



Software Center Denmark Day: *Customer Data and Ecosystems*

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LEERO Software for a better world

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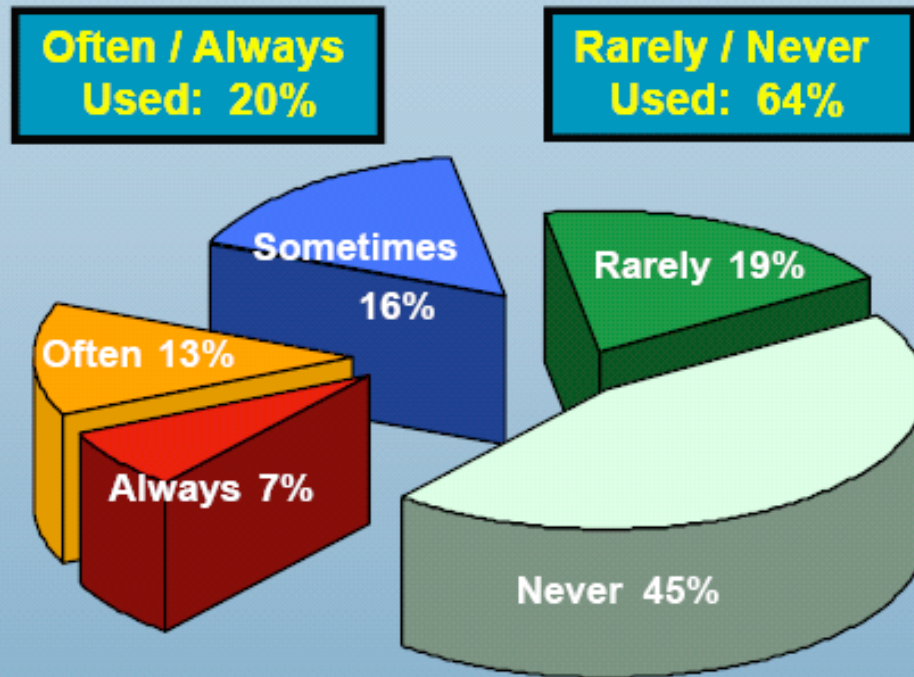
WASP | WALLENBERG AI,
AUTONOMOUS SYSTEMS
AND SOFTWARE PROGRAM

Project 5: 'Accelerating Digitalization Through Data'

- This project aims at **advancing the adoption of data driven development practices** to ensure rapid and continuous delivery and improvement of customer value
- We focus our research on **'value design'** with the intention to help companies identify and agree on what to optimize for, align metrics at different levels and transition from a qualitative towards a quantitative understanding of customer value
- The overall project goal is to **accelerate digitalization** and help companies move towards continuous delivery of customer value

“Featuritis”

Features / Functions Used in a Typical System



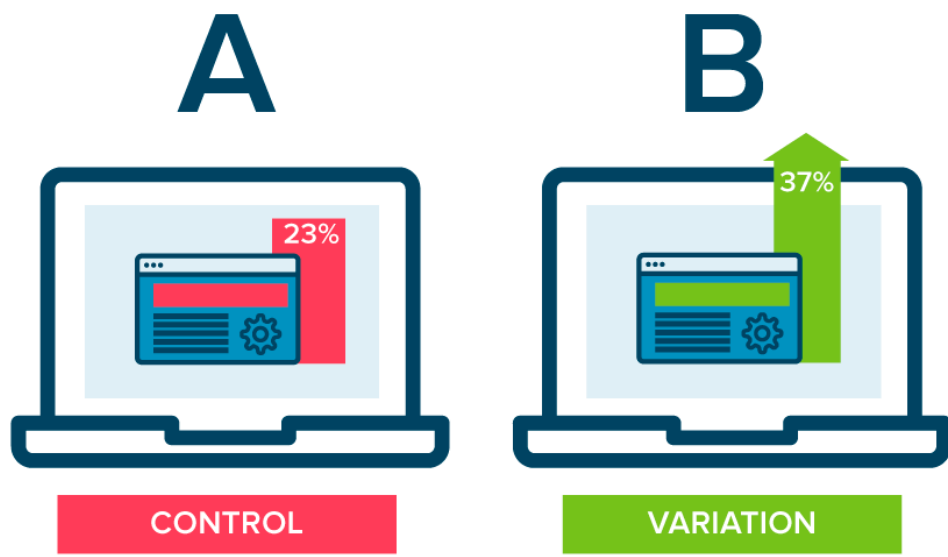
Standish Group Study Reported at XP2002 by Jim Johnson, Chairman

Background

- An accurate understanding of customer value is critical success
- Since customer needs evolve over time, as well as new technologies becoming available, companies need mechanisms that help them continuously monitor value
- For more than a decade, **data-driven development practices** has attracted attention as one of the most powerful means to ensure value delivery to customers
- Companies in the online domain use data driven practices and controlled experiments (i.e., A/B testing) to guide product development and continuously improve software features and functionality

A/B testing

Example hypothesis: “Changing the color of the “Add to cart” button from blue to green will increase revenue by 10 percent”



Forming a Hypothesis and Selecting Users

- ✓ Formulate your hypothesis and Success Metrics
- ✓ Choose the Appropriate Unit of Randomization
- ✓ Check and Account for Pre-Experiment Bias

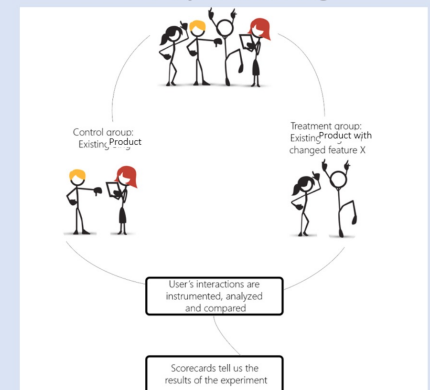
Pre-Experiment Engineering Design Plan

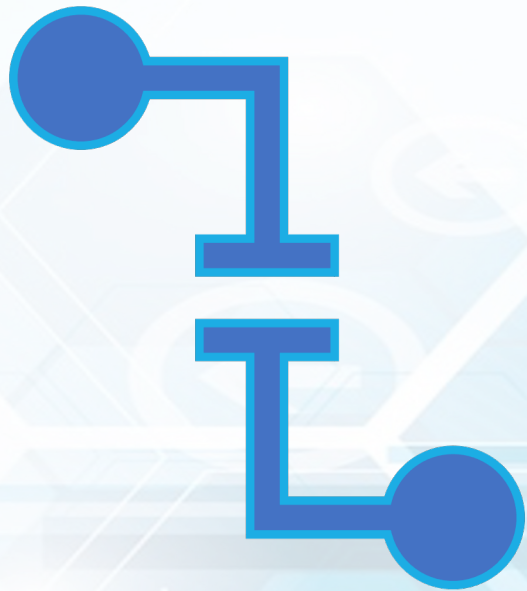
- ✓ Set Up Counterfactual Logging
- ✓ Have Custom Control and Standard Control
- ✓ Review Engineering Design Choices to Avoid Bias

Pre-Validation by Progressing Through Populations

- ✓ Gradual Rollout Across Different User Populations
- ✓ Gradual Rollout within a User Population

Trustworthy AB Experimentation: Pre-Experiment Stage





"Data is what keeps us alive. Everything we do ends up with, or start with, an ***experiment***. We have passed the point where we make decisions on what to ship or not. Everything is instrumented and we base what to ship on the results we get from experimentation and the actions we see users take".

(Product Manager, Microsoft)

What we see happening...

- Due to increasing connectivity and data collection from products in the field, data-driven practices are being adopted also in software-intensive embedded systems companies
- In these companies, experiments are run on selected instances of the system or as comparison of previously computed data to ensure value delivery to customers and to explore new value propositions

- **However, to utilize the benefits of data-driven and experimental development practices, companies need to define what to optimize**

Performance

Security

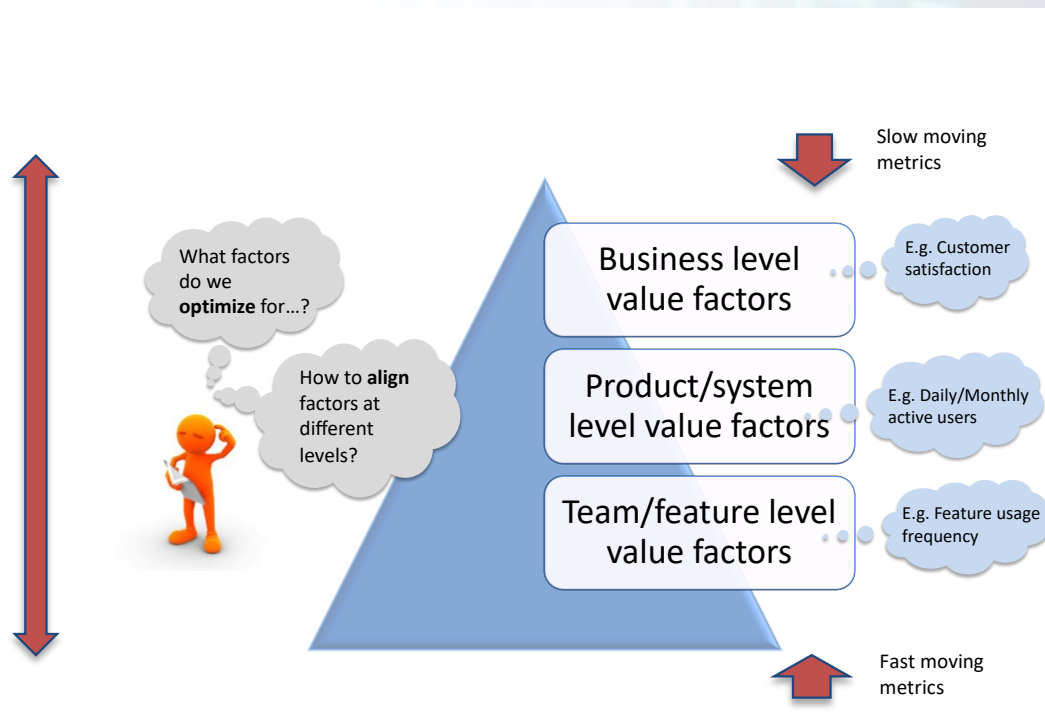
Time to perform a task

Stability

Efficiency

Value Design

Value design is concerned with helping companies and teams clarify and agree on what they optimize for. It is a technique for identifying, prioritizing and aligning metrics at the feature, system and business level.



- Value factors at different levels that need to align for an organization to benefit from data driven development practices and achieve the outcomes they look for
- The purpose of value design is to move from implicit assumptions about the value of a feature, a product, a portfolio, a service offering etc., to explicating those assumptions
- The process of 'Value Design' starts from a qualitative assessment of value factors but with the intention to translate this into quantitative metrics

Value Design: Step-by-Step Process

01

Define the artifact on which to focus on (e.g., a feature, a product, a portfolio, a service)

02

Ask each stakeholder to share assumptions on the value drivers that impact customer value for this artifact

03

Merge the value drivers that are shared by the different stakeholders

04

Prioritize the value drivers (qualitative prioritization) by asking each stakeholder to rank the value drivers

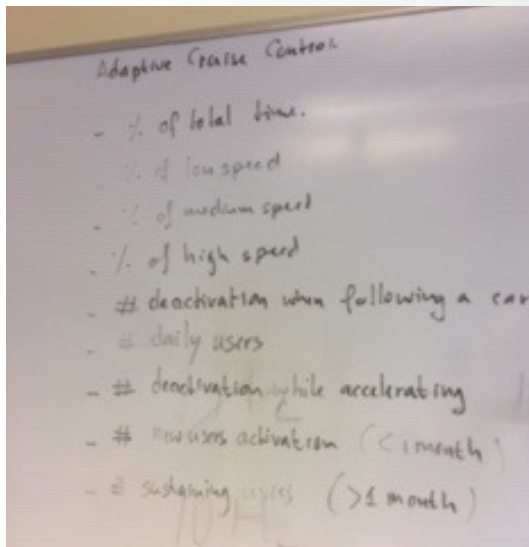
05

Combine the individual prioritizations of value drivers

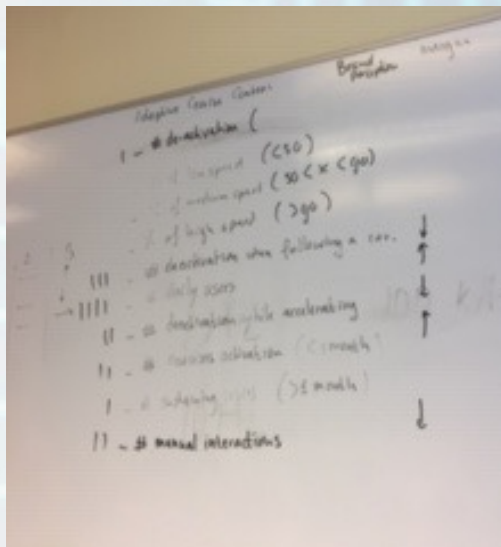
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Discuss, agree and reach consensus on which/what value factors to prioritize

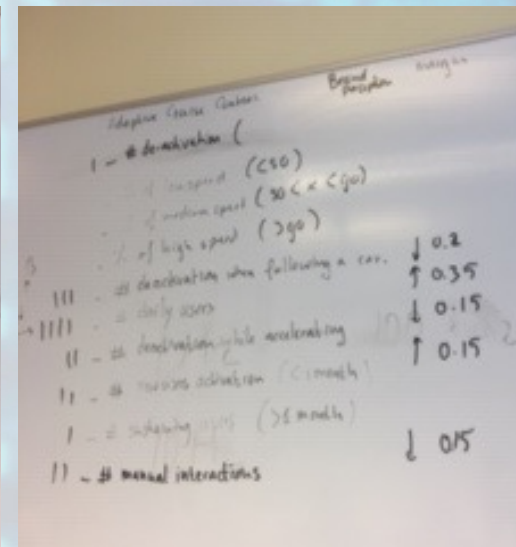
Case company example: Key value factors



↑
Identify key value factors



↑
Direction of key value factors



↑
Prioritization of key value factors

Case company examples: Value factors

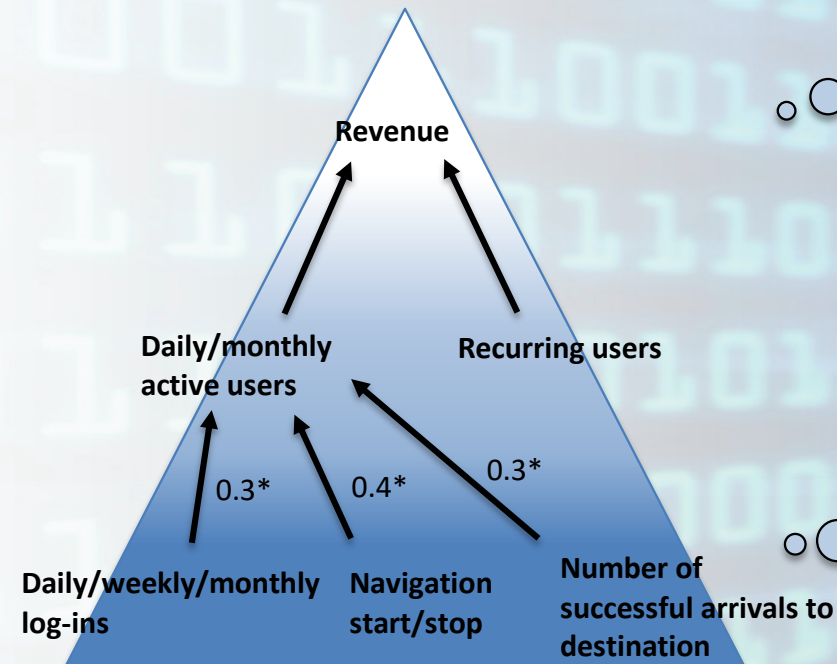
- We identified value factors such as *'usage'*, *'planning time'* and *'forecasting runs, stability'*, *'productivity'* and *'crew satisfaction'*.
- In one SC company, the innovation teams selected a new product for which they wanted to model value. For this product, they identified value factors such as *'number of newly created sales opportunities'*, *'addressable revenue'*, *'improved margin'* and *'success rate'*.
- In a second SC company, it was difficult to prioritize and decide on the relative importance between factors such as *'availability'*, *'ease of connectivity'* and *'stability'*.
- In a third SC company, the introduction of value modeling initiated a discussion in which factors such as *'output'*, *'efficiency'*, *'reliability'*, *'flexibility'* and *'maintenance of emission limits'* were identified. With this as the basis, the group discussed how to think about tuning efforts and how to build confidence in future value delivery.

Hierarchical value model (1/2)

**Business level
value factors**

**Product/system
level value factors**

**Team/feature level
value factors**



* Relative weight of value factors

Slow changing metrics:
Are influenced long-term
and used to predict and
understand trends.

Fast changing metrics:
Are influenced short-term
on a sprint basis and used
to confirm a pattern in
progress.

Hierarchical value model (2/2)

Business level value factors

Efficiency Revenue Performance

Slow changing metrics:
Are influenced long-term and used to predict and understand trends.

Product/system level value factors

User load Median throughput

Fast changing metrics:
Are influenced short-term on a sprint basis and used to confirm a pattern in progress.

Team/feature level value factors

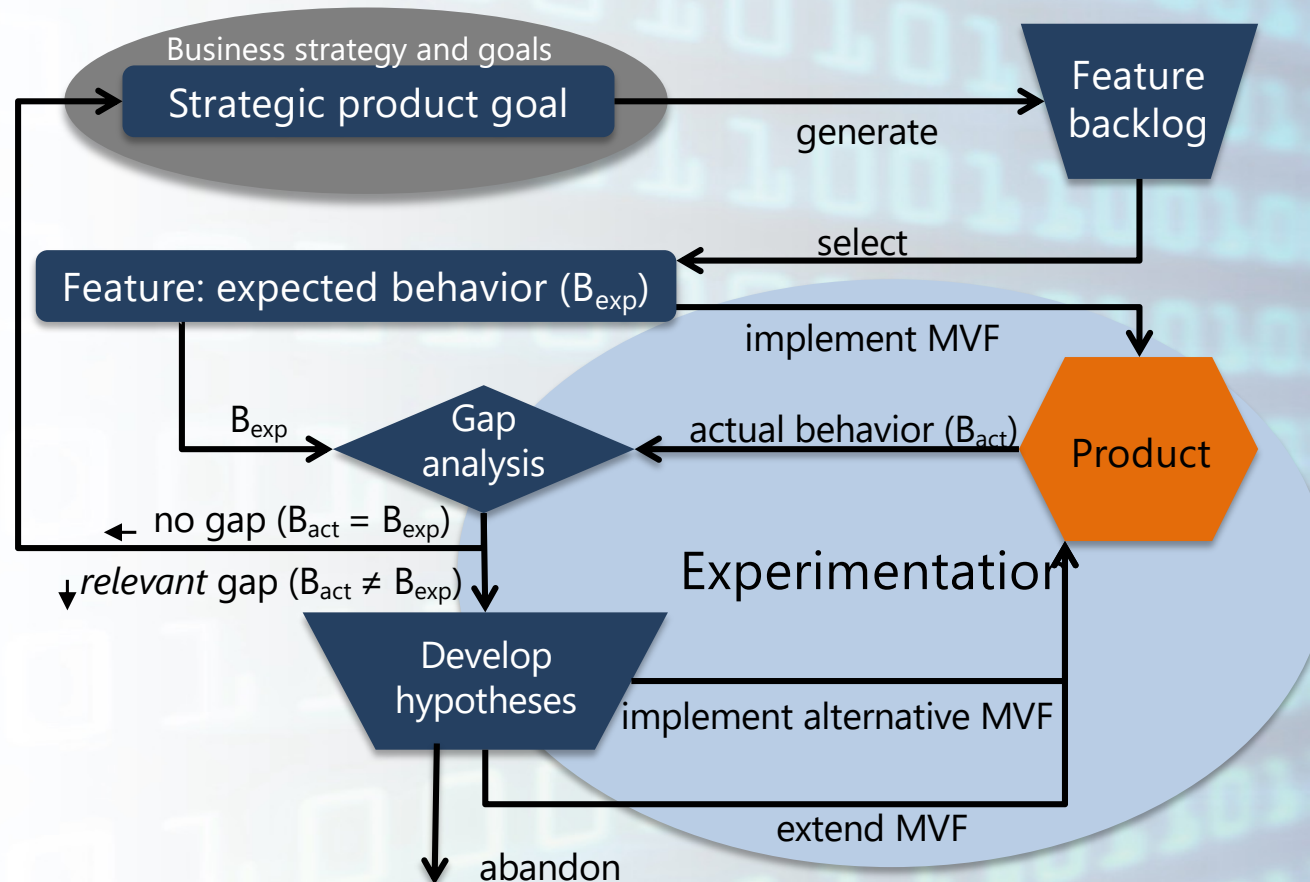
User throughput User performance Cell throughput

* Relative weight of value factors

Case company example: Hierarchical value function

- In company X, one team succeeded in developing a value function for one of their mobile apps (used by crew): **$V(f) = 0.1 * \text{feedback time} + 0.2 * \text{success rate} + 0.2 * \text{number of users} + 0.2 * \text{successful drops} - 0.3 * \text{cost of ownership}$**
Each value factor was given a relative weight and the formula indicates whether you look to increase or decrease the value when running an experiment
- In company Y, the team developed a value function expressed in: **$V(f) = 0.2 * \text{service cost} - 0.1 * \text{SLA violation} + 0.3 * \text{output upside} + 0.4 * \text{number of contracts}$** representing a discussion in which delivered versus promised reliability of the product was the focus
With this value function, the team could define an experiment with the intent to improve the monitoring of the costs associated with any potential downtime at customer site

The HYPEX Model



Conclusions

- The ability to frequently learn from qualitative and quantitative data is key for success
- To ensure continuous delivery of customer value, companies need to define (and agree upon) quantitative metrics that reflect customer and system performance and behavior
- The purpose of value design is to move from implicit assumptions about the value of a feature, a product, a portfolio, a service offering etc., to explicating those assumptions

Project 9: 'Strategic Ecosystem Driven R&D Management'

- We study **digitalization and digital transformation** of the embedded systems industry and the ways in which this impacts the business ecosystems in which companies operate
- As our primary focus, we study how companies manage the transition from product-based companies to businesses where **software, data and AI** play an increasingly important role
- The goal of this project is to provide companies with strategic guidance for how to transition **from traditional companies towards digital companies** (involving e.g., the transition towards recurring revenue streams, continuous monetization of data and the adoption of new and innovative ways-of-working)

Background

- In our experience, most of the Software Center companies look to complement their existing physical offerings with **new digital services**
- For these companies, **new service innovation and development** is high priority and a primary area of attention
- This involves not only the development of these services but also ways to **monetize and create new revenue streams**
- However, developing services that go **beyond existing sales** and that generate entirely new revenue streams prove difficult for several reasons e.g., prioritization and validation of ideas, architectures that allow for unbundling of functionality, new payment infrastructures and shortage of R&D resources

Digitalization



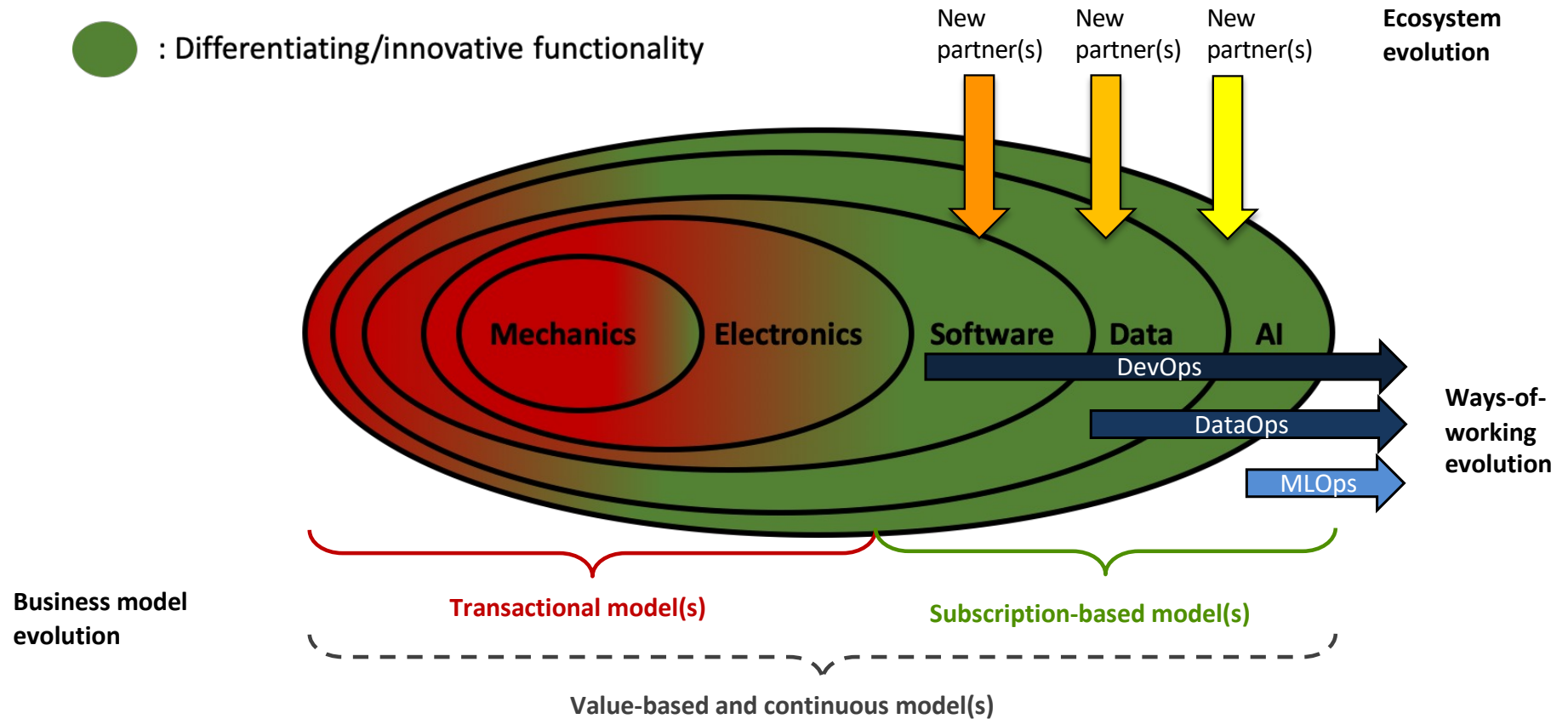
Digitalization is the use of digital technologies to change a **business model** and provide **new revenue** and **value-producing opportunities**; it is the process of moving to a **digital business**.
- Gartner

Technology Evolution

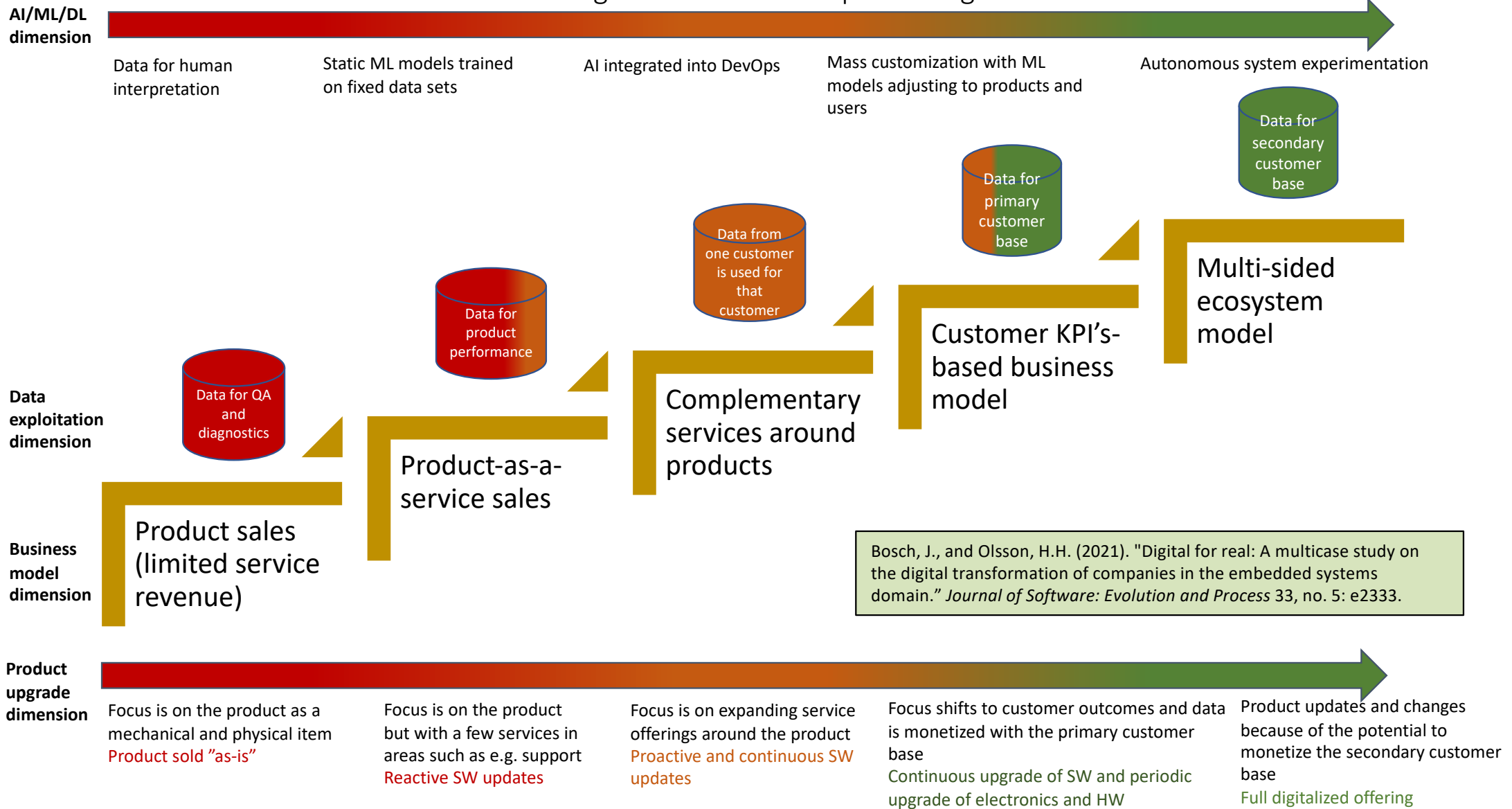


Business Evolution

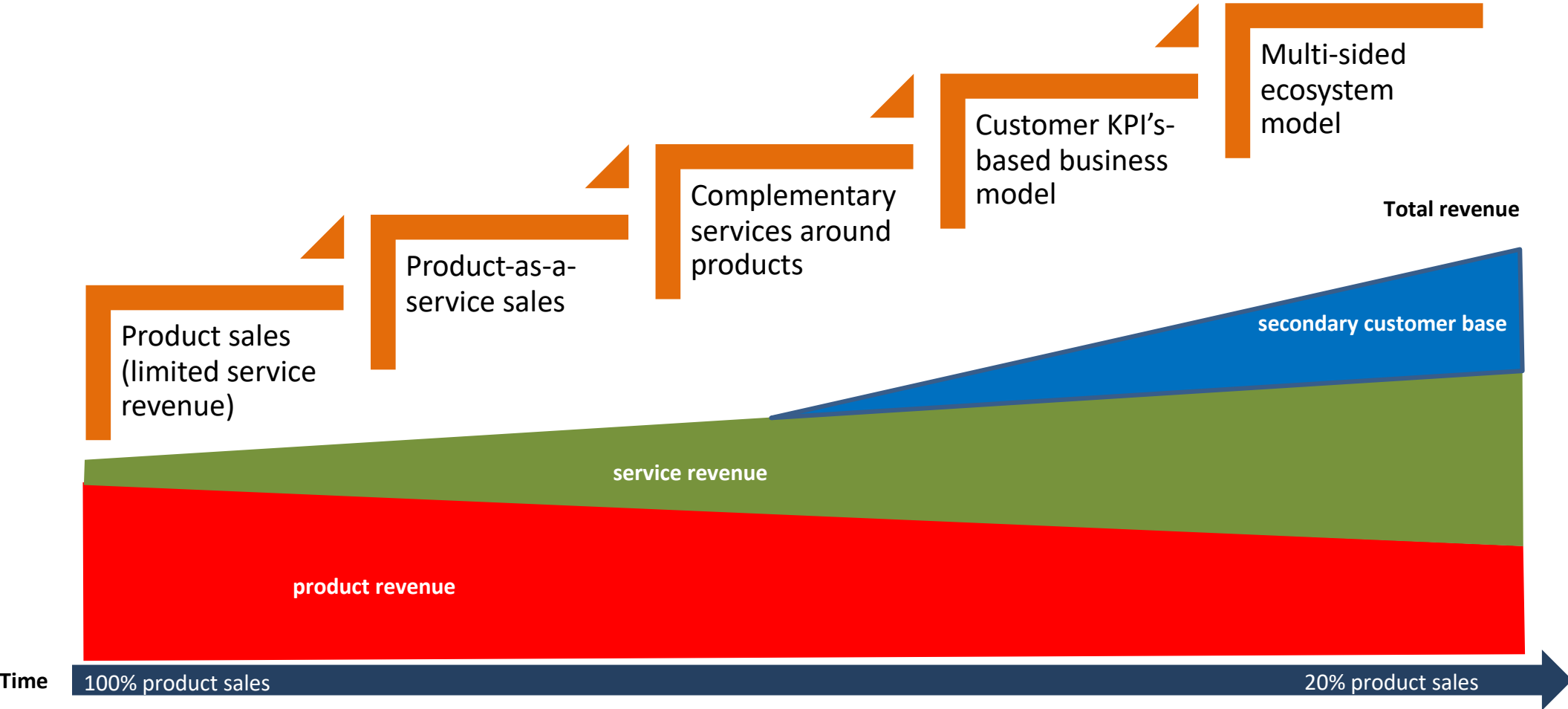
- : Commodity functionality
- : Differentiating/innovative functionality



From Traditional to Digital: The evolution path along four dimensions



The 'business model' dimension



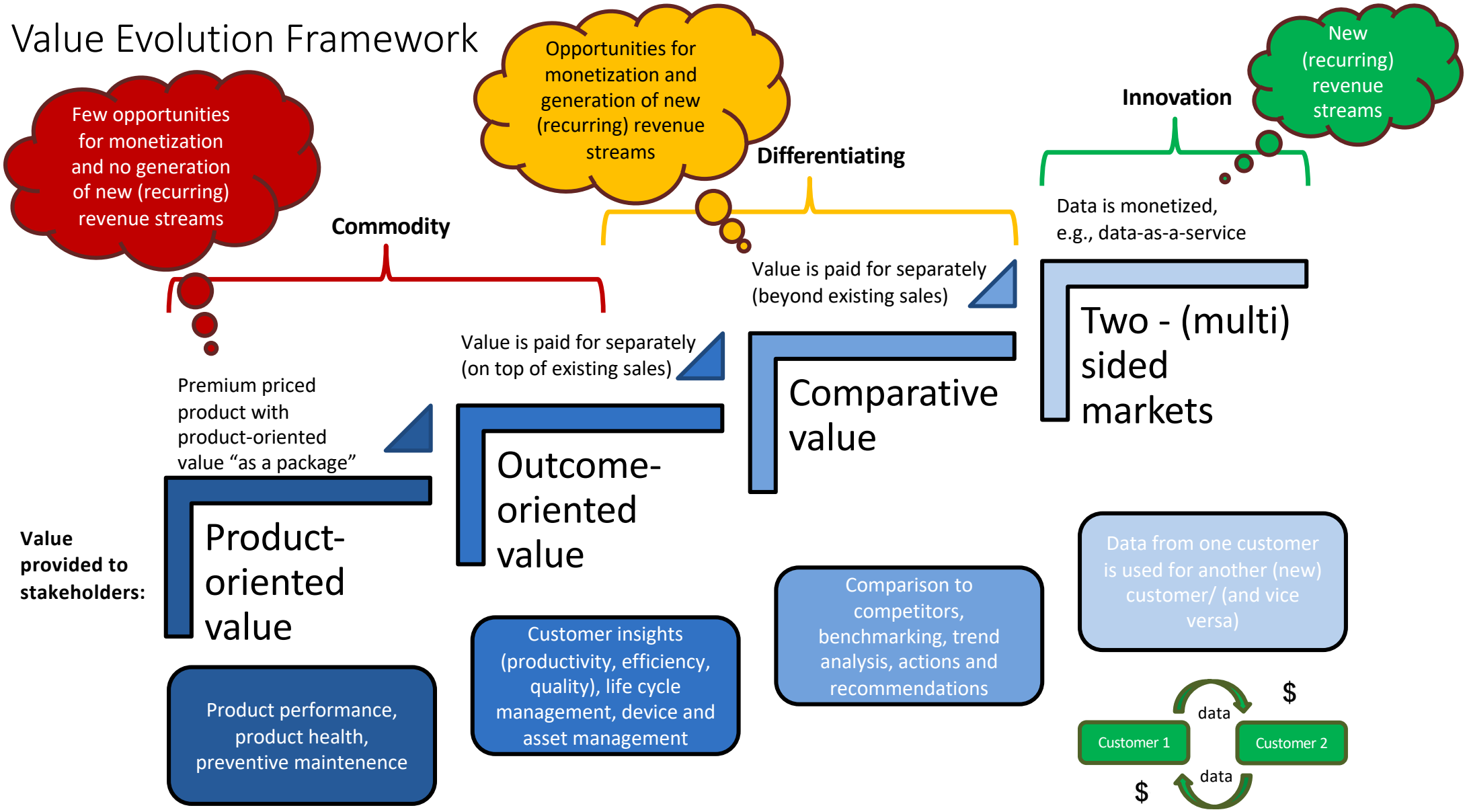
Complementary services: Why?

- Enhance performance of the product
- Improve customer and user experience of the product
- Shift value delivery from today's transactional models towards more (continuous) models
- Establish a continuous relationship to customers (the physical product becomes an enabler for selling services and digital products)
- Shorten the distance to customers and users of the system
- Forward-integrate in the value chain to increase access to partner and customer knowledge using data collected from the products

Examples of service offerings

- Performance, e.g., truck up-time
- Product/system “health”, e.g., how is the pump/truck/forklift/radar/car etc., doing?
- Availability, e.g., is the truck/trailer/car available when I need it?
- Life cycle/asset management
- Insights for customers, e.g., productivity, quality, goods damage, comparisons/bench marking
- Predictive and preventive maintenance
- Safety and security, e.g., active safety services

Value Evolution Framework



Conclusions

- The essence of digitalization is the fundamental shift in value delivery to customers, moving from transactional revenue to recurring revenue streams
- To thrive in a digital age – companies need to explore, experiment and effectively exploit software, data and AI for continuous delivery and improvement of customer value

The money is where you can support a continuous model e.g., paying for movement, item, performance, productivity etc.

Shift focus to the customer to identify what the customer needs and where the customer will be in the future.

- For successful service innovation and development, companies need to effectively engage with their surrounding ecosystem



Thank you – and welcome to join the project!

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