

WIVE workshop

Managing distributed innovation processes in
Virtual Organisations by applying the
Collaborative Network Relationship Analysis

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Content

- Categories of innovation
- Case study for distributed innovation in VO
- Qualitative and quantitative methods to investigate collaborative relationships in distributed innovation processes
- Collaborative network relationship analysis
- Case study - revisited
- Conclusions

Categories of Innovationen

Innovation:

Product innovation



I-Phone, IPOD

Process innovation



Global innovation processes (concept in US, manufacturing in China, test cases in several countries, etc.)

Service innovation



Automatic update of Podcasts

Business model innovation



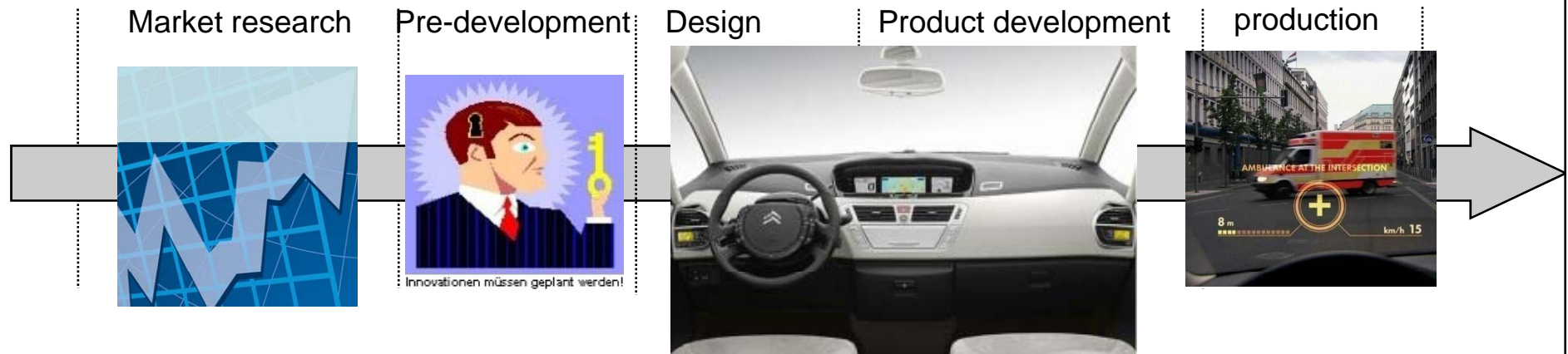
I-Tunes, platform for all types of new business ideas (talking books, radio stations, podcasts, ...)

Further models

technical Innovation, application innovation, empirical innovation, marketing innovation, structural Innovation

(Reference: Granig 2007, S. 197, Geoffrey 2004, S. 62)

Example innovation project: Intelligent front mirror



Main innovation:

Multi-touch governance of objects and information on an intelligent front mirror



Situation:

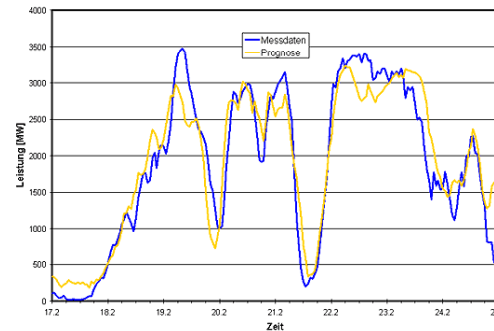
- 4 companies would like to collaborate (VO-oriented),
- Sharing competencies is key,
- Technological and organisational challenges and
- Is there a market for intelligent front mirrors (cost estimate: 1500-2500 Euros) ?

Objective:

- Definition and analysis of needed, collaborative network relationships

Analysis of collaborative network relationships

Quantitative and qualitative methods



Quantitative-oriented methods-measure

(Ellmann 2007, Rank 2003, Wald 2003, Wührer 1995, Jansen 2006, Abreu and Camarinha-Matos 2008, S. S. Msanjila, H. Afsarmanesh 2008, Wasserman/Faust 1994):

- Density of partner
- Centrality
- Inward-oriented relationships
- Outward oriented relationships
- Closeness to other partner,
- Benefit analysis
- Value systems and trust management

Qualitative-oriented methods – estimate

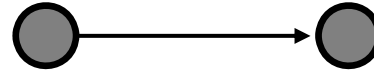
(Hollstein 2006, Eschenbaecher 2009, Jarimo And Korpiaho 2008, Wassermann and Fausst 2008):

- Triangulation
- Field research
- Interpretative procedures
- Open interviews
- Time series analysis
- Relationship analysis (collaborative networks)**
- Etc.

Quantitative Network Analysis – various Indicators

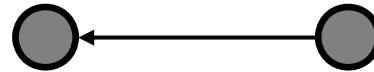
Outward Orientation

(Rank 1998, Wald 2003,...)



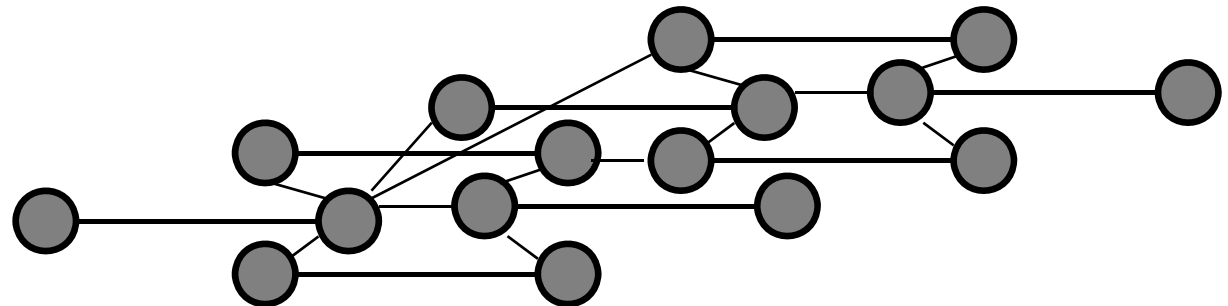
Inward Orientation

(Renz 1998, Rank 2003, Wald 2003, ...)



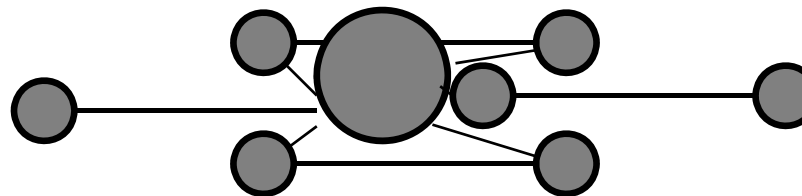
Network Density

(Ellmann 2008)

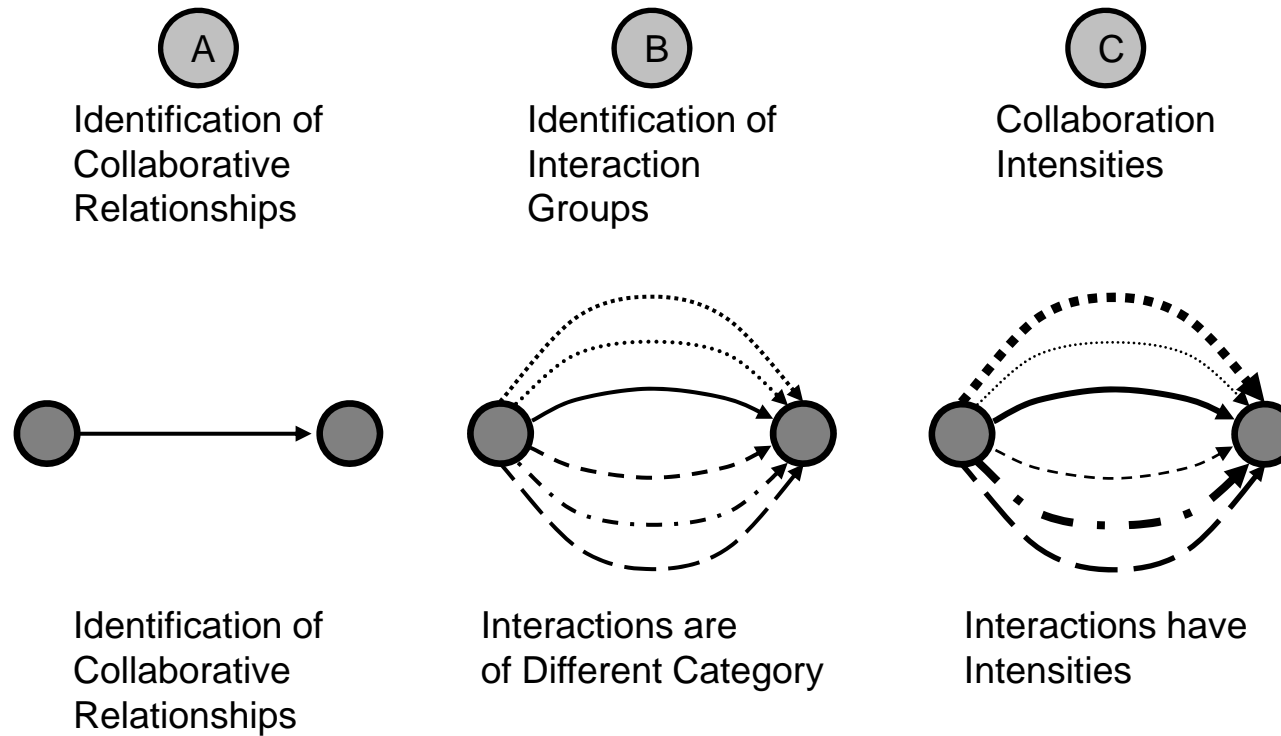


Network Centrality

(Ellmann 2008)

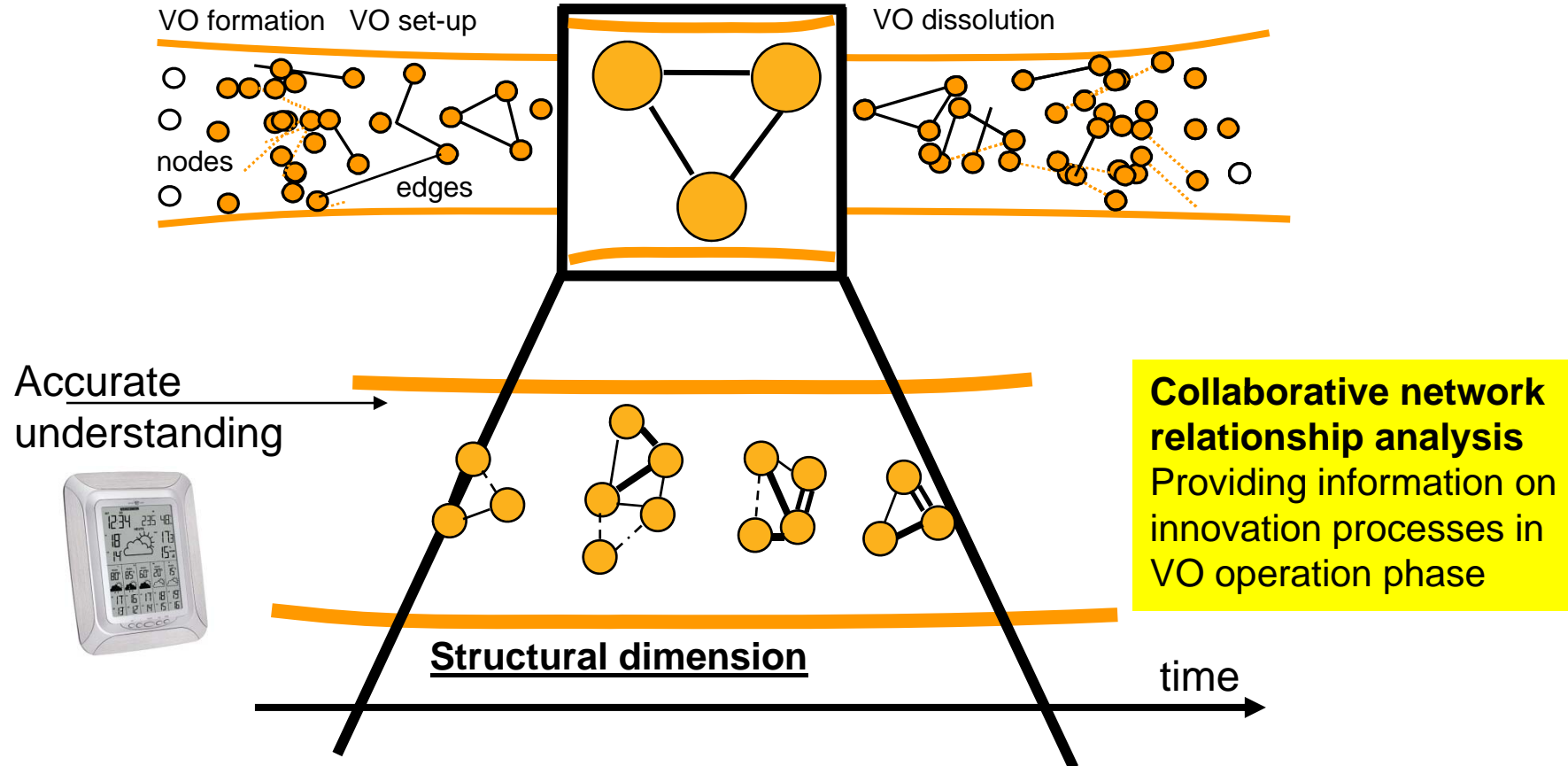


Qualitative view: Collaborative relationships and intensities

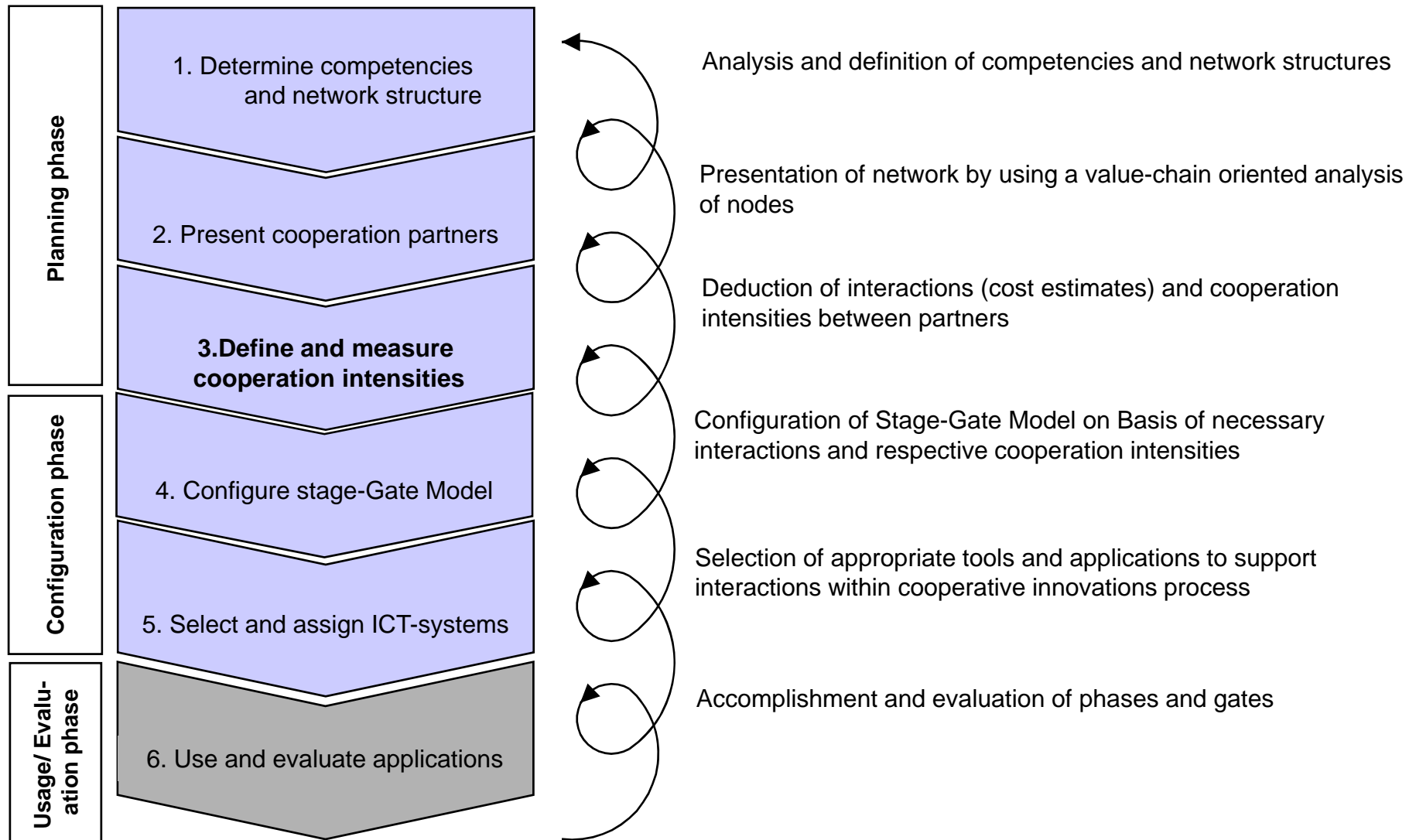


Collaborative network relationship analysis

Life-cycle

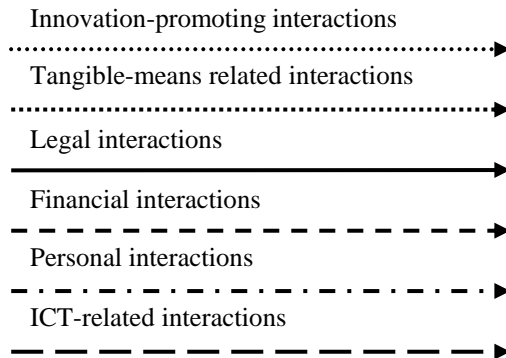


Collaborative network relationship analysis

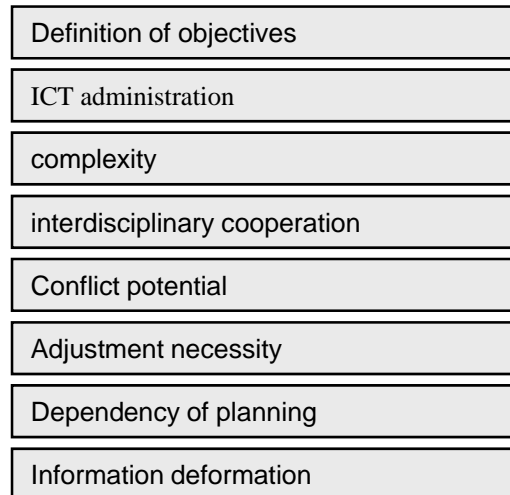


Step 3: Method to define and measure collaboration intensities

Step 1
Identification of Interactions and their Categories



Step 2
Definition of Variables for each Interaction Group

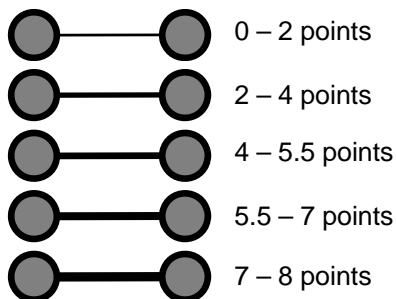


Step 3
Investigation of the Collaboration Intensity

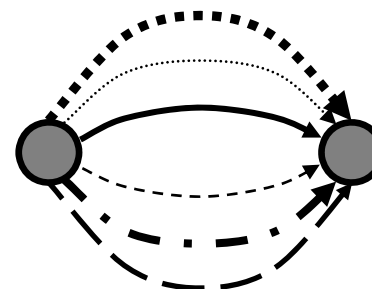
Estimate about cooperation intensity by using a scoring system:
1 = difficult, 0.5 = medium, 0 = simple

| Criteria | Interaction | | | | |
|--------------------------|-------------|-----|-----|-----|-----|
| | I1 | I2 | I3 | I4 | I5 |
| Definition of objectives | 0 | 0,5 | 0,5 | 1 | 0 |
| ICT management | 0,5 | 1 | 1 | 0,5 | 0 |
| Complexity | 0,5 | 0,5 | 1 | 1 | 0,5 |

Step 4
Specification of the Collaboration Intensity by application of steps 1-3



Step 5
Identification of the Collaborative Relationships Based on the Evaluated Interactions



Case revisited – main interactions

Innovation-promoting interaction

- I1: Display technology
- I2: display contrast and brightness
- I5: Software concept
- I7: First prototype
- I13: Feedback by living labs

Tangible means related interactions

- I3: Derating
- I8: pre-series models
- I10: technology test

Legal interactions

- I14: patent management

Financial interactions

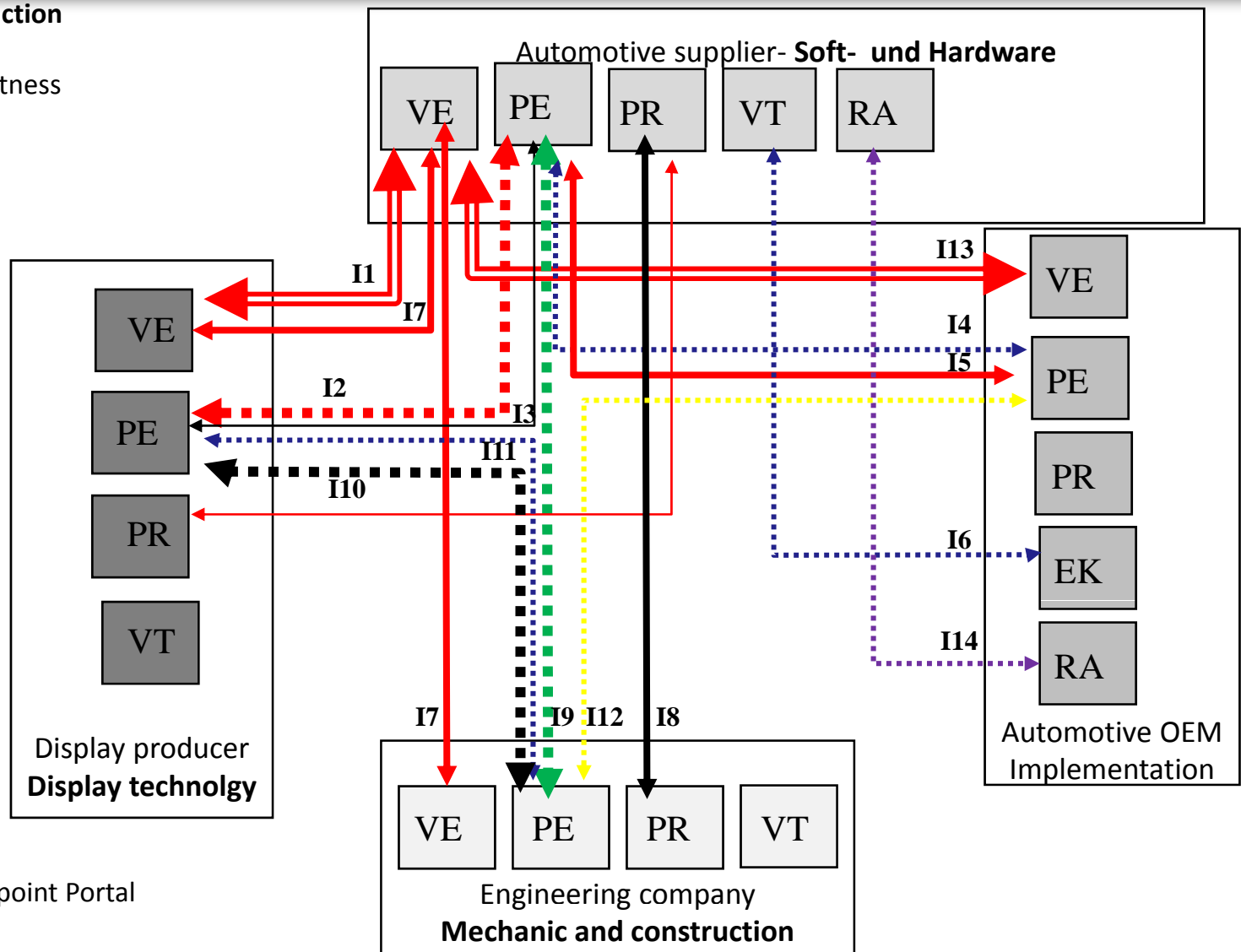
- I4: House Engineer
- I6: sample management
- I11: project controlling

Personal interactions

- I9: exchange of experts

ICT related interactions

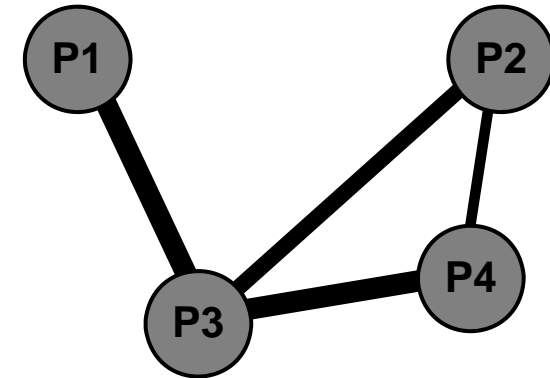
- I12: ICT infrastructure, Sharepoint Portal



Collaboration Intensity – Example (1)

Example – Basic Assumptions

- Project with 4 Partners (Nodes)




Workplan

- 4 Tasks to be performed
(effort in person-days, time in weeks)

| | P1 | P2 | P3 | P4 | Totals | Start | Dur. |
|--------|------|------|------|------|--------|-------|------|
| Task 1 | 20.0 | | 12.0 | | 32.0 | 0 | 4 |
| Task 2 | | 30.0 | 21.2 | | 51.2 | 2 | 8 |
| Task 3 | | 14.0 | | 10.0 | 24.0 | 6 | 6 |
| Task 4 | | | 18.0 | 30.0 | 48.0 | 8 | 6 |

Collaboration Intensity – Example (2)

Assuming equally distributed resources over the duration, the collaboration intensity can be calculated by dividing the totals by the duration of the task.



| | P1 | P2 | P3 | P4 | Totals | Start | Dur. | Intens. |
|--------|------|------|------|------|--------|-------|------|---------|
| Task 1 | 20.0 | | 12.0 | | 32.0 | 0 | 4 | 8.0 |
| Task 2 | | 30.0 | 21.2 | | 51.2 | 2 | 8 | 6.4 |
| Task 3 | | 14.0 | | 10.0 | 24.0 | 6 | 6 | 4.0 |
| Task 4 | | | 18.0 | 30.0 | 48.0 | 8 | 6 | 8.0 |

Quantitative Network Analysis – Common Indicators

(Wassermann und Faust 1994, 2008, Knoke und Kulinski 2006)

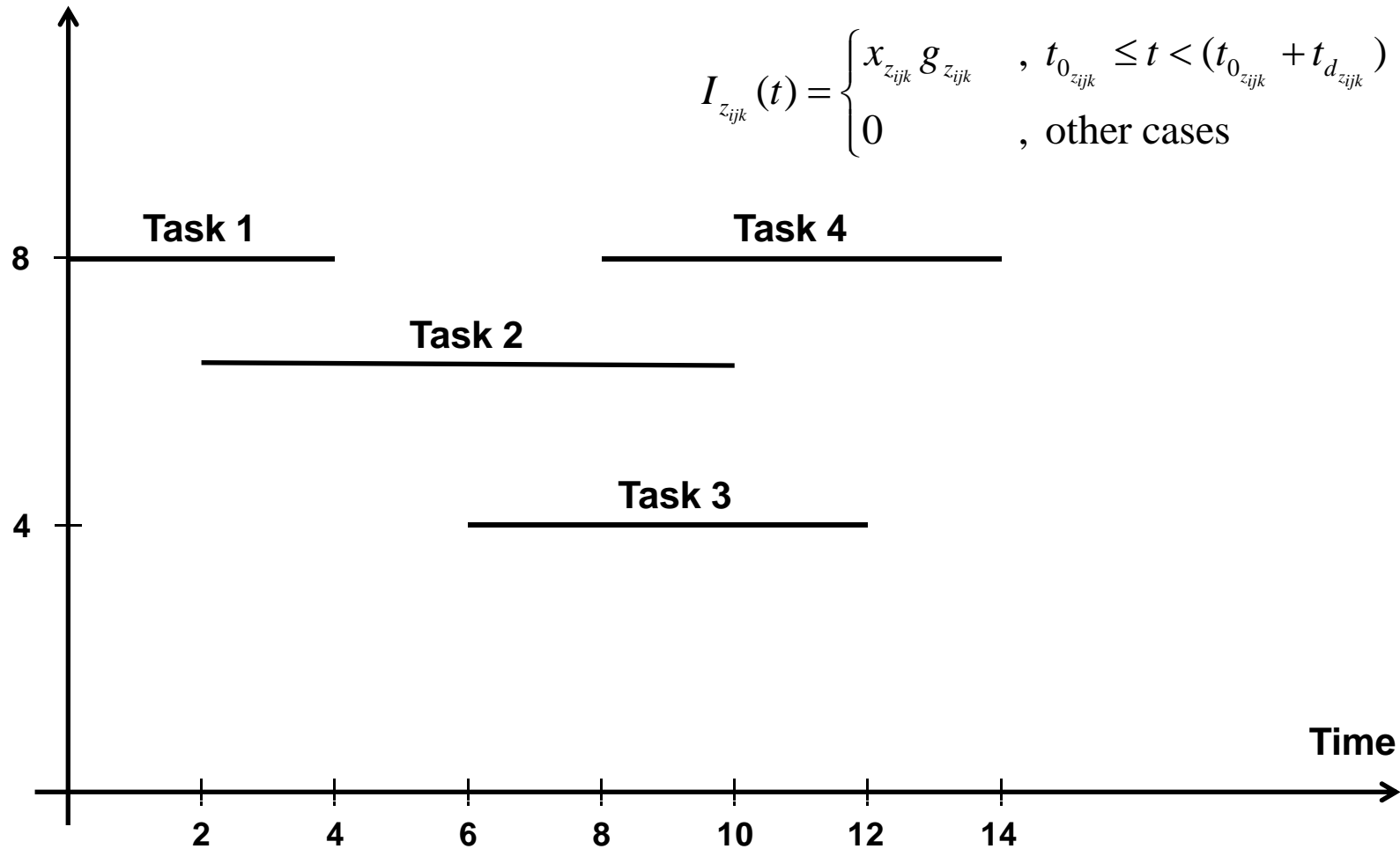
| | | | |
|--|--|-----|--|
| Outward Orientation (Rank 1998, Wald 2003,...) | $O_{Out_i} = \sum_{j=1}^N z_{ijk}, (i \neq j)$ | i | index of actor i |
| | | j | index of actor j |
| | | k | network k |
| | | N | total number of actors in a network k |
| Inward Orientation (Renz 1998, Rank 2003, Wald 2003, ...) | $O_{In_i} = \sum_{i=1}^N z_{ijk}, (i \neq j)$ | | |
| Network Density (Ellmann 2008) | $D_k = \frac{1}{N^2 - N} \cdot \sum_{i=1}^N \sum_{j=1}^N z_{ijk}, (i \neq j)$ | | |
| Network Centrality (Ellmann 2008) | $C_i = \frac{\sum_{j=1}^N (z_{ijk} + z_{jik})}{\sum_{i=1}^N \sum_{j=1}^N z_{ijk}}, (i \neq j)$ | | |

Additional Symbols to develop collaboration intensity indicator

| Symbol | Description |
|---|--|
| $\sum_{i=1}^N \sum_{j=1}^N z_{ijk}, (i \neq j)$ | Number of considered Interactions |
| z_{ijk} | interaction z (between the nodes i and j) of category k |
| $x_{z_{ijk}}$ | Collaboration intensity of interaction z_{ijk} |
| $t_{0_{z_{ijk}}}$ | Starting point (in time) for interaction z_{ijk} |
| $t_{d_{z_{ijk}}}$ | Continuity of interaction z_{ijk} |
| $g_{z_{ijk}}$ | Weighting factor of interactions z_{ijk} |
| $x_{z_{ijk}} g_{z_{ijk}}$ | Product of collaboration intensity and weighting factor of interaction z_{ijk} |
| $I_{z_{ijk}}(t)$ | Intensity of interaction z_{ijk} at point in time t |
| $C_{z_{ijk}}$ | Cost of interaction z_{ijk} during the duration $t_{d_{z_{ijk}}}$ of interaction |
| $c_{z_{ijk}}(t)$ | Cost of interaction z_{ijk} at point of time t |

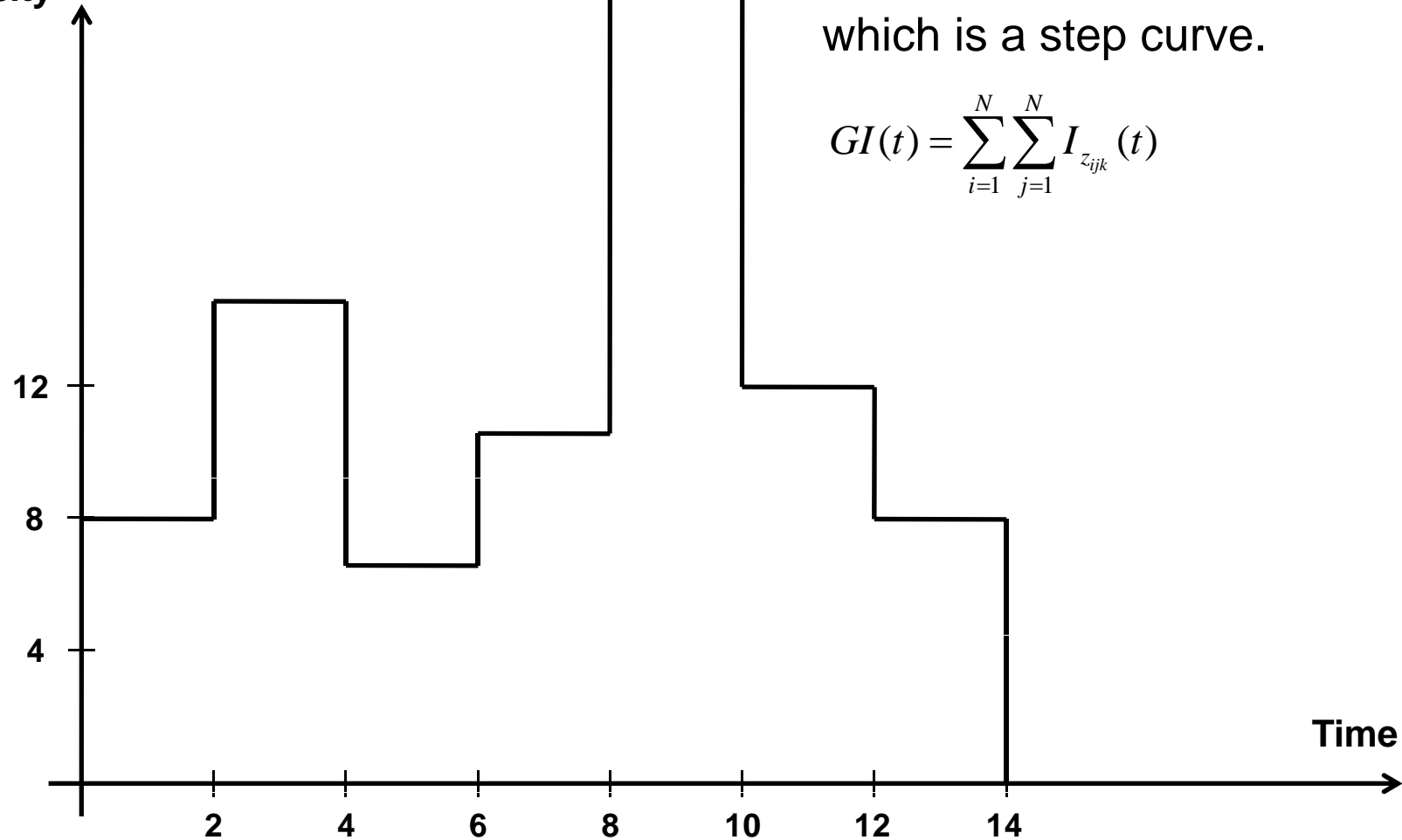
Collaboration Intensity – Example (3)

Intensity



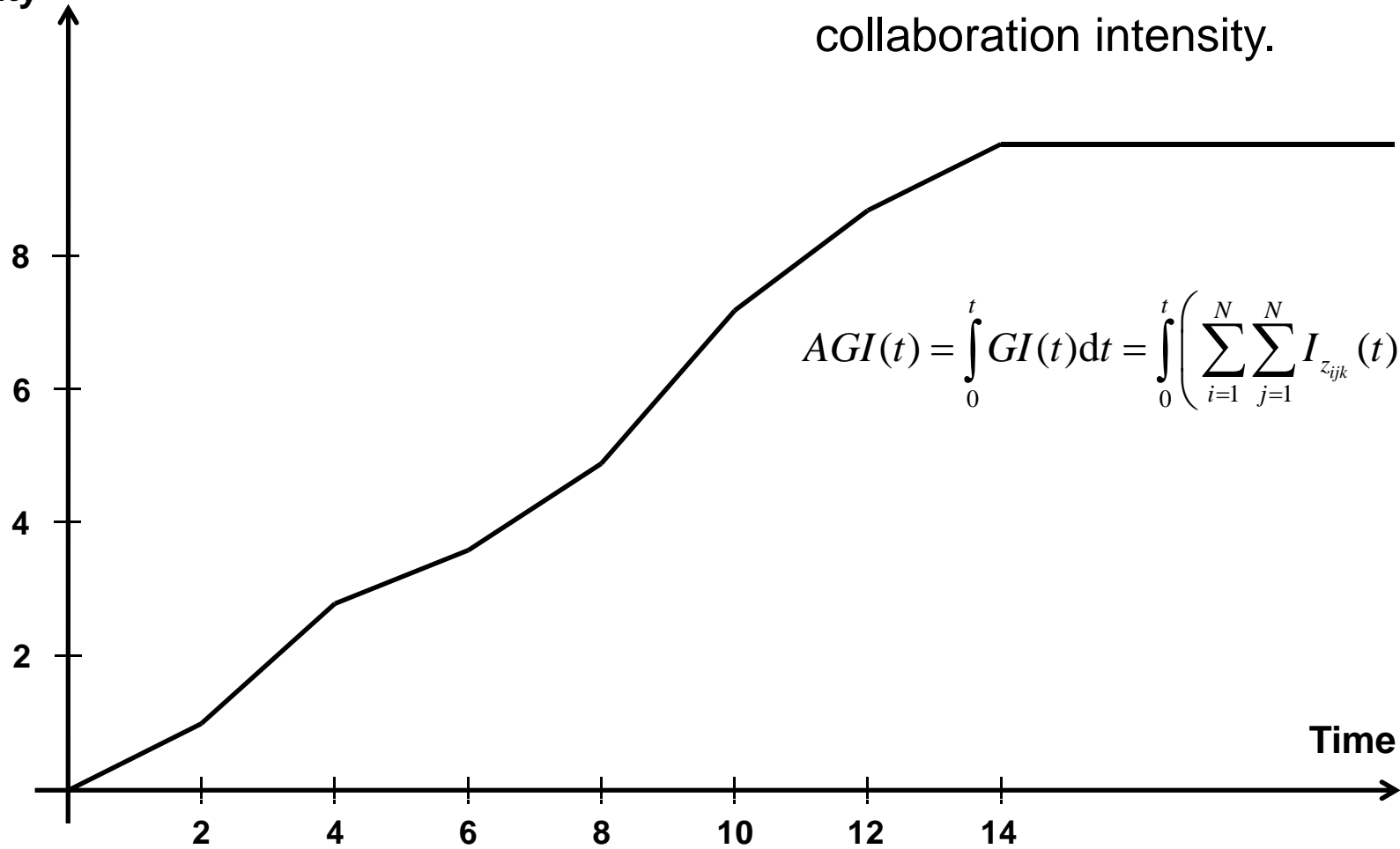
Collaboration Intensity – Example (4)

Accumulated Intensity

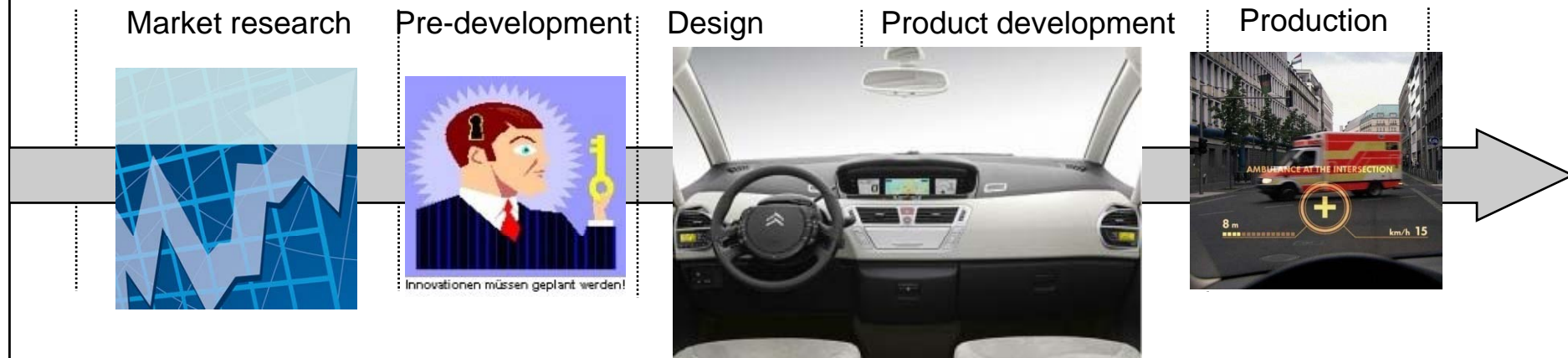


Collaboration Intensity – Example (5)

Accumulated Intensity



Example: Intelligent front mirror - revisited



The project **has been started without a collaborative network relationship analysis. Uncorrectly estimated work efforts in project management** led immediately to both cost increase and lead time delays.

Due to economic crises **innovation project is in hold position.**

The innovation project **budget has been substantially underestimated.**

Conclusions and future outlook

Methods to support a more practical, qualitative **analysis of collaborative network relationships are yet not available in mature state.**

Current Research is focussing on the application of mathematical, quantitative models. These models are often **very static and they also imply a concrete understanding of real processes** which probabaly remains difficult.

The ideas of an indicator for analyzing collaborative relationships on information's delivered by managers can be seen as an attempt to **combine analytical methods with qualitative information.**

First steps in case studies show that the **specification of collaboration intensities supports analytical thinking**

In a next step the authors will try to **formalize the collaborative network relationship analysis by applying graph theory and media-richness theory.**

Thank you for your attention!

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