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Sustainability Through Business Architecture, Part I:

Decoding the Circular Economy

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This two-part *Executive Update* series provides an overview of the composition and impact of the circular economy along with business architecture's role in transitioning an organization into becoming a player in the circular economy while concurrently meeting other essential business objectives. Business architecture provides the means where seemingly disconnected goals and objectives can be integrated under a common, holistic set of strategic initiatives through a coordinated, ecosystem-wide roadmap. Here In Part I, we provide an overview of the circular economy and the strategic challenges it presents and demonstrate how business architecture provides the means for a formal, robust transition to the circular economy. We also demonstrate the power of business architecture by leveraging a formal framework. In Part II, we will examine an automotive company seeking to optimize its traditional manufacturing business model while concurrently seeking to deploy a new, innovative, digitally connected customer business model.

Circular Economy Motivations & Roadmap

Sustainability is the ability to exist, with the goal being to "create and maintain conditions, under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic, and other requirements of present and future generations." The three pillars of sustainability are generally accepted to be environmental, social, and economic. The establishment of a circular economy is perhaps the most emblematic proposition toward sustainability, involving changes along all three pillars. The circular economy is expected to preserve the environment by moderating resource extraction, distribute wealth by boosting the demand for localized labor, and sustain the economy by preventing waste while extending the fruition of materials and products, thus maximizing their return value. Figure 1 highlights the difference between the linear economy and the circular economy.

As shown in Figure 1, the circular economy represents a paradigm shift, where strategic focus shifts to preserving asset value for as long as possible, versus the linear economy, which is based on maximizing the speed of asset flow and disposal. The circular economy further differentiates from the linear economy in its intent to maintain value in addition to creating it anew, optimize stock management in addition to stock flows, and increase asset-utilization efficiencies along with production efficiency. For example, in the circular economy materials used in production are recycled, components are repaired or refurbished (remade),

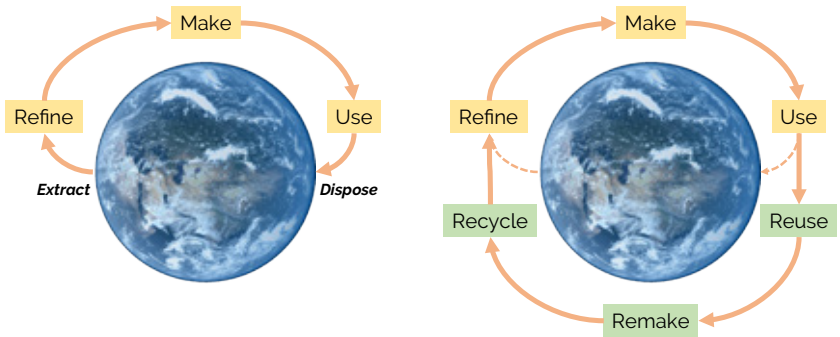

Figure 1 — Linear economy vs. circular economy.

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and products are reused. The longer an asset is maintained within the economic ecosystem, the more its value will be leveraged. Moreover, implementation of such *value cycles* (discussed in more depth later in this *Update)* involves a shift in labor focus from mere production to production and maintenance, thus implying a partial redistribution of labor demand from centralized factories to localized repair workshops.

While the circular economy delivers environmental, social, and economic sustainability on a global level as well as business opportunities for entrepreneurs, individual industries and companies within those industries require a roadmap for transitioning to the circular economy that incorporates motivational aspects for those organizations.

Compared to the linear extract-make-dispose pattern, circular economy patterns are in principle more connected because they rely on the interlock of actors along a cycle, with respective independent behaviors and value perspectives. Transitioning to a circular economy implies changes in consumer behavior along with pricing models, which challenge existing business models. For example, consumer spending patterns would need to shift from repetitive purchases of the cheapest item to a purchase-and-maintain pattern that considers extended product life spans. As part of this transition, consumer preferences would shift toward durability and repairability, and consumption patterns would refocus on asset sharing "as a service" versus ownership.

The circular economy model, though perceived as necessary or even desirable by many, is far from being mainstream in industry. While the circular economy delivers environmental, social, and economic sustainability on a global level as well as business opportunities for entrepreneurs, individual industries and companies within those industries require a roadmap for transitioning to the circular economy that incorporates motivational aspects for those organizations.

A roadmap implies a pathway for incremental transition to the circular economy that blends actions and milestones with bottom-line results. Such a roadmap must be based on a formal discipline that views the organization holistically and can identify key investments, maps the effects on user experience and behavior, articulates transition phases, predicts the impacts of changes, and effectively manages risks. Ideally, transitioning to a circular economy aligns to and influences business strategies and business model innovation. Business architecture — and the role it plays in end-to-end

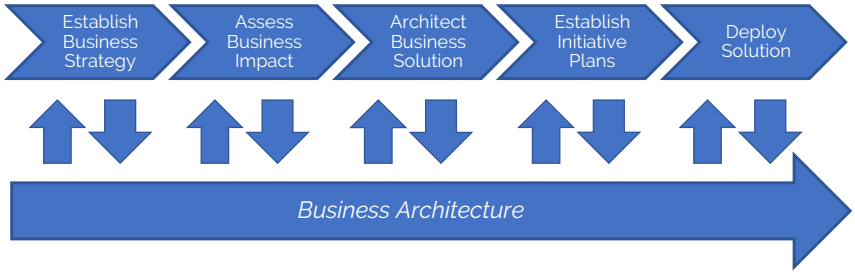

Figure 2 — Strategy execution path leveraging business architecture. (Source: Business Architecture Guild.)

strategy execution — provides such a roadmap. The strategy execution path shown in Figure 2 provides an overview of the roadmap that may be used for any planning initiative. The roadmap applies to any plans or investments that begin with strategic objectives and move through impact analysis, solution design, initiative plan definition, and deployment over a series of iterative business transformations large and small. Goals focused on transitioning toward the circular economy would be integrated into this planning and execution model in order to align and optimize a coordinated set of investments that can, for example, satisfy and align customer or revenue-related objects with circular economy–related objectives.

Business Architecture Approach to Strategy Execution

Business architecture delivers business ecosystem–wide transparency as the basis for strategy execution and business model optimization. A business ecosystem is defined as "one or more legal entities, in whole or in part, that exist as an integrated community of individuals and assets, or aggregations thereof, interacting as a cohesive whole toward a common mission or purpose."

Business architecture's cross-ecosystem perspective ensures that strategy execution and business model optimization are not obscured by siloed business unit constraints, while providing a clear

line of sight into all aspects of customer and partner engagement. For example, a *Use Product* or *Take a Trip* value stream provides aftermarket visibility into customer product and service utilization along with the role of partners in those activities. Business architecture's foundation is based on formally defined capabilities, information concepts, value streams, and organizational views, providing the basis for realizing business strategies, complying with policies, delivering products and services, optimizing stakeholder value delivery, and executing initiatives.

Figure 3 introduces the business architecture framework, a formal definition of the makeup and context of the business architecture discipline, as defined by the Business Architecture Guild. The framework has been globally adopted and will serve as the point of reference for business architecture in the context of this *Update* series.

The business architecture framework depicts the three foundational aspects of business architecture: (1) the holistic business architecture knowledgebase, (2) a wide range of business scenarios that leverage business architecture, and (3) the business "blueprints" that embody a wide variety of knowledgebase-derived business perspectives required to deliver business value for one or more business scenarios. For example, a merger scenario would leverage a combination of organization, capability, and information domains.

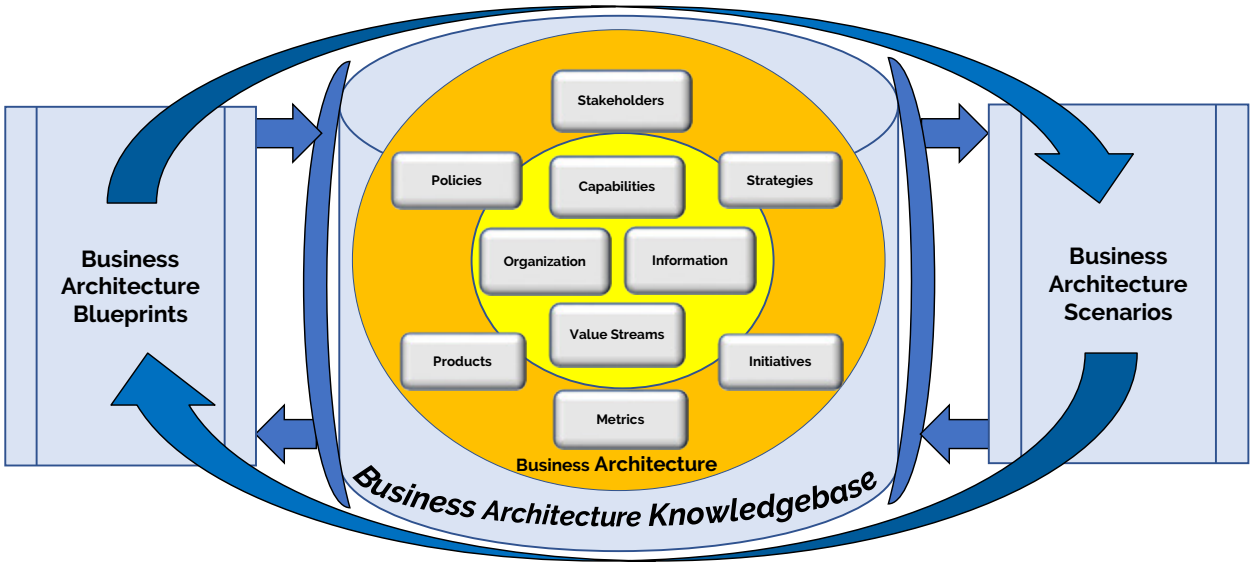

Figure 3 — Business architecture framework. (Source: Business Architecture Guild.)

Figure 3 highlights each of the 10 business architecture domains housed within a central knowledgebase. These domains and cross-domain associations form a rich tapestry of ecosystem-wide business knowledge that may be used to plan, communicate, and execute a wide range of business scenarios. For example, capabilities, which represent a finite set of rationalized, nonoverlapping business objects and actions against objects, provide a comprehensive perspective of "what" an organization does. One example of a business object is "material," which encompasses a wide variety of types, such as ore, ingredients, parts, fuel, and sub-assemblies. A second business architecture domain, information concept, uniquely defines these business objects, corresponding types and states, and relationships with other information concepts.

Organizations have the basis to formalize and streamline investments and related initiatives on an enterprise scale, with a clear understanding of the role of each business unit and business partner in end-to-end strategy execution.

Two additional domains round out the business architecture "baseline." Value streams frame how an organization delivers customer, partner, and internal stakeholder value. When value streams are aligned to capabilities that enable value delivery and the information required by those capabilities, organizations have the basis in place to execute strategy, optimize business models, and rationalize and prioritize corresponding initiative investments. Moreover, organizations have the basis to formalize and streamline investments and related initiatives on an enterprise scale, with a clear understanding of the role of each business unit and business partner in end-to-end strategy execution. (Part II of this *Update* series will provide practical examples as to how business architecture enables business model optimization and innovation for an automotive company seeking to achieve a cross-section of business goals and objectives.)

Recognizing Business Architecture Concepts in the Circular Economy

Rather than one single loop as shown in Figure 1, a circular business ecosystem is the combination of several possible loops that reuse,

remanufacture, and resell goods and re-extract or recycle components and materials. While the linear economy seeks to maximize value by achieving the highest speed of production, consumption, and replacement along a chain, the circular economy's goal is to maximize value by extending the fruition of assets. This complex pattern is often represented by "the butterfly diagram" (see Figure 4).

Various stakeholders are involved in each branch that participates through different roles, each one according to their own value perspectives. Based on the self-sustaining circularity, each stakeholder's actions should interlock in closed-loop fashion while still allowing each actor's pursuit of independent value. This requirement highlights the circular economy's complexity.

Business architecture offers a systematic approach to deciphering business ecosystem complexity and determining progress on transitioning that ecosystem toward the circular economy. Business

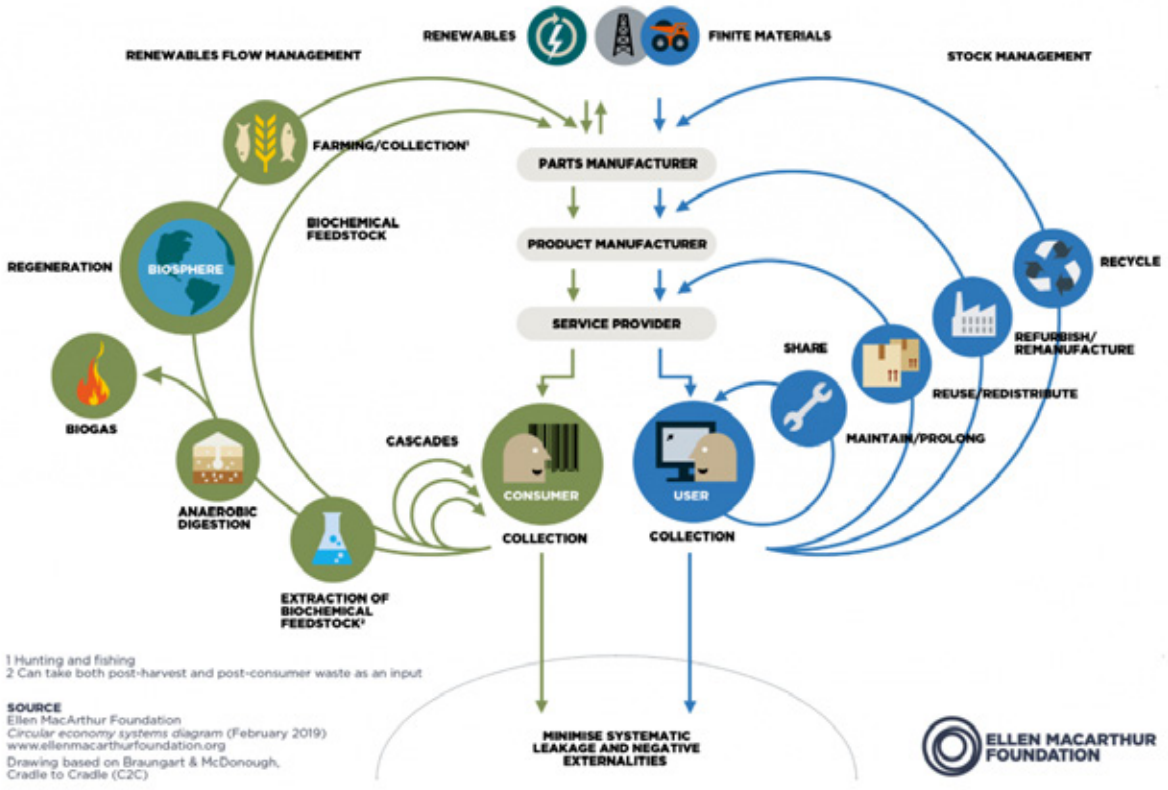

Figure 4 — Circular economy butterfly diagram. (Source: Ellen MacArthur Foundation.)

architecture additionally helps uncover opportunities within existing business models, predict the change impacts and related risks, surface regulatory considerations, and align initiatives needed to enable the transition from a linear to the circular economy.

Circular economy patterns apply to various assets or idling capacities, such as time, space or facility, utility, products, skills, and capital shared among stakeholders who extract value from them as long as possible through repeating value cycles. We define value cycle as "the closed-loop path formed by the branches described in a circular economy that maximizes the lifecycle of 'value carriers.'"

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For purposes of this discussion, a value carrier is "a business object shared iteratively among stakeholders in a circular economy, by which stakeholders achieve value." The term "business object" is broadly interpreted and represents any physical or logical tangibility that can be shared or exchanged across a business ecosystem. In a circular economy, value carriers maybe be shared, maintained, refurbished, repurposed, regenerated, or disassembled for reuse. *Value carrier* and *business object* differ because not every business object carries value, but every value carrier is based on a business object. Examples of value carriers vary by industry but might include vehicles, materials, products, assets, capital, competencies, routes, locations, and so on.

Incorporating business architecture into this picture aligns value carriers through "stories," or business scenarios centered on value streams encountered along the value cycles. A value stream is "an end-to-end collection of activities that create a result for a 'customer,' who may be the ultimate customer or an internal 'end user' of the value stream." Value streams are enabled by capabilities and corresponding information concepts, which are based on formally defined, ecosystem-aligned business objects. Value cycles, therefore, represent a collection of value streams influencing each other where they share the same value carrier, each of which is aligned to stakeholders, enabling capabilities, and corresponding information concepts. (The above concepts and corresponding relationships are illustrated in more detail in the following section.)

Leveraging business architecture in the context of a circular economy transition requires aligning or "cross-mapping" value, stakeholder, capability, and information perspectives, as defined by business architecture, with corresponding concepts recognizable in the circular economy pattern.

Value Mapping

Value cycles as defined within the circular economy represent and align to a collection of value streams that share common value carriers and therefore influence each other. Due to such mutual influence and interdependence, the analysis of one or more value streams must be complemented by an analysis of the overall value cycle that aligns to those value streams.

For example, in a car-sharing cycle, the value carrier, which is the vehicle, is a common business object shared across multiple value streams. The vehicle is used, maintained, and reused over an indefinite number of times. By following value carrier exchanges along the value cycle, we can identify the value streams that align to the value proposition delivery within the circular economy for a given ecosystem along with dependencies and relevant stakeholders. Consequently, organizations would invest in the discovery, analysis, and equalization of the capabilities that enable those value streams. Figure 5 highlights a value cycle for car sharing along with selected value streams that align to this cycle.

In the car-sharing example in Figure 5, the value streams *Maintain Vehicle* and *Take a Trip* are incorporated into the same value cycle but remain distinct, being independently triggered by different stakeholders, each of which may be pursuing distinct value propositions. The vehicle is the common object characterized within the value cycle. For such a cycle to sustain, the aligned value streams, value propositions, and enabling capabilities must match. For example, even if the value stream *Maintain Vehicle* were perfectly implemented, ineffective vehicle-defect detection and message targeting, linked to underperforming capabilities enabling the *Take a Trip* value stream, would negatively impact the overall value cycle.

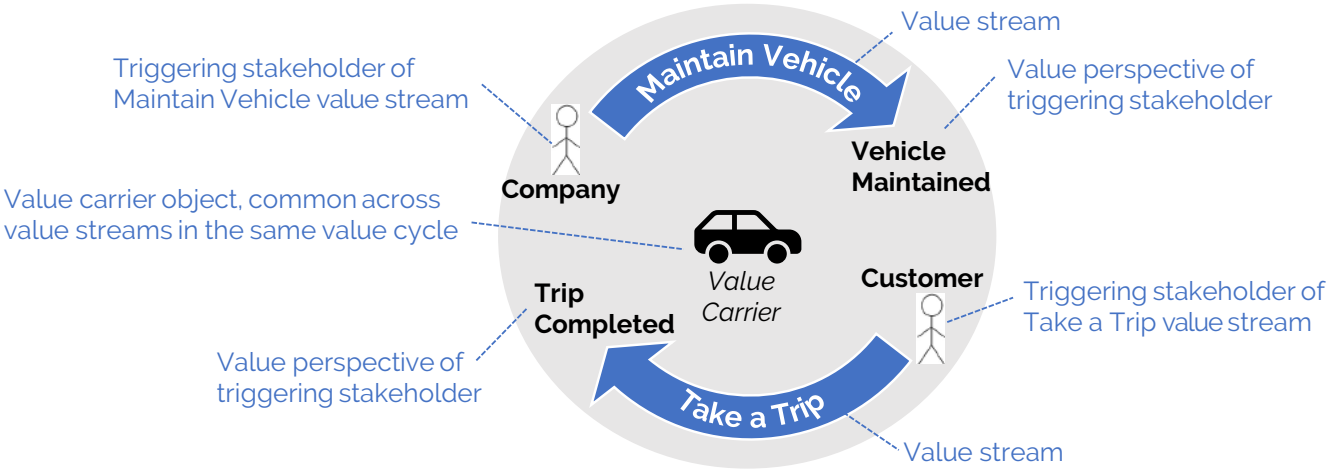

Figure 5 — Value streams in a value cycle: car-sharing example.

Iterative Nature

Iteration through cycles constitutes the economic attractiveness of the circular economy: each loop can run multiple times, delivering value repetitively while involving only incremental cost. It is essential that transaction costs occurring at each iteration are kept to a minimum. This is the reason why digitalization is a powerful catalyst of circular economies; it minimizes transaction costs — but does require up-front investment. Therefore, the identification of iterative paths through value cycles via value stream analysis requires continual capability optimization for those capabilities that are iteratively invoked the most.

Location Criteria

Value cycles are often characterized geographically, where smaller, geographically distributed cycles are more likely to succeed than centralized, larger ones. Migration from linear to circular economy tends to move resources from production to maintenance activities. This implies a move of labor and corresponding demand from manufacturing sites, which are often centralized in low-cost economies, to the place where users are located, requiring a decentralized approach.

Dynamics Criteria

Latency must be taken into account when predicting success factors of circular economy implementations. For example, recycling of a product may happen years after its production, exposing technological obsolescence risks. By extending the service life of materials, assets, and related business objects, the circular economy should reduce the speed of external resource inflow, while the stock of value carrier stored within the system is preserved. Therefore, a dynamic analysis of value streams is recommended; techniques exist for dynamic analysis of value maps, such as *system dynamics* and *discrete elements*.

Capability Mapping

> *By extending the service life of materials, assets, and related business objects, the circular economy should reduce the speed of external resource inflow, while the stock of value carrier stored within the system is preserved.*

"Capabilities enable laserlike business investment focus [and] serve as a baseline for strategic planning, change management, and impact analysis." Mapping capabilities in a circular economy context reveals gaps and allows organizations to define actions, relevant investments, and responsibilities (see Figure 6). The circular economy brings some peculiar perspectives on capabilities, as described below.

Balancing Within the Cycle

Stakeholders participating in the same value cycle should have balanced capability profiles. In the same cycle, if one member has limited capabilities, it will "choke" the whole cycle. That is why organizations like Airbnb invest in making "matching capabilities" available to single users, who, otherwise, on their own, would miss them.

Mapping in Geography

Capabilities that extend the life of manufactured objects, such as those that facilitate service brokering, vehicle repair, and material traceability, should be available locally. For example, Patagonia "operates mobile repair workshops, which travel to skiing or

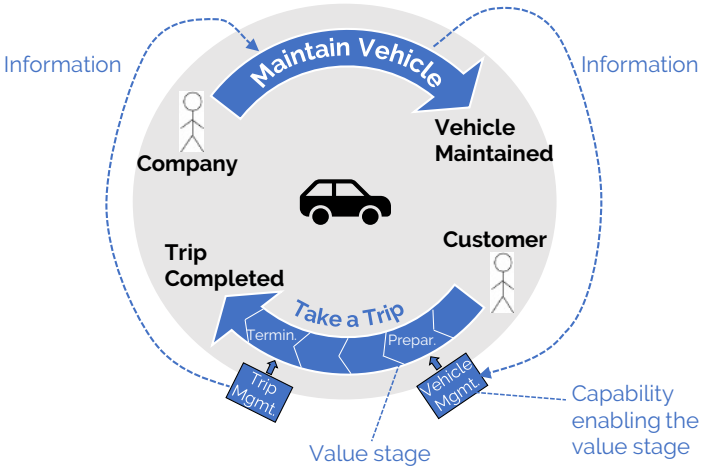

Figure 6 — Capabilities and information enabling the value stages.

mountaineering events." It is, therefore, important that availability of these capabilities be mapped geographically. Commonly employed capabilities that accommodate geographic mapping and distribution of work include Location Management and Geographic Space Management, which collectively match to various business objects, such as vehicle, material, asset, facility, partner, customer, network node, and work items, as a basis for mapping locations.

Capability Information Requirements

In the circular economy, capabilities "to undo" are particularly important and have specific information requirements, which in turn are essential for optimizing circular economy execution. Information related to vehicle assembly, configuration, tracking, control, repair, and disassembly enable a fully functioning set of optimized capabilities. Formal information maps, based on holistic information views required by capabilities, serve as a baseline for deriving and validating data architectures that are critical to digital transformation and most other technology optimization and transformation efforts.

Capability Evolution

As described above, the benefits of circular economy may need several iterations of each cycle to be realized. One possible mistake

when attempting to establish a circular economy is to focus on the capabilities needed by an organization in its final state. However, initiating a loop may require specific capabilities and investment, such as the allocation of working capital along the loop to activate each part. Business architecture roadmaps address this requirement by defining intermediate states in a journey from current to future state and defining subsequent targets for capability configuration of the ecosystem.

Stakeholder Mapping

"A critical capacity of business architecture is to represent key stakeholders within a business" along with their relationships, value perspectives, and dependencies. Rationalization and categorization techniques within business architecture stakeholder mapping provides an ecosystem-wide mapping of internal and external stakeholders that enable, for example, customer segmentation or partner delineation, and needs determination.

Business architecture roadmaps address requirements by defining intermediate states in a journey from current to future state, defining subsequent targets for capability configuration of the ecosystem.

Orchestrating Independent Triggers

In a circular economy ecosystem, each stakeholder triggers its own value stream, but they collectively engage in a common value cycle. The value cycle has not one single triggering stakeholder but rather has multiple triggering and participating stakeholders engaged in multiple value streams that align to a given value cycle.

Business architecture specifies the value stream scenarios where different stakeholders extract value propositions across a value cycle, which enables the cycle to start and be sustained. For example, if the circular economy were only based on regulatory constraints and lacking clear stakeholder value perspectives, stakeholders would miss incentives and the overall value cycle loop would likely break up. Analysis of motivation and "stakeholder experience" is key to ensure a healthy circular economy implementation.

Multiple Ecosystem Roles

Besides those directly involved in value cycles, organizations must also identify other stakeholders with complementary roles. These include:

- **Service enablers** — who facilitate the implementation of specific technologies
- **Integrators** — who provide a digital technology platform as needed
- **Anchors** — who may serve as promoter of the original vision, initiator of its implementation, or advocate of circular economy
- **Regulators** — who ensure consistency with existing policies, regulations, compliance criteria, and certifications, such as may be required to certify recovered material purity and traceability, and legal agreements.

Stewardship, Ownership & Liability

Business architecture specifies the value stream scenarios where different stakeholders extract value propositions across a value cycle, which enables the cycle to start and be sustained.

In the linear economy, creation and disposal happen across different ownerships, so that the manufacturer is not liable for the disposal. Organizations must map and distinguish stewardship and liability from ownership. Figure 7 describes stewardship mapping in the previously discussed car-sharing example.

Figure 7 highlights various stages within the value cycle and corresponding stakeholders' liabilities. When considering a circular economy, the boundary of liability among stakeholders needs to be discerned between the manufacturer and the buyer and also between the owner and the custodian of the value object.

Consider, for example, manufacturer and buyer liability differentiation. Lacking end-to-end stewardship, the manufacturer or producer will typically sell the hardware but not the software associated with the product, making it impossible to repair or remanufacture that product. Similarly, the producer will not be motivated to design the product for easy disassembly to recycle basic materials. Consider the example of the Extended Produce Responsibility (EPR)

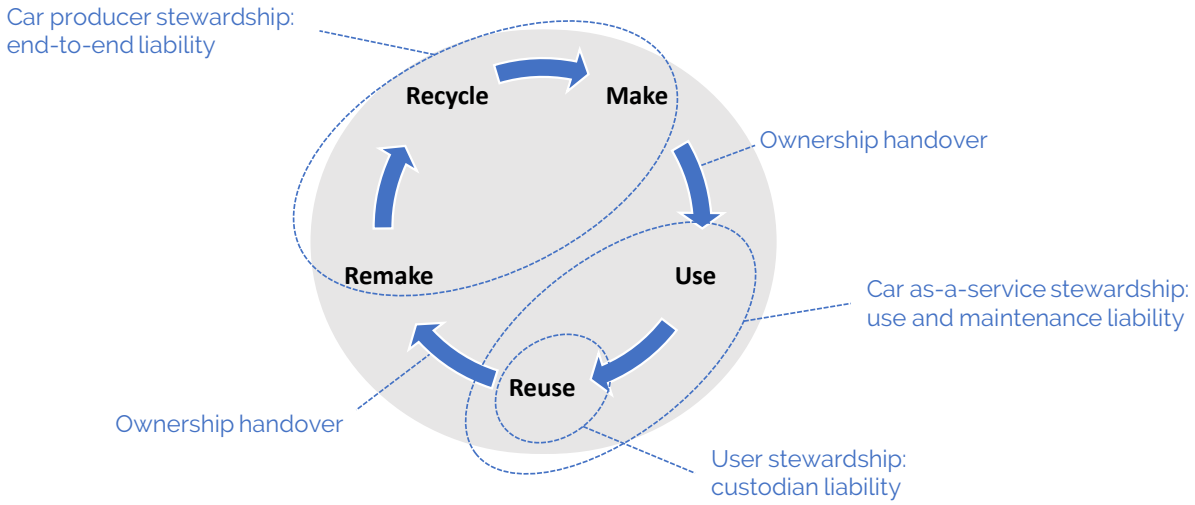

Figure 7 — Stewardship mapping for the car-sharing example.

law, introduced by the EU in 2003. This law aimed to incentivize the reuse and recovery of materials at the end of a product life by its producer, while actual end-of-life servicing could be delegated to third parties. However, such third parties, have "no access to producer knowledge and lack the expertise [...] to exploit the highest value conservation option of reusing components or materials, they aim for the cheapest recycling or disposal methods, thus waiving the opportunities."

Further consider liability differentiation between the owner and asset custodian for assets shared within a reuse value cycle, where the lack of clarity can determine failure of a circular economy initiative. Consider the following example, where "Mobike, a Chinese company renting bicycles [...] which can be left anywhere and used spontaneously where they are (free float principle), has been banned in a number of cities (Zurich, Singapore, China) because of chaotic user behavior."

Summary & Conclusion

The circular economy can lead to great benefits for organizations, individuals, and surrounding communities. The circular economy implements the three fundamental dimensions of sustainability:

environmental, social, and economic. However, transitioning from the linear to the circular economy is a challenge, especially for those organizations already pressed by market contingencies, market uncertainty, and demanding goals.

Business architecture provides a framework to configure and navigate the phased transition to the circular economy while concurrently balancing goals, investments, programs, and related impacts. In this perspective, the alignment between circular economy and business architecture is the key enabler. We achieve such alignment by means of establishing two perspectives on the circular economy: the value cycle and the value carrier. Examples of these value-based perspectives help illustrate the alignment of circular economy principles and actionable business architecture domains.

Part II of this *Update* series will further describe how business architecture can enable business model optimization and innovation in the context of transitioning from linear to circular economy. We will offer specific examples related to an automobile manufacturer seeking to optimize its make-and-sell business model while concurrently transitioning to a new, digitally connected, customer value–oriented business model.

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Cutter Consortium helps clients address the spectrum of challenges technology change brings — from disruption of business models and the sustainable innovation, change management, and leadership a new order demands, to the creation, implementation, and optimization of software and systems that power newly holistic enterprise and business unit strategies.

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