opportunities identified will be characterised (requirements design) in terms of their ‘economic drivers’ (e.g. monetise excess and idle inventory, increasing financial flexibility, access over ownership, etc.), ‘ecological drivers’ (e.g. reduction of ecological and carbon footprints, etc.) and social drivers’ (e.g. asset-light business paradigm, collaborative consumption, etc.). Following, a first rough architectural design of the GVBE bag of assets taxonomy will be defined (e.g. based on business and accounting principles – current assets, long-term investments, fixed assets, intangible assets, other assets) together with its sharing governance model (e.g. own-to-mesh vs. full mesh, community diversity vs. company control, adoption vs. appropriability of benefits, informal contracting vs. formal contracting, trust by reputation vs. trust by commitment, non-market mediated vs. market mediated, social capital vs. individual benefits, identification avoidance vs. perceived ownership [21]) and business models (e.g. sharing plan, sharing method(s), sharing investment, cost and profit model(s)). Subsequently, GVBE members willing and suitable to participate (as sharing users, sharing suppliers and/or broker(s)) in the long-term *Sharing Economy* collaboration (business) opportunity should be searched and selected according to the degree that their shareable assets profile (e.g. shareable assets inventory, trust level [22], etc.) matches the GVBE bag of assets scope. Then the rough taxonomy and sharing governance and business models should be detailed and agreed by the GVBE members through a negotiation process that aims to embed social (shared) value creation into contracts and agreements. Finally, the GVBE bag of assets operation should be launched.

For the particular situation of the GVBE bag of assets dissolution, shareable assets already count with an specific ownership by the GVBE members (sharing suppliers), so decommissioning efforts will be centred in common assets jointly purchased.



**Fig. 3.** GVBE Bag of Assets Creation Framework Pillars

On its ‘collaborative procurement’ pillar, the *GVBE bag of assets creation framework* starts with the identification and conceptualisation of the potential participant pool to get involved in the collaborative purchasing opportunities. The GVBE members interested will begin communication and information exchange concerning their (individual) planned purchases in order to identify similar commodities in the same market – a broker may support this coordination action. Next, the collaborative purchase will be characterised (requirements design) in terms of number of participants involved, their size, their geographic location, their purchasing volume, etc. in order to use the appropriate mechanisms to obtain additional discounts or rebates beyond

the initial volume-driven lower per-unit pricing. Following, a first rough architectural design of the total purchase size and individual bundles will be calculated as well as expected benefits for the participant GVBE members. Subsequently, GVBE members will confirm their participation in the collaborative purchasing opportunity. Then the rough collaborative purchase order will be detailed and transform into a request for quotation that will trigger concurrent negotiation processes with the suppliers, responding to a call for tenders issued by the GVBE manager or GVE coordinator, until an agreement is reached and a contract is signed. Finally, the winning supplier will issue an invoice and the GVBE members will expect the purchase within the time frame agreed in the collaborative procurement operation.

### 3.2 GVBE Bag of Assets Management Practice Aspects

The *GVBE bag of assets management practices* may include function-wise, the following bundle of services, related to the *shareable assets management*: setup and update of the shareable assets taxonomy, shareable assets inventory management, reservation and scheduling of shareable and common assets, assignment/re-assignment of shareable and common assets, logistics and distribution of shareable assets, and monitoring of shareable and common assets utilisation (e.g. tracking assets condition, lifecycle cost, performance measurements, etc.). Resources-wise (and related to *GVBE members' participation management*), the services bundle may include: shareable assets contributions and utilisation accounting, shareable and common assets financials (e.g. purchase, payment and invoice systems) and rewarding mechanisms to stimulate the internal B2B breeding environment sharing marketplace. Organisational-wise (and related to the *GVBE bag of assets governance*), the service bundle may include support for 'centralised' and 'decentralised' control and management models. Finally, information-wise the *GVBE bag of assets services bundle* should be supported by an information management system as detailed below.

### 3.3 GVBE Bag of Assets Information Management System

First generation *GVBE bag of assets management systems* [23] were mainly focused on storing and sharing intangible assets (e.g. documents, software tools, and other knowledge items); they were implemented as 'content management systems' providing services (functionalities) for the GVBE members, such as: subscribing/unsubscribing, publishing information (metadata), viewing information (browsing and sorting) and support for GVBE member(s) reward. In this first generation, the GVBE bag of assets management was mainly a task for the GVBE manager and GVE coordinator(s), responsible for collecting 'reference information' that could support future better decision-making and efficient business processes execution.

Second generation *GVBE bag of assets management systems*, empowered by the Internet of Things [24] paradigm, aim to enable a repository supporting the collection and dissemination of common and shareable assets-related information, capable of offering advanced functionalities or services for assets availability, assets conditions, assets tracking and assets usage, cost tracking, cash flow forecasting and financial reporting. In this second generation, in a centralised management model, *brokers* play a new supporting role for the GVBE manager and GVE coordinator(s) as

'matchmakers' of the supply and demand for common and shareable assets within the breeding environment, closing deals, and scheduling and tracking their utilisation. On the other hand, in a decentralised GVBE bag of assets management model, assets' sharing becomes every breeding environment member's business.

As a result, a *GVBE bag of assets management system* can be seen nowadays as a B2B e-marketplace within the breeding environment, based on a collaborative business ICT infrastructure (online platform), capable of creating reciprocal economic value by increasing assets utilisation through online accessibility and community sharing, as well as environmental and social value by reduced ownership overhead and stronger collaboration.

#### 4 Conclusions & Further Research

The *Sharing Economy* attempts to define a wide range of collaborative (business) practices whose central characteristics are the ability to save or make money, reduce ecological footprints and strengthen social ties. This paper has put forward the concept of *GVBE bag of assets* as a novel internal sustainable business model based on sharing idle assets and other under-utilised resources and collaborative procurement strategies within a breeding environment in order to save costs, co-create shared value, efficiently utilise resources and deepen the trust among GVBE members. Moreover, the ongoing research work has introduced a proposal for a GVBE bag of assets conceptual framework to be further developed.

The transition to an 'assets sharing economy' as a corporate practice is not an easy task; nevertheless, GVBEs collaborative culture and common infrastructure present promising social, economic and technological drivers and enablers [25] such as the desire for cooperation, sustainability, shared value co-creation, social networking, and collaboration platforms.

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<sup>1</sup> A shareable (tangible) asset is characterised by its high acquisition price, low availability and low frequency of use.

<sup>2</sup> A *Green Enterprise* is an enterprise that strives to meet the triple bottom line by ensuring that all products, processes, manufacturing and logistics activities in its business operation address the sustainability principles [6] [7].

<sup>3</sup> *Sustainable Value* is the long-term shareholder value created as a scalable source of competitive advantage by embracing opportunities and managing the risks/benefits associated with their economic, environmental and social developments [9].

<sup>4</sup> A *Triple Top-line Strategy* establishes three simultaneous requirements for sustainable activities: financial benefits for the enterprise, natural world betterment, and social advantages for employees. Though this is sometimes called the triple bottom-line, triple top-line stresses the importance of initial value rather than after the fact effects [13].