TECHNISCHE UNIVERSITÄT CHEMNITZ

The Application of Incentive Mechanisms for the Participation of Enterprises in Collaborative Networks from an economic Perspective

Agenda

1. Motivation
2. Incentives in an Economic Environment
3. Insufficient Production Capacity
4. Lacking Financial Rewarding of an Order
5. A Framework-related Approach
6. Conclusions

Collaborative Network Management: The EVCM*-Approach

Objectives (selection)

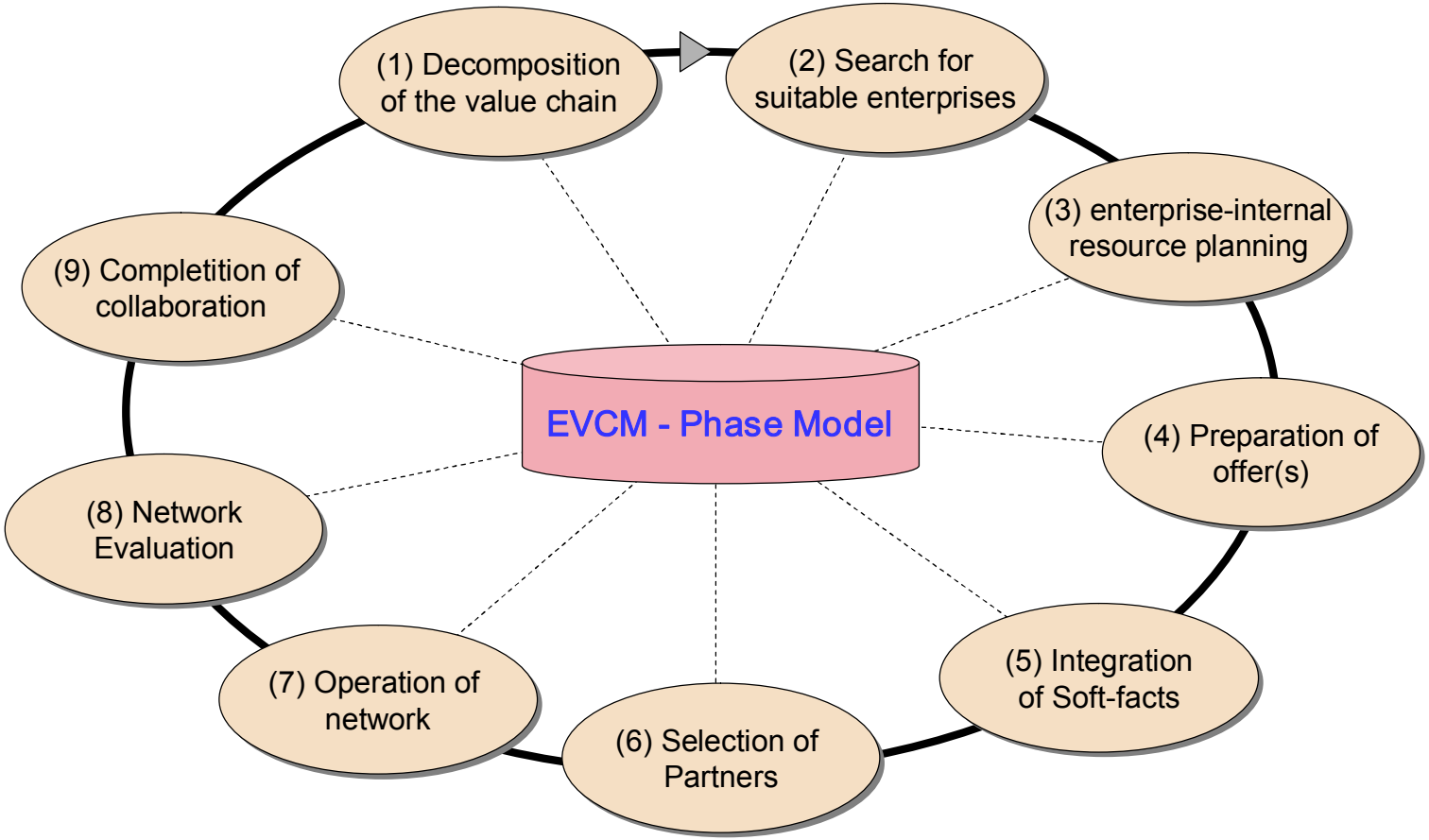
*"Extended Value Chain Management"

- central management instance of the network
- equal rights for all participants
- permanent satisfaction of costumers is aimed
- identification of customer oriented best solutions (price, delivery date) for sustainable success

Functions (selection)

- supply of suitable methods for the configuration and operation of SME-based collaborative production networks … "Phase Model"
- partner selection under consideration of hard- and soft-facts
- allocation of income / profit and comprehensive performance analysis

Process Organisation: The EVCM-Phase Model



process organization / workflow management

→ typical phases of the life cycle of a collaborative production network

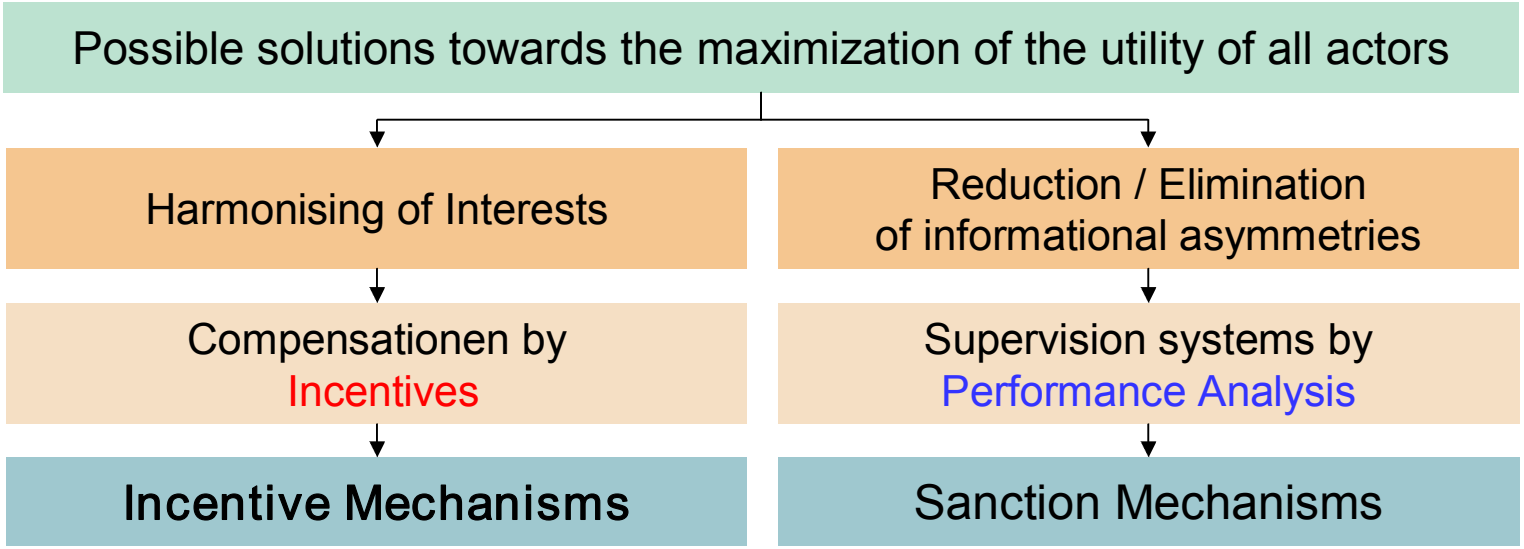
Theoretic Economic Framework

Behaviour Assumptions of the New Institutional Economics

- individual maximization of utility
- opportunistic behavior
- bounded rationality
- asymmetrical distribution of information

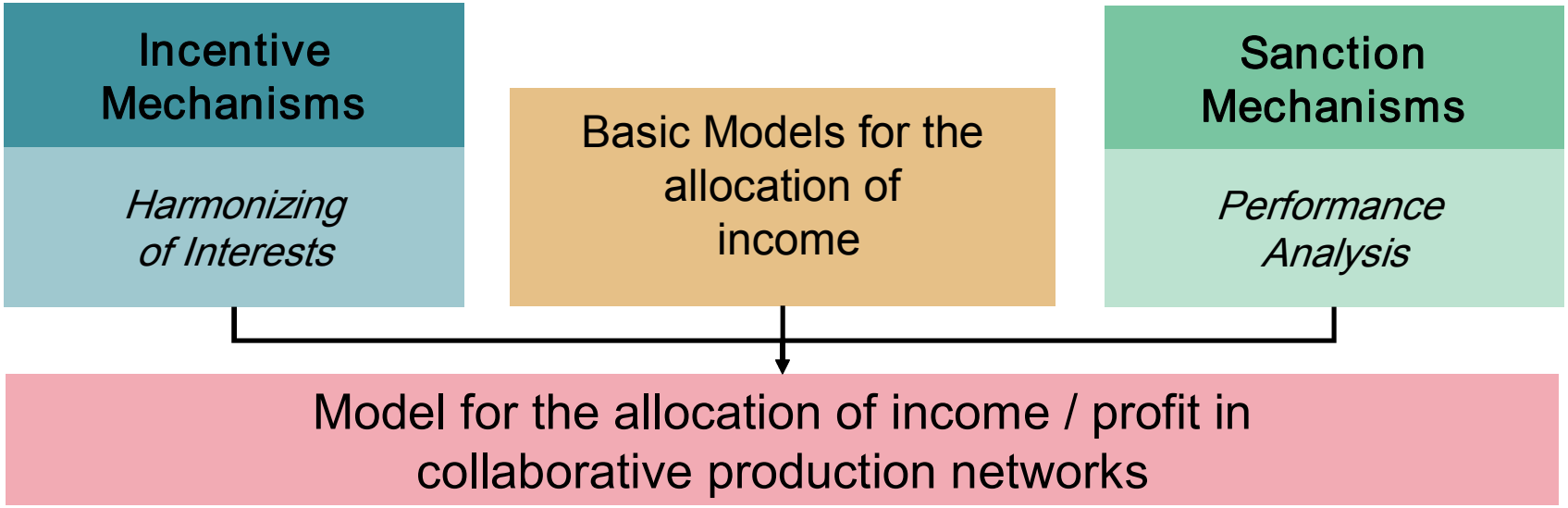
Problem: actors (enterprises) take advantage of the actual situation

Objective: maximization of the utility of all actors (participating enterprises)



Methodology and Objective(s)

- a fair allocation of income / profit
- integration of incentive and sanction mechanisms
- development of models
- combination of approaches
- application in praxis
- sustainable success



Incentive Mechanisms

Functions

- activation: stimulation of motivation and cognitive abilities
- controlling: influence of the agent‘s behaviour
- information: agents get signals regarding desirable behaviour
- selection: principals get information about agents‘ performance
- coordination: coordination of single sections of agents

Requirements

- economically justifiable
- incentives must be lower (or at least equal) to the expected profit
- considering the correct receiver
- payment of the correct amount (quantification of incentive)
- considering side-effects
- transparency
- performance oriented

Incentive mechanisms

Different initial situations, for example:

Incentives in case production capacity is not sufficient

- production capacity is not available according to the demand
- no offers by requested enterprises
- possibilities for the supply of necessary capacities

Incentives in case of a lacking financial attractiveness

- an enterprise is not willing to participate
- core competence is available in the static network
- attempt to convince (utility of net vs. utility of enterprise)

Incentive mechanisms I: Insufficient Production Capacity

Incentives in case production capacity is not sufficient

- non-participation of an enterprise (maximization of utility)
- required production capacity is not available / sufficient according to the demand
- no offer by requested enterprise is released
- (but) enterprise is the only to offer requested core competence
- suitable incentives for the “missing” enterprise need to be identified

→ problem: quantification of incentive payments

→ solution: searching for a suitable approach

Incentive mechanisms II: Insufficient Financial rewarding

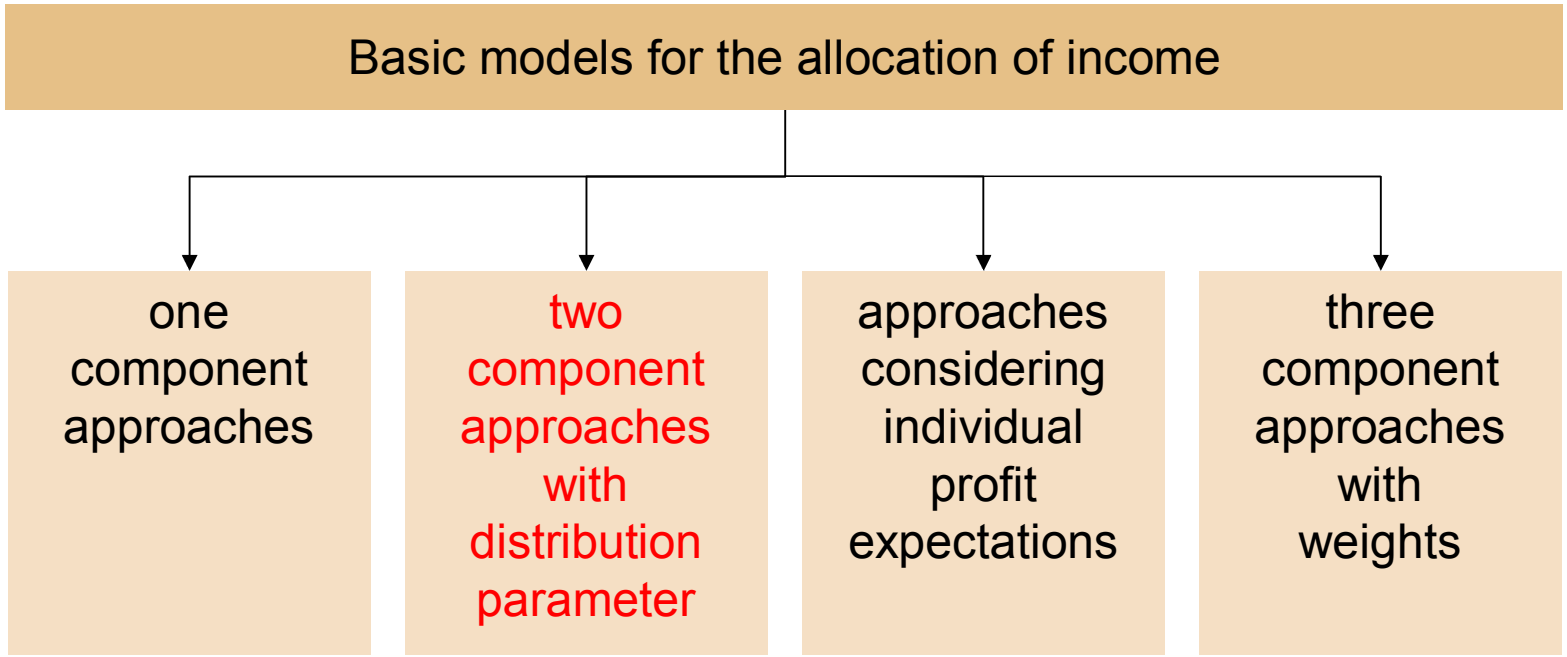
Incentives in case of a lacking financial rewarding

- an enterprise is not willing to participate
- reason: lacking financial rewarding (profit)
- process of determination of profit (preparation of the offer)
- core competence is available in the static network
- sufficient production capacities
- attempt to convince “missing” enterprise (utility of network vs. utility of enterprise)
- precondition: considering the consequences
- incentive payments according to the situation
- guaranteed profit share is not accepted
- quantification of expected profit share
- difference complies the necessary incentive payment
- granted amount depends on the approach for profit distribution

Different approaches for income allocation

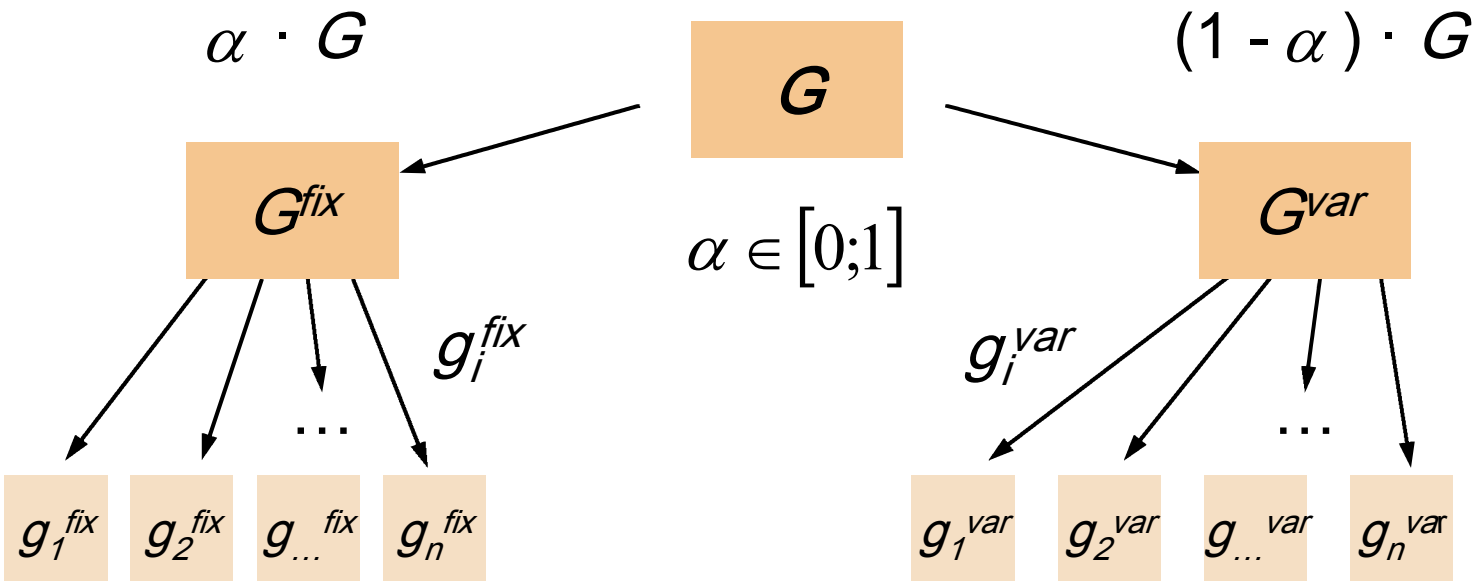
- different influence factors and different situations

→ different approaches for the allocation of income



Special scenario: allocation of losses

Two-component approaches with a distribution parameter



$$g_i^{fix} = \alpha \cdot \frac{G}{n} \quad + \quad g_i^{var} = (1-\alpha) \cdot G \cdot \frac{c_i}{C}$$

α : weights the profit distribution according to the share which is distributed fixed and variable

Assumptions

Calculation of individual profit shares

Basis: comprehensive calculation approach

a. incentive payment is integrated into allocation of income

b. profit share is based on a fixed and a variable share (see page before)

c. all incentive and profit payments are financed from the total profit of a value-added process

d. agreements considering a minimum guaranteed profit share allow a comprehensive calculation approach

→ minimum profit share consist of regular profit share and incentive payment, incentives are financed by all network members

Modeling / Conditions

Calculation of individual profit shares

Basis: comprehensive calculation approach considering a finite number of enterprises in collaboration while only one receives an incentive payment

→there are some conditions to consider:

(1) sum of profit shares is total of profit less incentives granted

$$\sum_{i=1}^{n} g_i = G - \sum_{j=1}^{n} a_i$$

(2) two-component approach for profit distribution

$$g_i = \alpha \cdot \frac{\sum_{j=1}^{n} g_i}{n} + (1-\alpha) \cdot \frac{c_i}{\sum_{j=1}^{n} c_i} \cdot \sum_{j=1}^{n} g_i$$

(3) consideration of a minimum guaranteed profit share $g_i^{min} = g_i + a_i - u_i$

(4) condition concerning slack variable and incentives $a_i \cdot u_i = 0$

→ 4 equations and 3 variables to calculate: a_i, g_i, u_i

Example

3 enterprises in a collaborative network

→ 5 variables to calculate:

a_i, g_1, g_2, g_3, u_i

with 6 equations:

$$(1) \quad \sum_{j=1}^{n} g_i = G - a_1$$

$$(2) \quad g_1 = \alpha \cdot \frac{\sum_{j=1}^{n} g_i}{n} + (1-\alpha) \cdot \frac{c_1}{\sum_{j=1}^{n} c_i} \cdot \sum_{j=1}^{n} g_i$$

$$(3) \quad g_2 = \alpha \cdot \frac{\sum_{j=1}^{n} g_i}{n} + (1-\alpha) \cdot \frac{c_2}{\sum_{j=1}^{n} c_i} \cdot \sum_{j=1}^{n} g_i$$

$$(4) \quad g_3 = \alpha \cdot \frac{\sum_{j=1}^{n} g_i}{n} + (1-\alpha) \cdot \frac{c_3}{\sum_{j=1}^{n} c_i} \cdot \sum_{j=1}^{n} g_i$$

$$(5) \quad g_1^{min} = g_1 + a_1 - u_1$$

$$(6) \quad a_1 \cdot u_1 = 0$$

Example

Result (after several calculation steps)

→ equation for the calculation of the incentive

$$a_1 = \frac{G \cdot \left(\frac{\alpha}{n} + (1-\alpha) \cdot \frac{c_1}{\sum_{j=1}^{n} c_i}\right) - g_1^{min}}{\frac{\alpha}{n} + (1-\alpha) \cdot \frac{c_1}{\sum_{j=1}^{n} c_i} - 1}$$

Basis: only enterprise one is an incentive payment granted

In case of more enterprises in the network the number of equations rises.

The model gets more complex but is still solvable.

Conclusions

Problems to be solved:

- distribution of loss
- decision support for profit distribution approaches
- calculation of distribution parameter α
- incentive mechanisms
- extended modeling of evaluation functions
- contribution to sustainable success

Future works:

- empirical research
- validation of assumptions
- information-technical implementation
- practical application

THANK YOU
FOR YOUR ATTENTION

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