

DIH Süd
Digital Economy

March 13, 2023

ufo.tugraz.at

Institut für Unternehmensführung und Organisation

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Agenda

| Zeit | Format | Inhalt |
|-------------|-----------------------|---|
| 9:00-09:15 | Vorstellungsrunde | |
| 09:15-10:15 | Impulsvortrag | Digital Economy – Konzept und Bedeutung |
| 10:15-10:25 | Pause | |
| 10:25-11:25 | Fallstudiendiskussion | Netzwerkeffekte |
| 11:25-11:35 | Pause | |
| 11:35-13:00 | Simulation | Netzwerkeffekte |

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VORSTELLUNGSRUNDE

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Keynote

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The Traditional Economy

Initial State

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The Products

- Products are (rather) simple and consist of a low number of different parts.
- Products have a very high stand-alone value.
- Products have a long lifecycle before the next generation is introduced.
- The functions are predefined by their physical components.
- Products have a limited ability to interact with each other.
- Examples: typewriter, telephone



Pictures: Wikipedia

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The Markets

- Central mechanism to coordinate supply and demand.
- Market actors have very limited knowledge and mobility.
- High transaction costs
 - Slow and expensive process of communication
 - Slow and expensive process of transportation
- Many markets are fragmented and have high entry barriers.
- Example: London Metal Exchange, Farmer's markets



Pictures: New York Times; Graz Tourismus

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The Industry

- A superordinate term to classify companies, organizations and individual people into types based on similar activities, products or behavior.
- Much of the companies' behavior is oriented towards industry peers:
 - External strategy analysis (Branch structure analysis)
 - Evaluation of internal strengths and weaknesses (Benchmarking)
 - Representation of interests (Industry associations)
- Examples: Automotive industry, Textile industry



Pictures: Wikipedia

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The Firms

- Labor-intensive tasks are facilitated by powered machines.
- Labor is divided into small, easily repeatable activities.
- Main activities of producing firms are development, production and distribution.
- The whole product and all of its components are developed and produced within the boundaries of large, vertically integrated firms.
- Example: IBM, Ford Motor Co.



Pictures: Wikipedia

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The Digital Economy

Current State

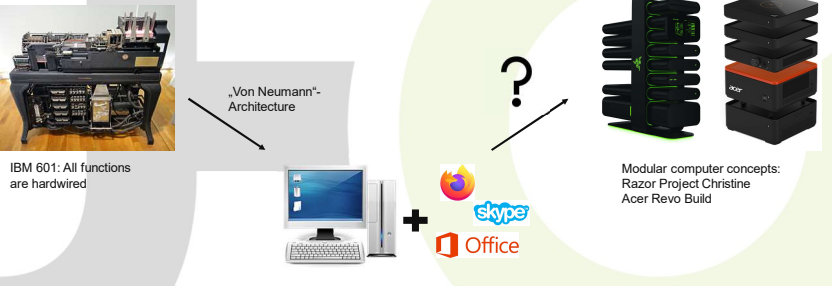
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Modularity



„Von Neumann“-Architecture

IBM 601: All functions are hardwired

Modern computer: Software and hardware are separate modules

Modular computer concepts: Razor Project Christine, Acer Revo Build

Picture: Wikipedia, polygon.com, winfuture.de

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Modularity

- Modern technologies are more and more complex.
- **Tasks need to be split up** and coordinated amongst people or groups of people.
- To further reduce the complex coordination, technological systems are split up in **independent modules**.
- „A module is a unit whose structural elements are powerfully connected among themselves and relatively weakly connected to elements in other units.“
- For the creation of independent modules, a **system architecture and interfaces** need to be specified.
- The number of modules can be increased by adding new modules or splitting up existing.

Source: Baldwin and Clark, 2000

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Modularity

Advantages:

- Increase the range of “manageable” complexity
- Reuse of modules in different combinations
- Higher number of options for heterogeneous customers
- Obtain scale and scope advantages in production

Disadvantages:

- Less control over complete system
- Lower performance than integrated system
- Interconnected design processes have uncertain outcomes

Source: Baldwin and Clark, 2000

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From Value Chains...

Initial concept: Value chain

- Focus on activities **within firm boundaries**
- Goal is to identify potential for competitive advantage

Sources: Porter, 1985, p. 88; Johnson et al., 2011 p. 153

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...to Value-Adding Network

Wider view: Value-adding network

- Focus on activities **across firm boundaries**
- Goal is to identify potential for competitive advantage

Sources: Porter, 1985, p. 88; Johnson et al., 2011 p. 153

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Complementarity

- Through modularization, complementarity can be explicitly considered.
- Definition of complementarity:
„Value of module A is maximized through combination with module B“
- Types of complementarity:
 - Generic complementarity: Many possible combinations lead to the same value
 - Non-generic complementarity: A can be combined only with B and B only with A
 - Supermodular complementarity: more of B makes more of A more valuable


Source: Jacobides et al., 2018; Teece, 2018; Baldwin, 2020

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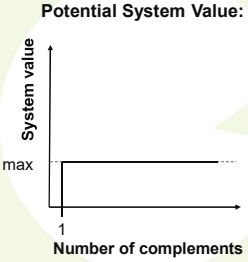
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Generic Complementarity



Potential System Value:



System value

max

1

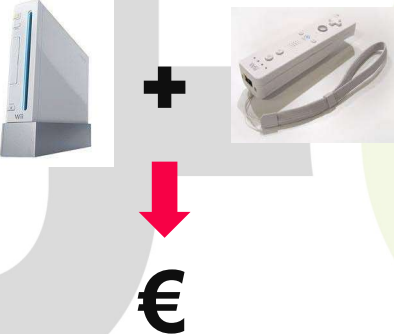
Number of complements

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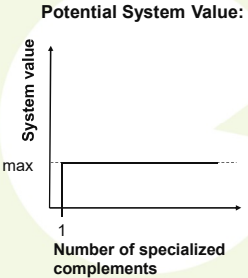
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Non-Generic Complementarity



Potential System Value:



System value

max

1


Number of specialized complements

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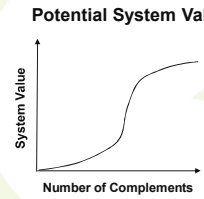
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Supermodular Complementarity



„Network externalities“

Potential System Value:



System Value

Number of Complements

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Network Effects

A user's perceived utility or value of a certain product or service depends on the number of users of compatible products and services.

- Direct network effects: one group of users
- Indirect network effects: at least two different groups of users

Picture source: Wikipedia
Picture source: Asahi Press
Picture source: Creative Commons by iStock

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Network Externalities

- Often leads to "Winner Take All" Markets
- Similar to natural monopolies
- Sometimes supported or enabled through standards
- Example: Windows, Intel, etc.

The availability of complementary goods attracts users, increasing the installed base. A large installed base attracts producers of complementary goods.

Schilling (2023), p. 76 ff

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Network Externalities

2 ways to break the monopoly:

- Incompatible but stand-alone utility is higher than total utility of current tech
- Compatible and offers slightly higher stand-alone utility than current tech

(a) Combined value of stand-alone technological utility, installed base, and complementary goods offered by existing technology.
(b) New technology competes only on the value of its stand-alone utility.
(c) New technology that is compatible with existing technology's installed base and complementary goods.

Schilling (2023), p. 76 ff

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From Actors to Networks

Actor, Dyad, Portfolio, Connected Relations, Network

Ritter et al. (2004), p. 179

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Positions in Interorganizational Networks

| Degree Centrality | Betweenness Centrality |
|---|---|
| # of links an organization has in a network | # times an organization lies on the shortest path between other pairs of organizations. |
| Advantages of high DC: <ul style="list-style-type: none"> Greatest access to information and influence | Advantages of high BC: <ul style="list-style-type: none"> Access to the highest diversity of information; gatekeeper for information transfer. |
| Disadvantages of high DC: <ul style="list-style-type: none"> Constraints through large number of relationships. | Disadvantages of high BC: <ul style="list-style-type: none"> How to benefit from this position? Maybe better to be connected to a broker than to be a broker. |

Schilling, 2023, p. 191

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The global technology collaboration network

Schilling (2023), p. 191

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Networks

- Bundles of interorganizational relationships
- Not restricted to a particular purpose
- Many examples:
 - Virtual enterprises
 - Value networks
 - Value-creating network
- Problems with networks:
 - In only focusing on interorganizational relationships, companies might overlook other sources of interdependency.
 - In complex technological systems, the source of interdependency is very often complementarity. This necessitates to focus on additional companies!

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Business Ecosystems

Moore, 1996, p. 93

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Value Systems

Hierarchy-based value system

Market-based value system

s et al., 2018, p. 2261

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Ecosystem-based Value System

Jacobides et al., 2018, p. 2261

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Ecosystems

“An ecosystem is a set of actors with varying degrees of multilateral, nongeneric complementarities that are not fully hierarchically controlled.”

Jacobides et al., 2018, p. 2264; Adner & Kapoor, 2010

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10 minutes

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Sony's Battle for Video Game Supremacy

Case Study Discussion

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Discussion Questions

- Which macro-environmental factors influenced the video game industry in 2006?
 - Which political, economic, societal, and technological factors influence the video game industry?
 - Which factors are particularly strengthening or weakening Sony's launch of the PlayStation 3?

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Discussion Questions

- Evolution of the video game industry: How did society and the demographics of video game players change?
- Role of the video game developers: Do they have a strong or weak position?
- How did the video console manufacturers try to target different audiences? How did their strategies shift over time?
- Considering network effects and characteristics of the digital economy, which implications could you identify in the case?


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Break

10 minutes

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Platform Wars

Simulating the Battle for Video Game Supremacy

Simulation - Briefing

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Many different platform wars...

- **VCRs** (Betamax vs VHS)
- **Personal Computers** (IBM PC vs. Macintosh)
- **Browsers** (Chrome vs. Firefox)
- **Mobile Phone Carriers** (AT&T vs. Verizon etc.)
- **High Def DVD players** (BluRay vs. HD-DVD)
- **Social Networks** (Twitter vs. Facebook etc.)
- **Smartphones/Tablets** (iOS vs. Android)
- **Alternative Fuel Vehicles** (ICE vs. P(H)EV vs. H2 vs. Biofuels vs. ???)
- **Many others**

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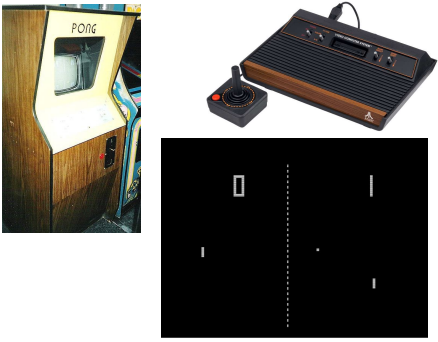
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Gaming then...



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Gaming in 2007...



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Gaming now...




PlayStation Plus

<https://www.express.co.uk/entertainment/gaming/1757125/PS-Plus-Extra-and-Premium-April-2023-new-games-reveal-date-time-leads>



GAME PASS

https://www.frandroid.com/franques/microsoft/771843_microsoft-donne-de-quoi-mesurer-la-progression-tout-en-jeux-avec-xbox-game-pass



Nintendo Switch Online

<https://thegamefix.com/2020/05/15/nintendo-switch-online-gaet-neuve-games-toevogel/>

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Competition in Platform Markets

- Product attractiveness depends not only on price, functionality, quality, etc., but on the **size of the network of users** and the **availability of complementary resources** (“content”, “apps”)
- Typically, **the larger the installed base** of the platform (e.g., your firm’s video game console), **the more attractive your platform becomes**, creating reinforcing (positive) feedbacks.

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Example

Sony Betamax vs. Matsushita VHS



SONY BETAMAX
RELEASED BY THE COMPANY



Cut \$110

Beta format VCR with 3-day/1 program capability. Betascan plus up to 5 hours of recording time. **\$379.95**

VHS VCR has 1-day/1 program capability with up to 8 hours of recording plus pause/still remote control. **\$439.99**

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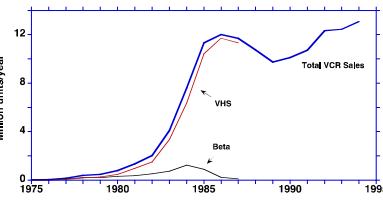
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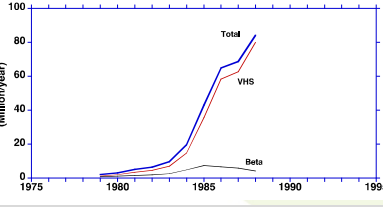
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VCRs: Betamax vs. VHS

Million units/year



Pre-recorded Tape Sales (million/year)



Source: Sterman, J. (2003) *Business Dynamics: Systems Thinking and Modeling for a Complex World*. McGraw-Hill, Ch. 10.

developed by John Sterman, MIT Sloan

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How strong are the network effects in the video games market?

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Gaming is often social...

PlayStation 2
singstar

Wii Sports

XBOX 360 KINECT
KINETIC ADVENTURES!

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Gaming is often social... and online

Call of Duty

LEAGUE OF LEGENDS

FORTNITE

League of Legends

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Video Game Simulator: Quick Facts

- You play the role of a video game hardware maker against a simulated competitor.
- You set:
 - Console prices
 - The royalty game makers (complementors) pay you for the right to produce games for your platform
 - How many (if any) initial games to subsidize
- Your goal is to **maximize your cumulative profit** (NPV of profit) over 10 years
- No balance sheet

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Let's Play!

- Open the link bit.ly/3LUXXu9
- On the website, navigate to **“Play as part of a class”**
- Credentials:
 - Login ID: e-mail address used for registration
 - Password: dih2023

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MIT Sloan Management Dashboard Overview

Console Price Market Share Net Income

Copy To Clipboard

Results for Year 0

| | You | Competitor | Industry |
|---------------------------|--------|------------|----------|
| Market Share (%) | 50% | 50% | |
| Console Price (\$ / Unit) | 250.00 | 160.00 | 172.82 |

Decisions for Year 1

Console Price (\$/Unit): 250 Royalty Paid by Game Maker: 30% Advance 1 Year Start Over

Game Titles to Subsidize: 10 Subsidy: 162M (\$/Year) % of Game Revenues

Credits Case Study Report Issues

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Let's Play!

<https://mitsloan.mit.edu/teaching-resources-for-aij/platform-wars-simulating-battle-video-game-supremacy>

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Platform Wars

Simulating the Battle for Video Game Supremacy

Simulation - Debriefing

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Simulation Discussion

- Share you experience and winning strategy
- How did you set the parameters to find the best strategy?
- What did you find challenging?
- What lessons can you take away from the simulation?

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Reinforcing (Positive) Feedback

Two common reinforcing feedbacks in platform markets:

- **Direct Network Externality:** The utility of the product increases with the size of the network of other users (example: fax machine)
- **Indirect Network Externality:** The utility of the product increases with the number and variety of complementary products that can be used on that platform (example: apps for Apple iOS vs Google Android)

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Direct Network Externality

The diagram illustrates a reinforcing feedback loop for Direct Network Externality. It starts with 'Industry Demand' leading to 'Sales of Your Platform' (indicated by a key icon). This leads to an increase in the 'Installed Base of Your Platform'. From there, the 'Installed Base' leads to 'Attractiveness from Network Size', which increases the 'Attractiveness of Your Platform'. This attractiveness leads to an increase in 'Your Market Share', which in turn leads to 'Sales of Your Platform', completing the loop. Two 'Network Effect' loops are shown: one between 'Your Market Share' and 'Attractiveness of Your Platform' (labeled R1b), and another between 'Attractiveness of Your Platform' and 'Your Market Share' (labeled R1a).

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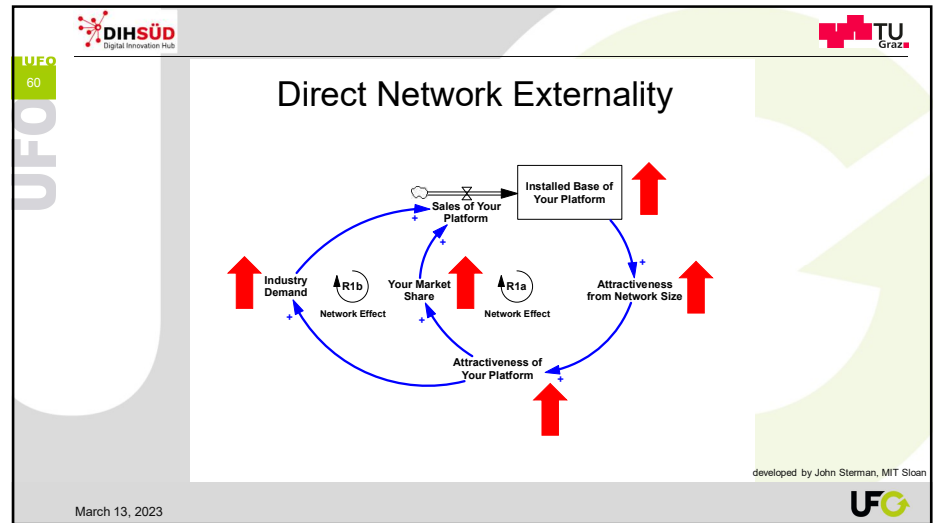
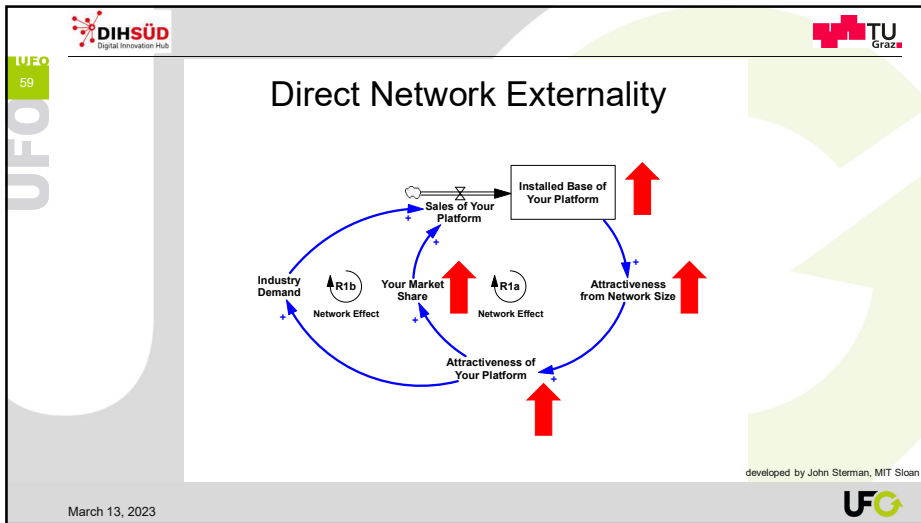
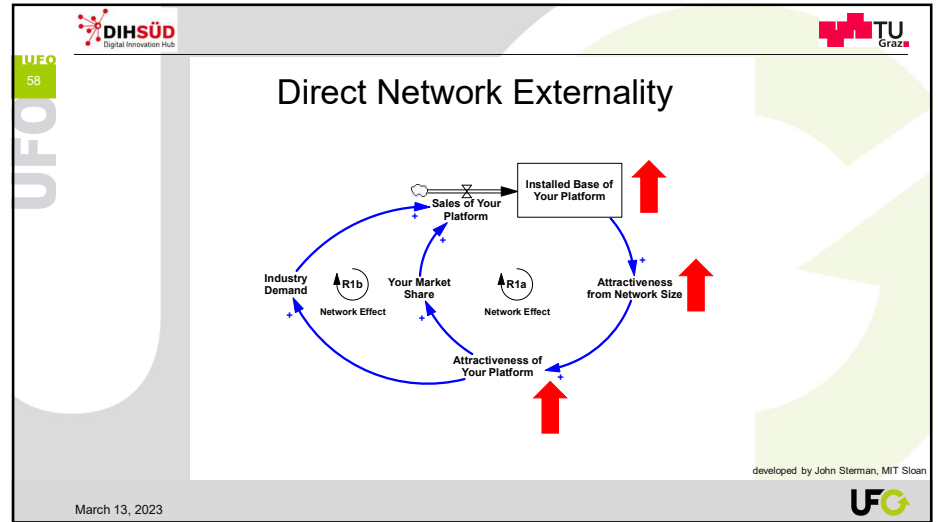
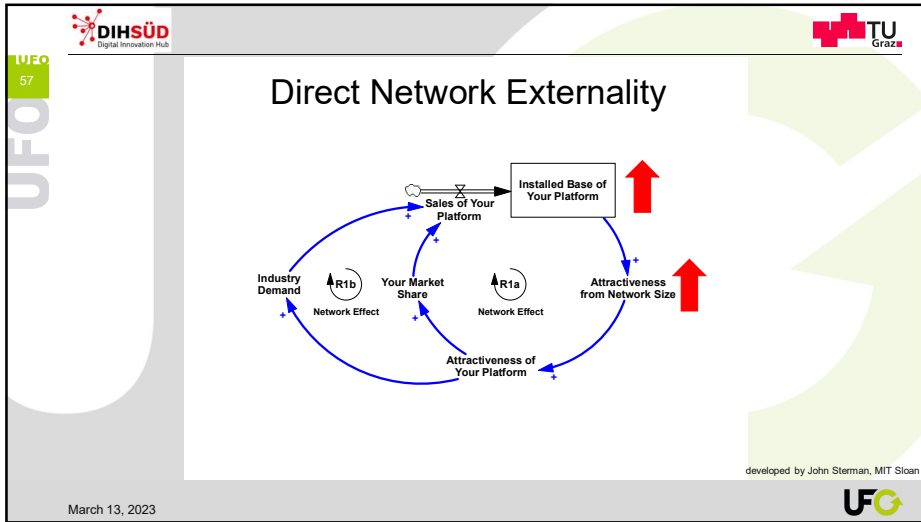
Direct Network Externality

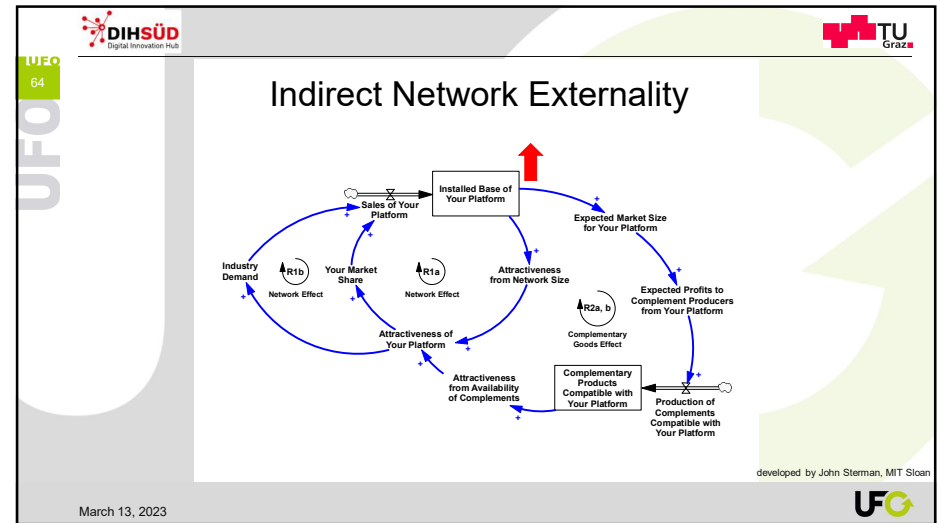
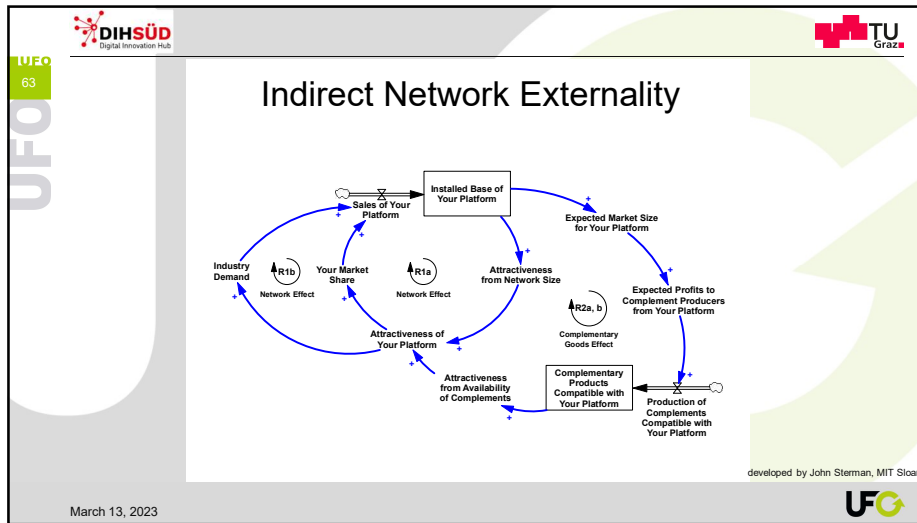
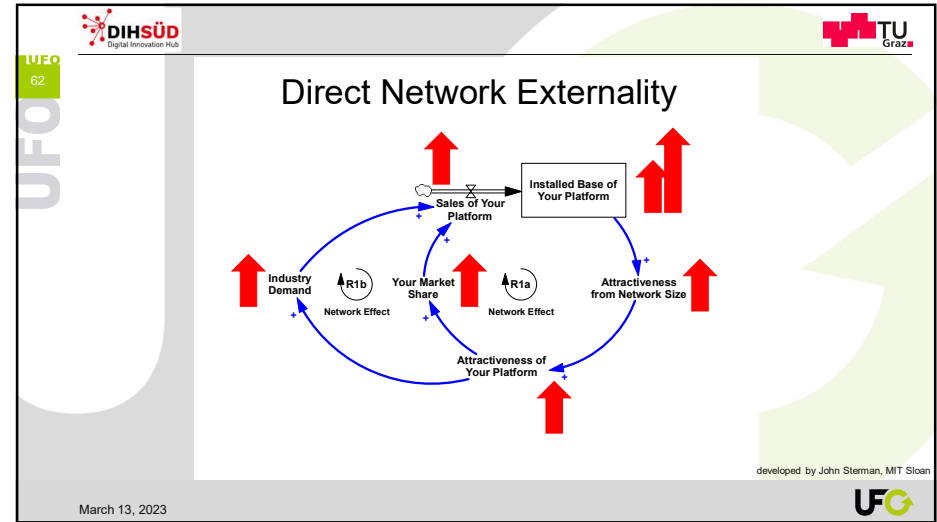
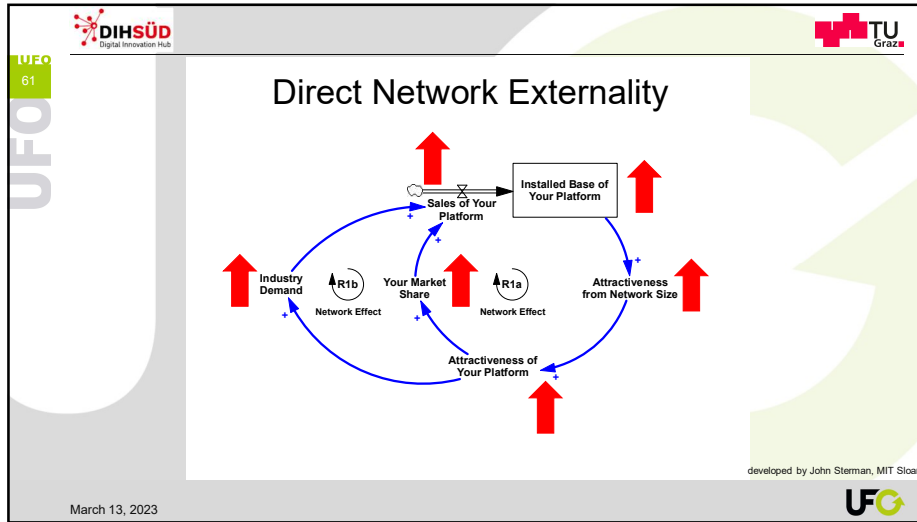
This diagram is identical to slide 55, showing the reinforcing feedback loop for Direct Network Externality. The only difference is a red arrow pointing upwards from the 'Installed Base of Your Platform' box, indicating a further increase or acceleration in the network size.

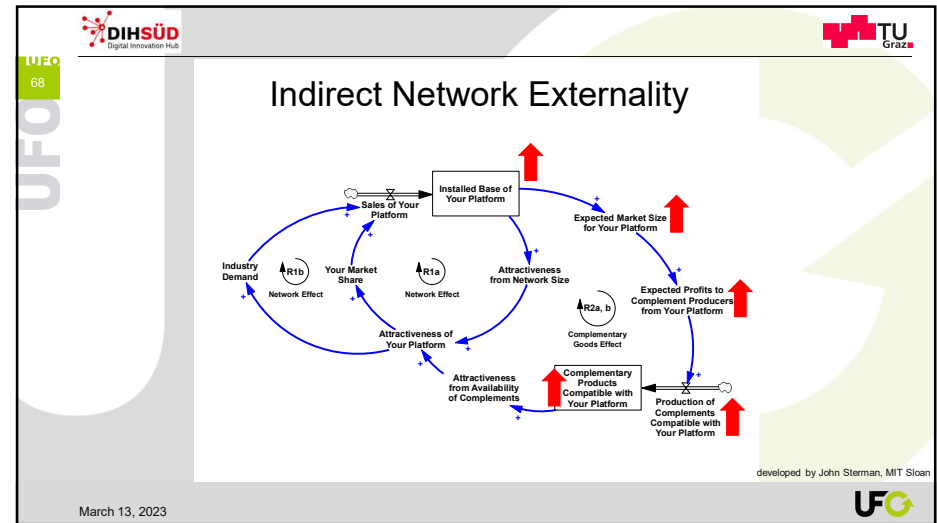
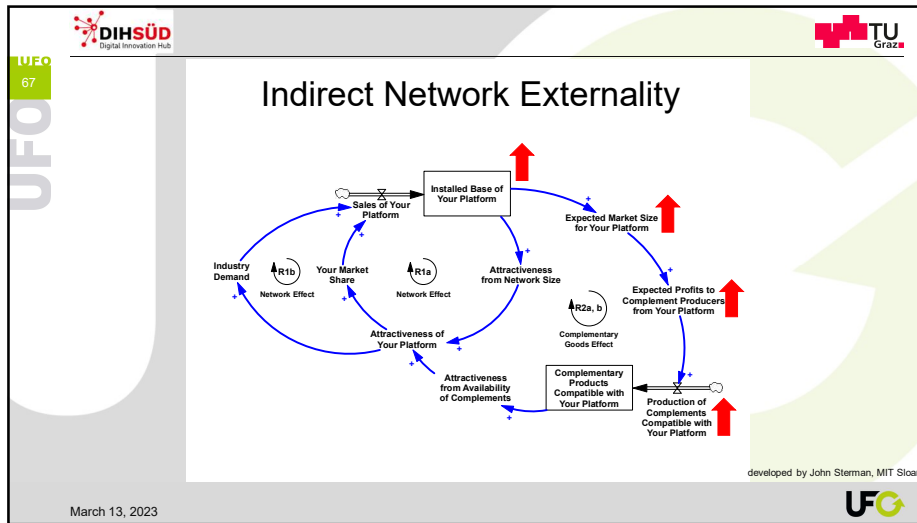
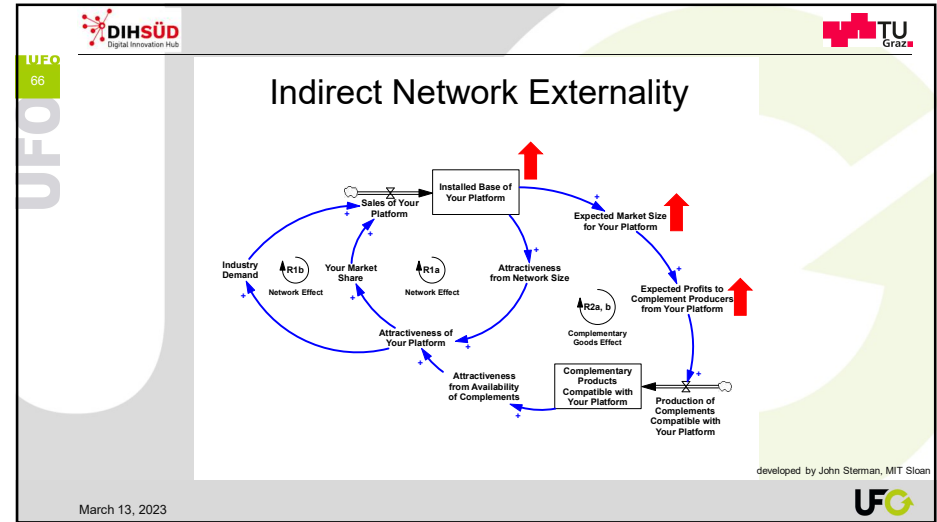
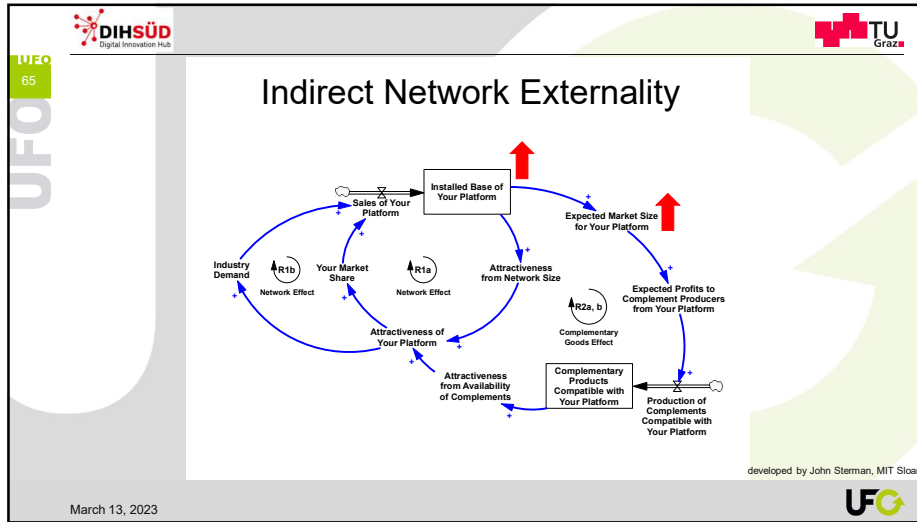
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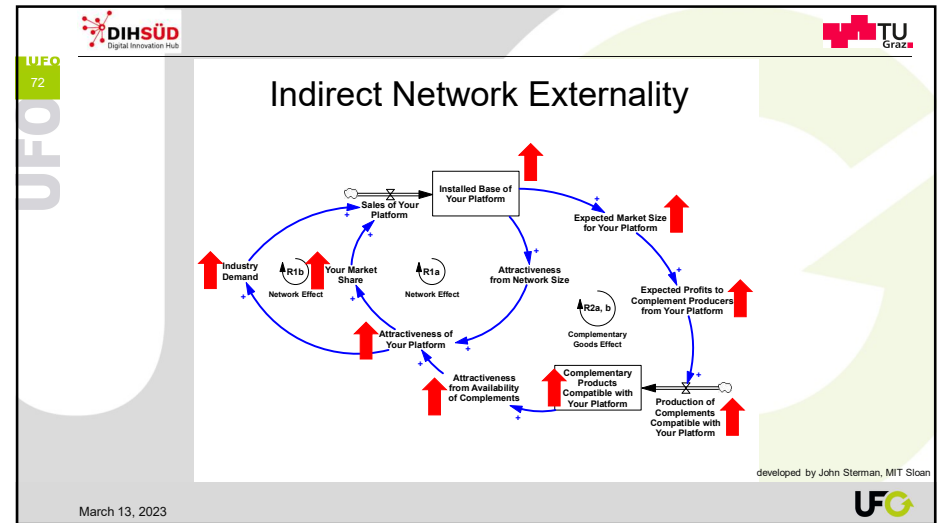
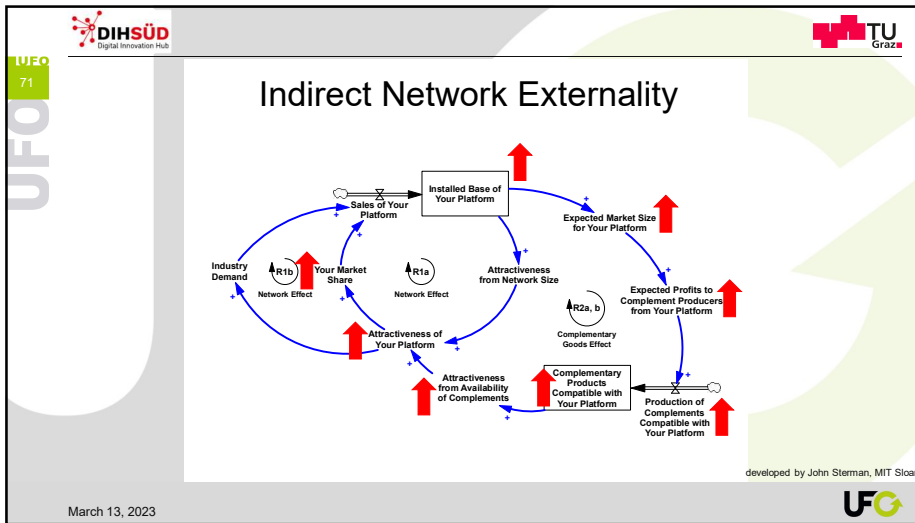
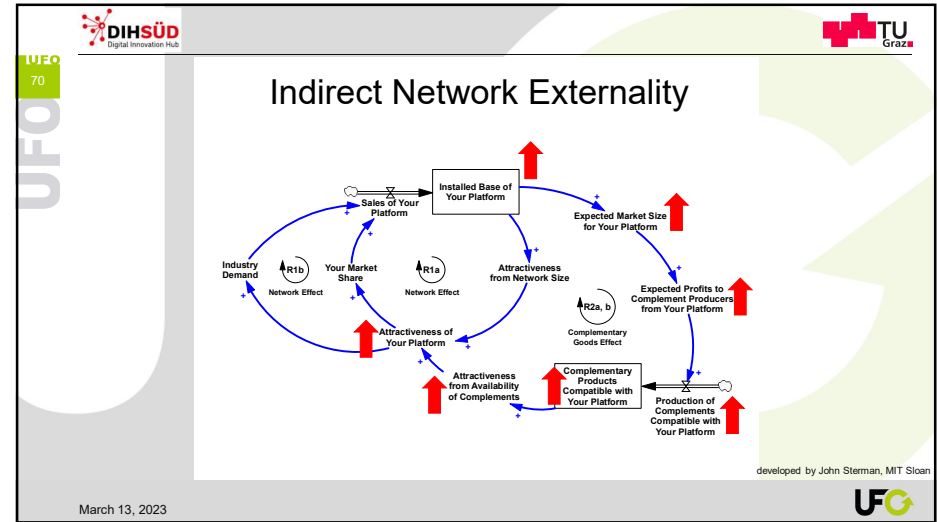
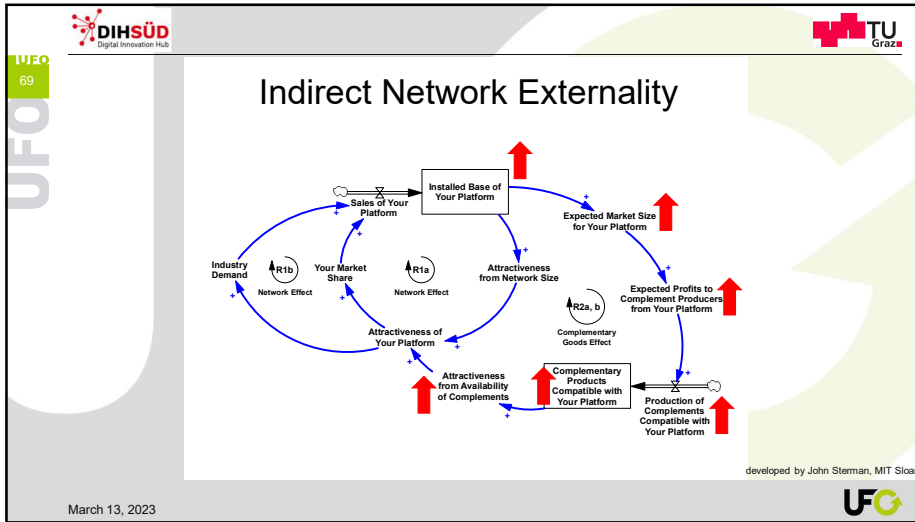
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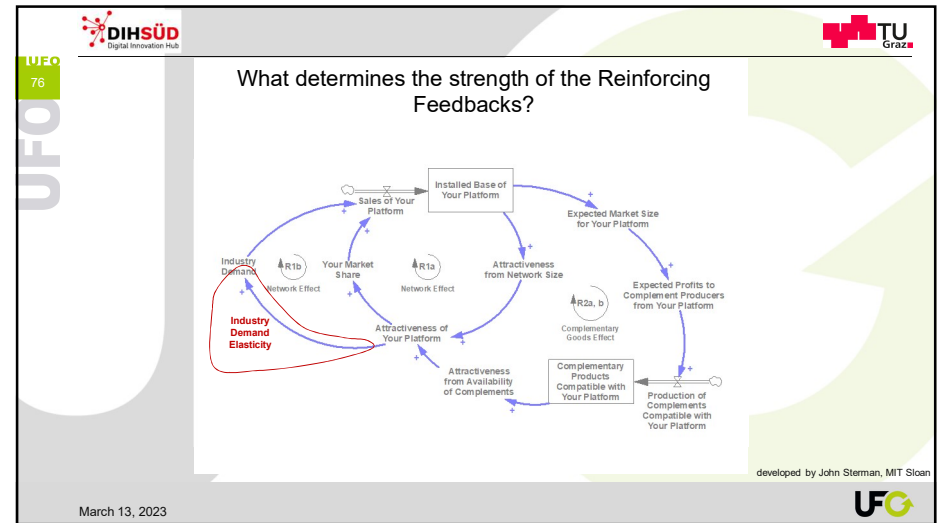
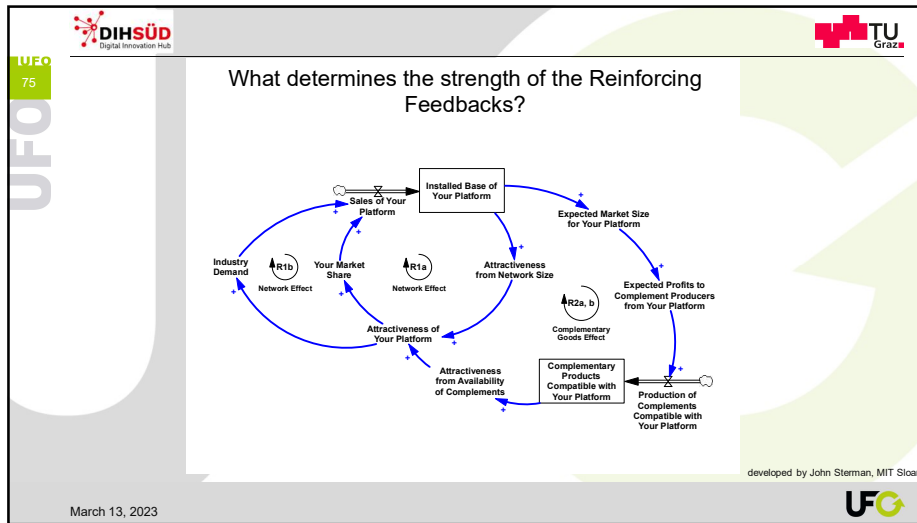
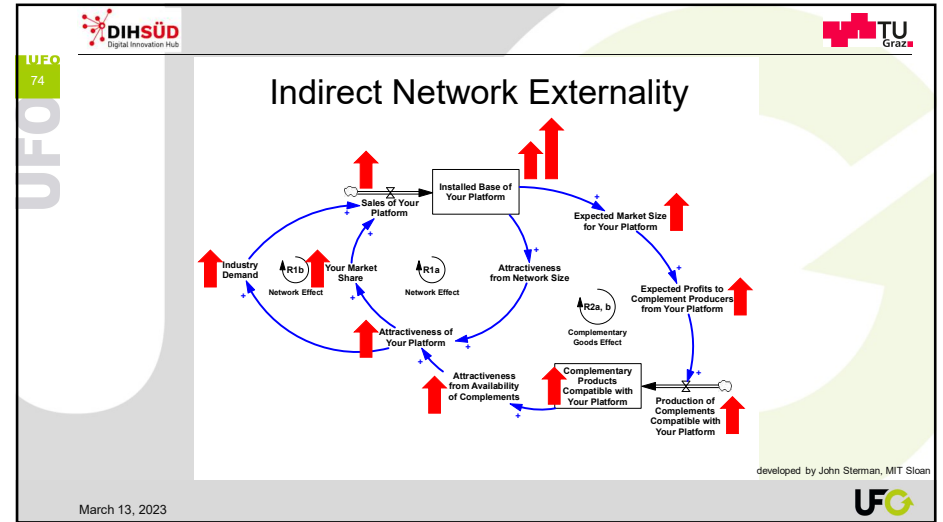
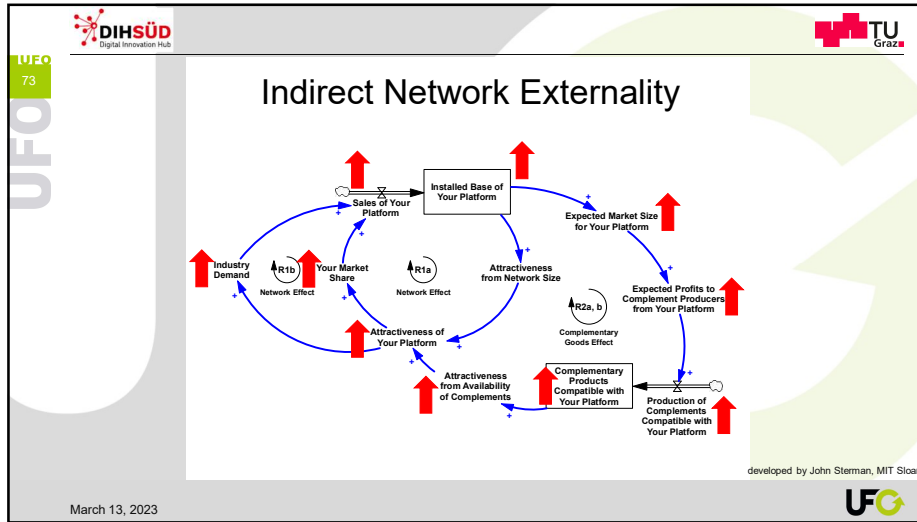
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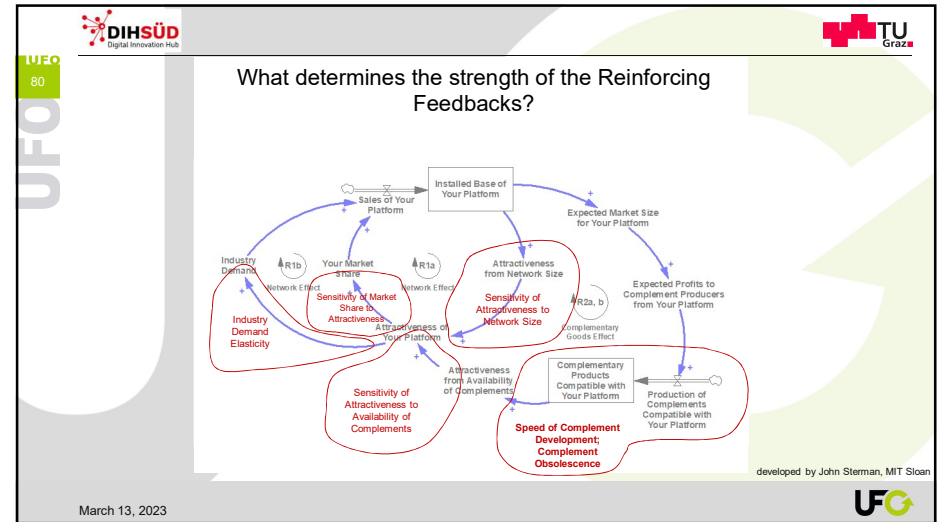
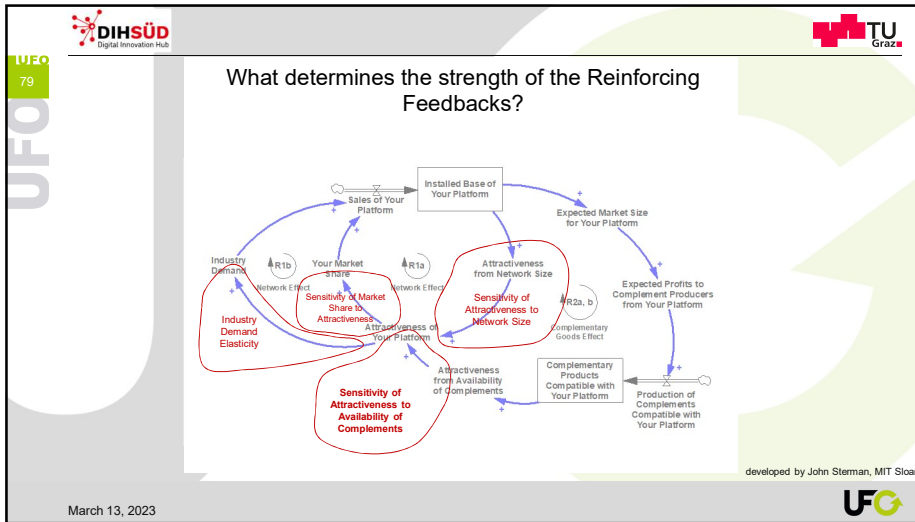
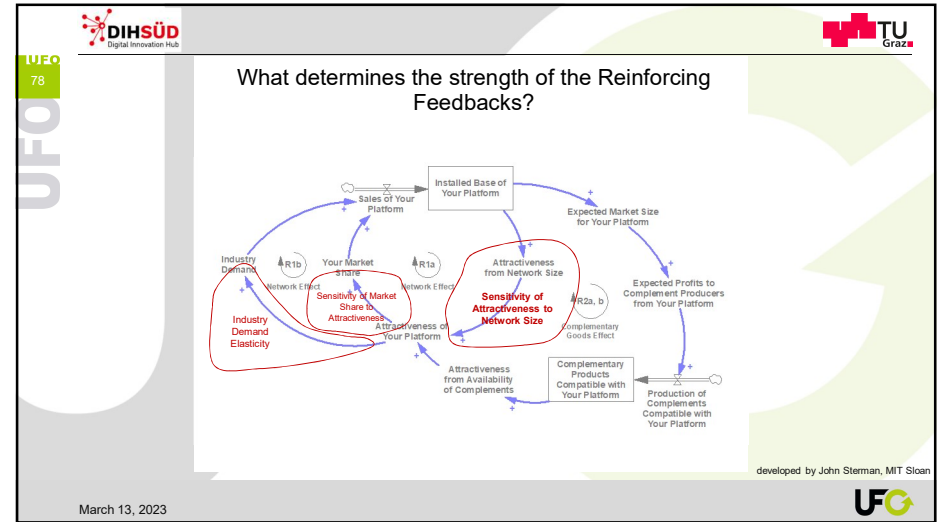
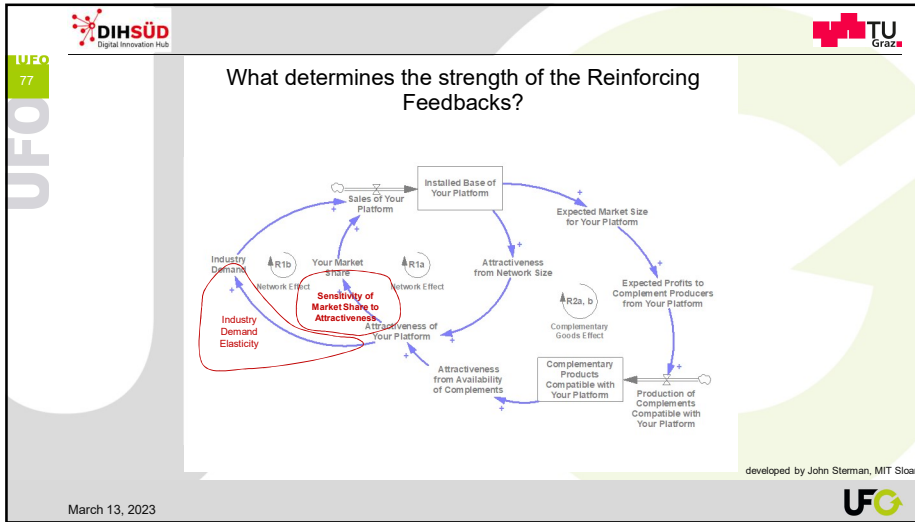












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What determines the strength of the Reinforcing Feedbacks?

developed by John Sterman, MIT Sloan

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Other Common Reinforcing Feedbacks

- Reinforcing feedbacks create the **possibility of lock-in** to a dominant platform (winner take all dynamics).
- Increasing awareness and brand equity through advertising and word-of-mouth;
- Cost reductions and functionality improvement through R&D, process improvement, learning-by-doing, scale economies, market power over suppliers and workers;
- Improvements in other capabilities through investments (direct sales force size and skill, product development process, post-merger integration, etc.)
- Sterman (*Business Dynamics*, McGraw-Hill, 2000) identifies nearly **three dozen such reinforcing feedbacks** firms can use to create sustained competitive advantage.

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