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Coping with the challenges of a heterogeneous PSS working context – a unique configuration of individual competencies for PSS workers

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Heterogeneity-coping in PSS:
agenda of the presentation

- relevance and motivation of the research aim
- understanding of the heterogeneity construct and classification of PSS built-in-heterogeneity
- definition and operationalization of competence
- empirical design, data collection and evaluation
- findings and interpretations

Heterogeneity-coping in PSS:
relevance and motivation of the research aim

Positive effects on performance – value in heterogeneity perspective

(e.g. Hoffman & Maier, 1961; Jehn, Northcraft & Neale, 1999)

Innovative and creative solutions, enhanced responsiveness and flexibility for dynamic requirement adjustments

Negative effects on performance – costs and inevitabilities of heterogeneity

(*e.g., O'Reilly & Flatt, 1989; Pelled, 1996*)

Conflict and destructive slack arising from perceived differences, misunderstandings and ineffective communication

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Innovative and creative solutions, enhanced responsiveness and flexibility for dynamic requirement adjustments

- Heterogeneity is becoming a conditional influence on work performance and organizational output with positive and negative effects at the same time (Van Knippenberg & Schippers, 2007)
- The heterogeneous working context itself is creating a complex coping challenge for PSS workers (Oliva & Kallenberg, 2003; Martinez, 2010; Ulaga & Reinartz, 2011)
- A lack of capabilities to handle the complexity of PSS may be one of the reasons why a relatively high ratio of PSS managers reports, that their offering does not meet expected economic results (Servadio & Nordin, 2012)

Negative effects on performance – costs and inevitabilities of heterogeneity

(*e.g., O'Reilly & Flatt, 1989; Pelled, 1996*)

Conflict and destructive slack arising from perceived differences, misunderstandings and ineffective communication

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Innovative and creative solutions, enhanced responsiveness and flexibility for dynamic requirement adjustments

How do PSS workers cope with the challenges of the heterogenous PSS working context?

a) What configuration of individual competencies can be observed for PSS workers?

b) How can this competence configuration be interpreted for maximizing the benefits and minimizing the negative effects of PSS built-in-heterogeneity?

Negative effects on performance – costs and inevitabilities of heterogeneity

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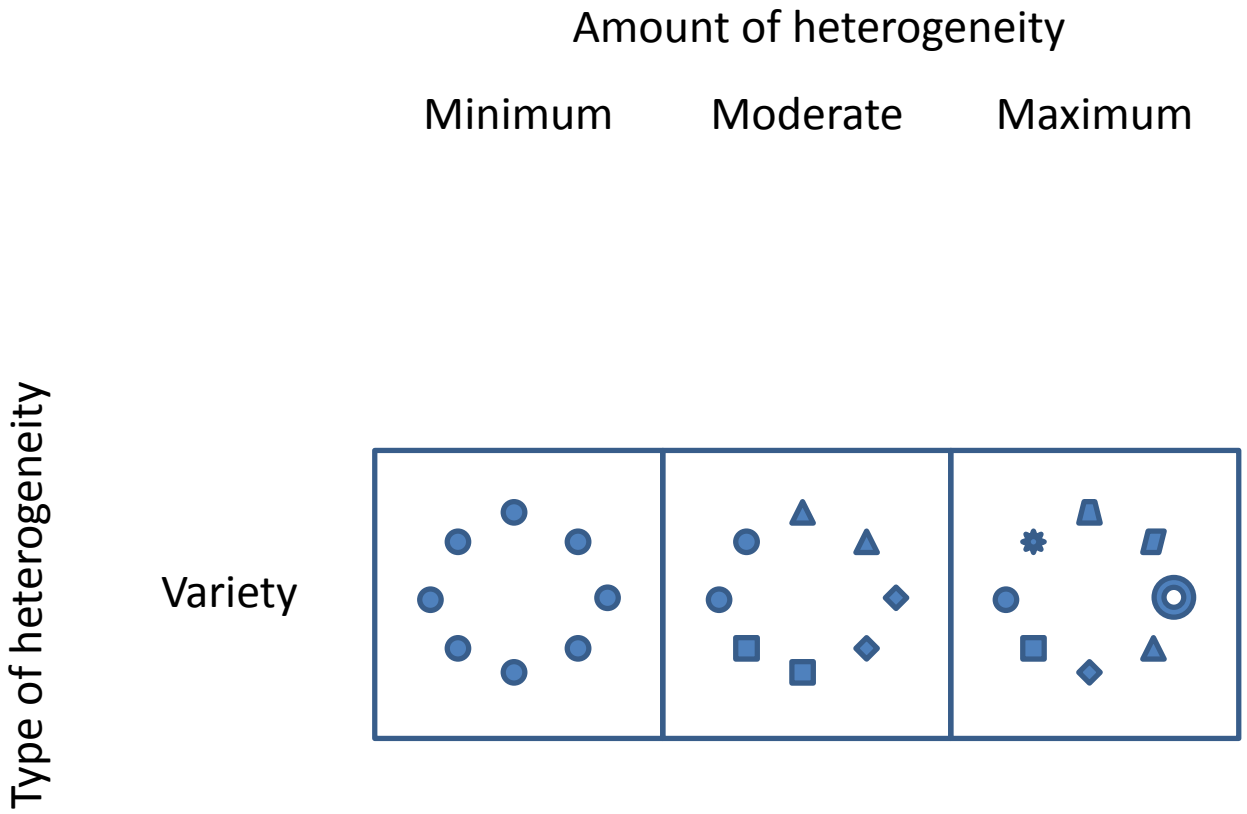
Conflict and destructive slack arising from perceived differences, misunderstandings and ineffective communication

Specifying the heterogeneity construct:
types and amounts of heterogeneity



Source: figure adopted from Harrison & Klein (2007, p. 7)

Specifying the heterogeneity construct:
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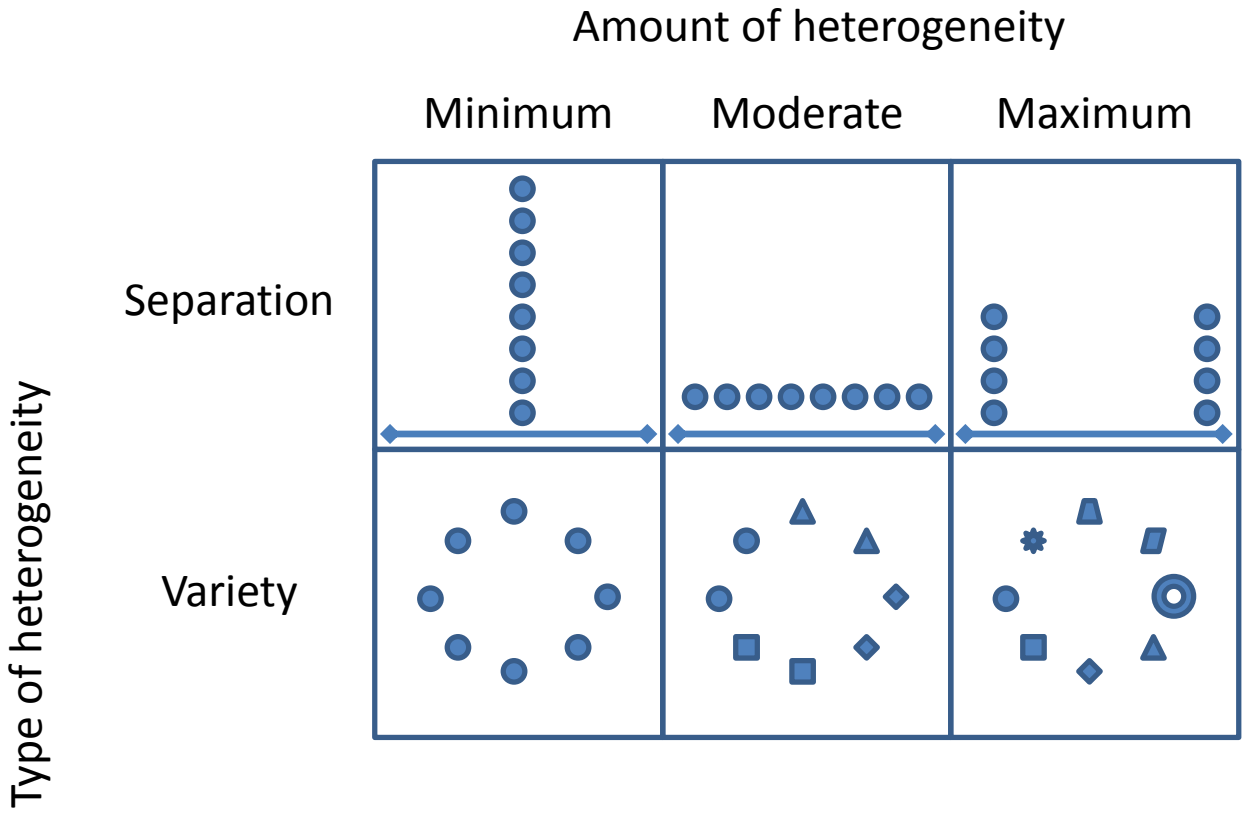

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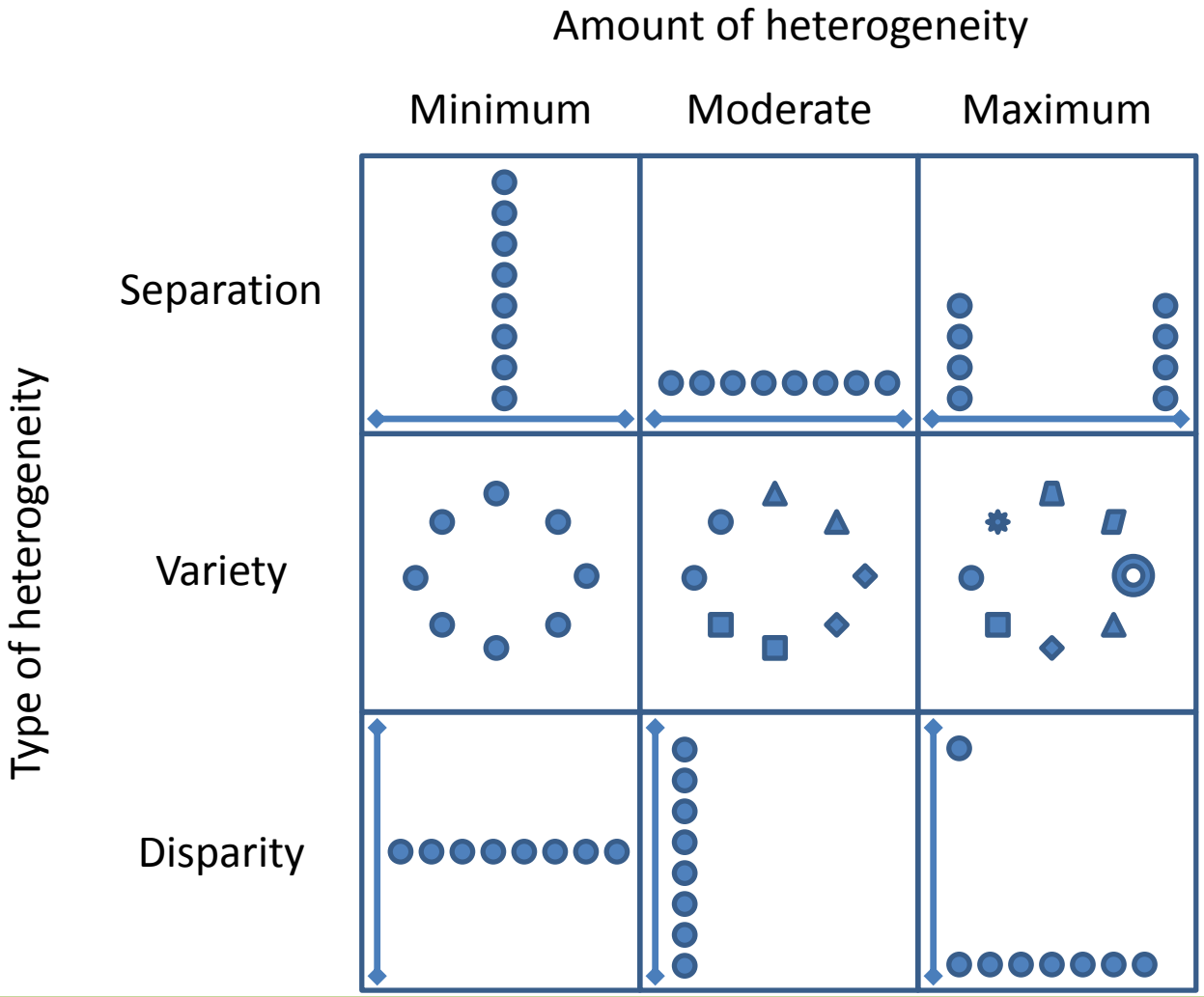

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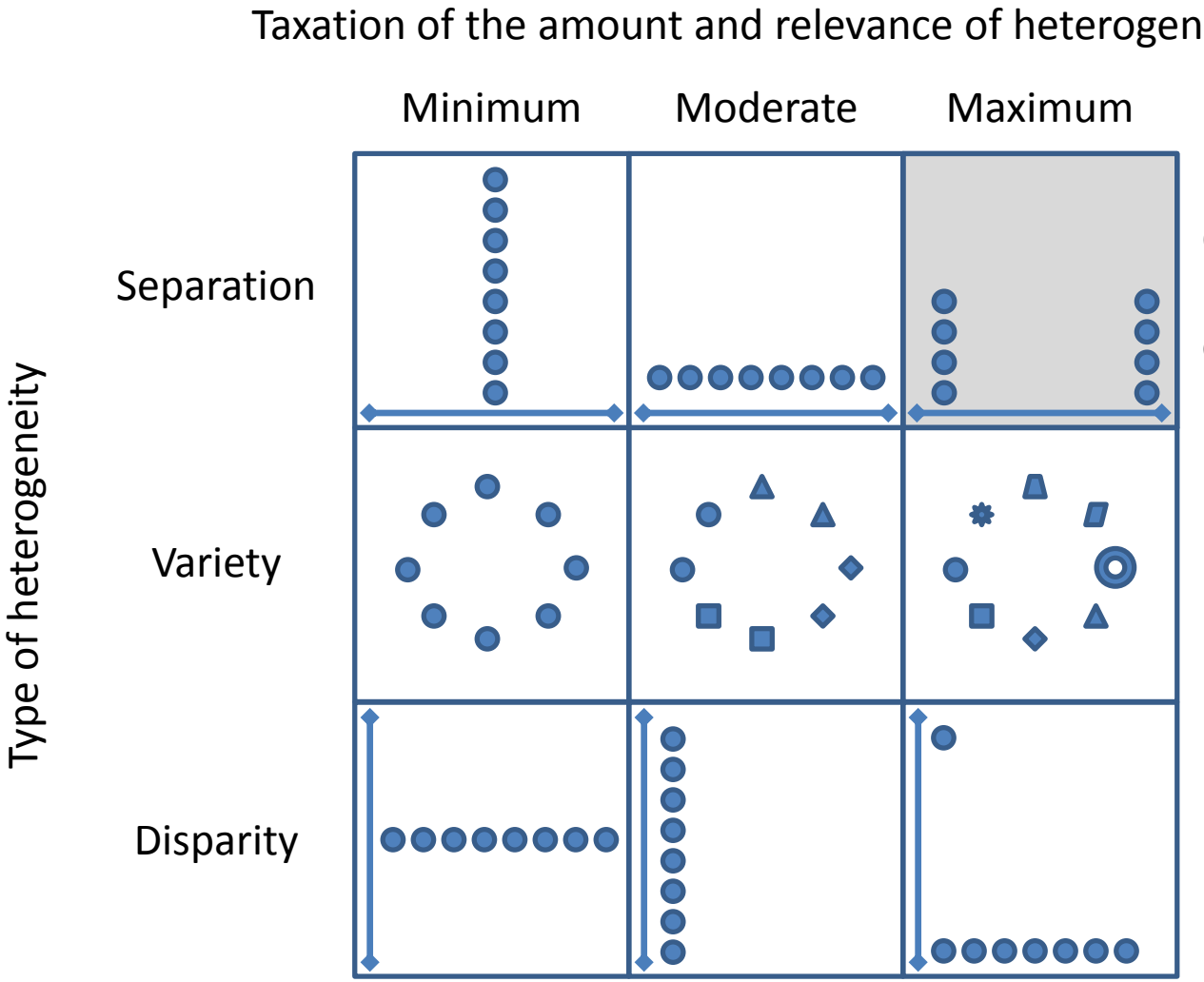
Classifying PSS built-in-heterogeneity:

types, amounts and meanings with references to PSS



differences in the ways and mentalities/images of organizing (GD vs SD logic)

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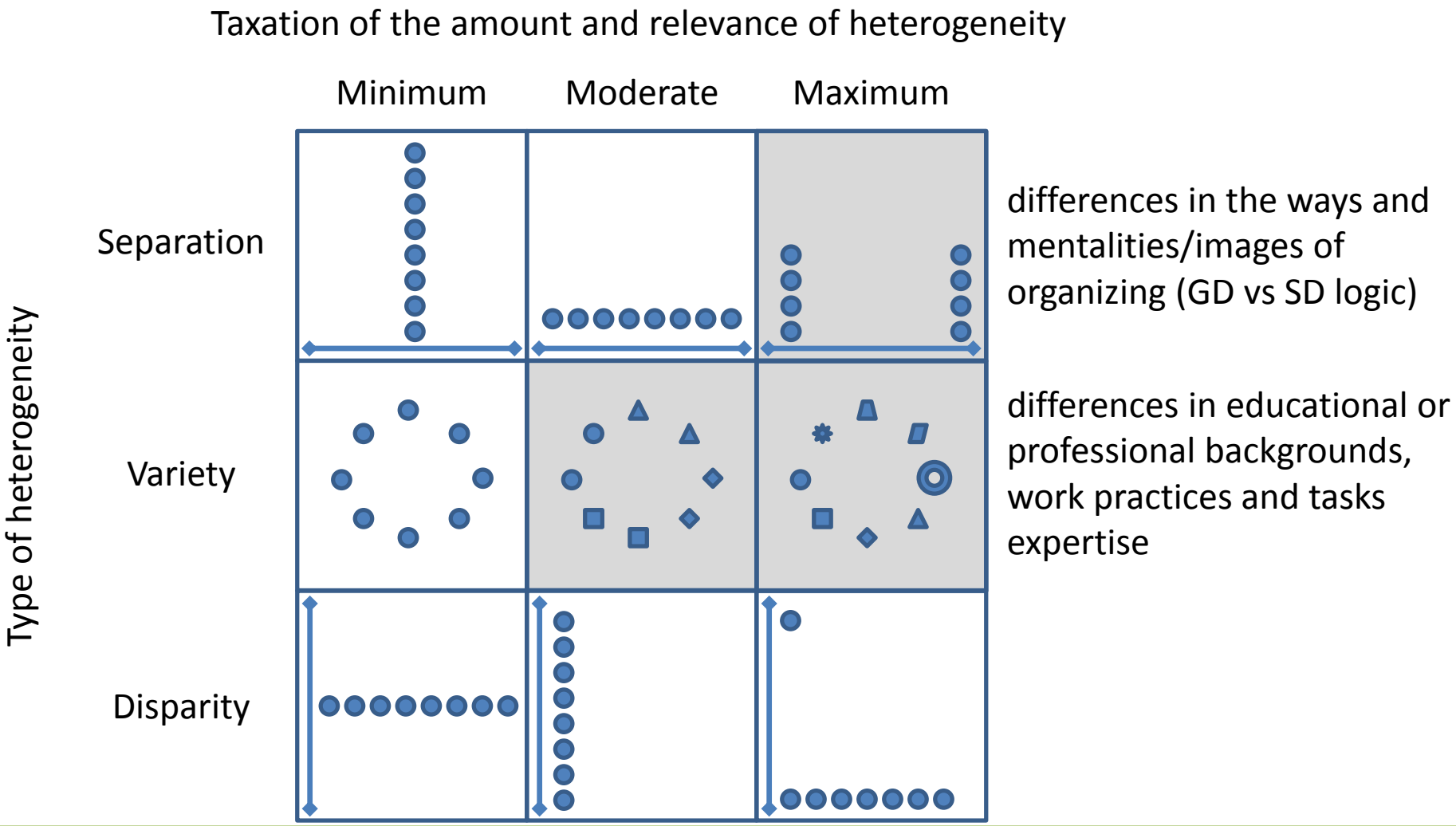

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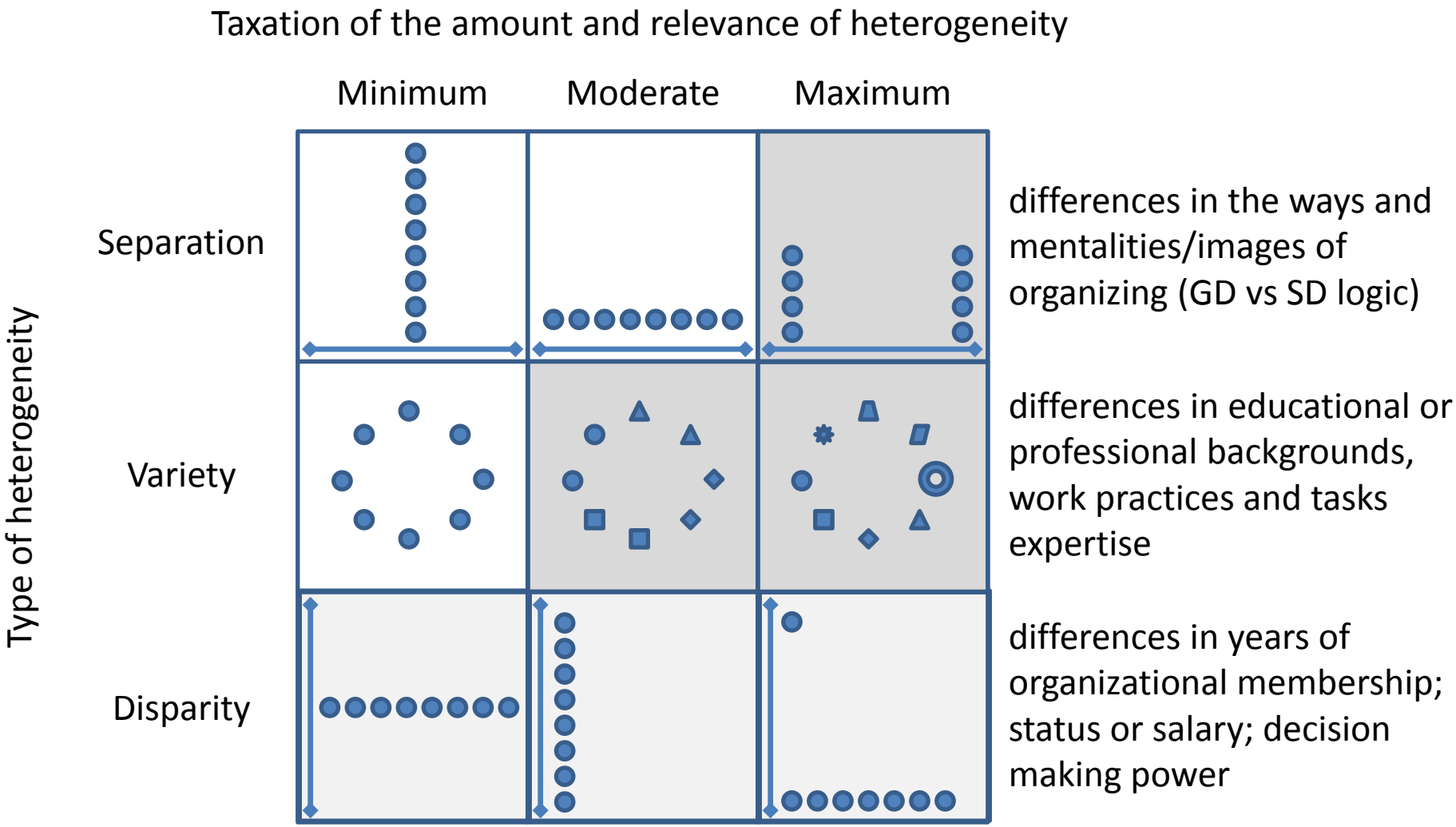

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Reminder of the research aim:

Relating competencies to PSS built-in-heterogeneity

Amount of heterogeneity

Type of heterogeneity

How do PSS workers cope with the challenges of the heterogenous PSS working context?

a) What configuration of individual competencies can be observed for PSS workers?

b) How can this competence configuration be interpreted for maximizing the benefits and minimizing the negative effects of PSS built-in-heterogeneity?

differences in the ways and mentalities/images of organizing (GD vs SD logic)

differences in educational or professional backgrounds, work practices and tasks expertise

differences in years of organizational membership; status or salary; decision making power

Source: figure adopted from Harrison & Klein (2007, p. 7)

What defines competence in this study?

general dimensions

Behavioral representation of cognitive, work related **problem-solving processes** under influences of complexity, uncertainty and heterogeneity + cognitive attributions of an individual **contribution to higher future outcomes**.

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Behavioral representation of cognitive, work related **problem-solving processes** under influences of complexity, uncertainty and heterogeneity + cognitive attributions of an individual **contribution to higher future outcomes**.

Coping with complexity

Perceiving and processing of information / use related filtering

Combination

Applying established knowledge bases to various problem solving context / recombining knowledge

(Self-) Reflection

Testing and evaluating established process & routines / searching and utilizing external feedback

Cooperation

Designing and sustaining cooperations with others to extend scope of actions

What defines competence in this study?

Applied operationalization of competencies

Standardized scale of individual cognition, action and interaction (Wilkens & Gröschke, 2008)

7-step Likert-scale –

I totally agree … I totally disagree

Complexity	I find it easy to filter the relevant information from a great variety of information.
Combination	I succeed in transferring my existing knowledge to novel problems.
Self Reflection	For my continuous development, I actively ask others for feedback.
Cooperation	I am well able to discuss problems with people from outside of my division.
Optimistic vision	I expect the best in uncertain situations at work.

Data collection and evaluation

- online-based survey among German engineers from summer 2012 to spring 2013 - return of 172 valid questionnaires
- Identification of participants with respect to organizational offering indicating work system characteristics (Süße et al., 2013)
- Exploratory principle component factor analysis of competence items

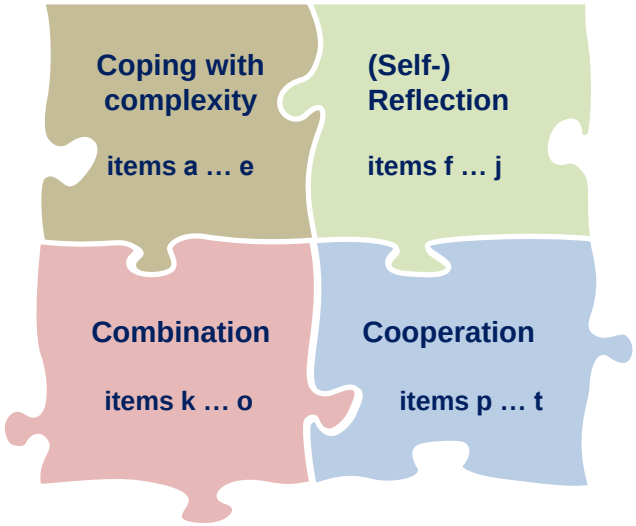
Type of work system	IPS²
Number of items	33
KMO (Kaiser-Meyer-Olkin)	0.770
Variance explained (5-step Varimax rotation)	0.662
Communalities range	0.326 – 0.886

- Interpretation of factor solution
  - Understanding of over-all-aim (content) of each competence bundling in the context of PSS work demands
  - Understanding the possible aims of competence bundlings for balancing positive and negative effects in the context of PSS built-in-heterogeneity

Findings:

What configuration of individual competencies can be observed?

Uncontextualized dimensions of individual competencies for dynamic and complex work contexts



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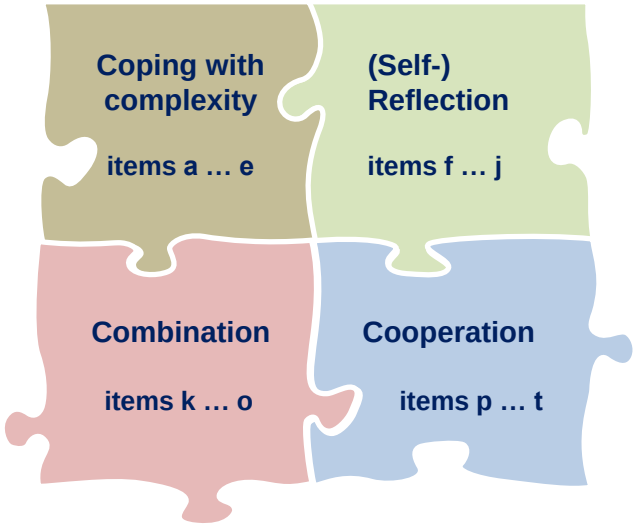
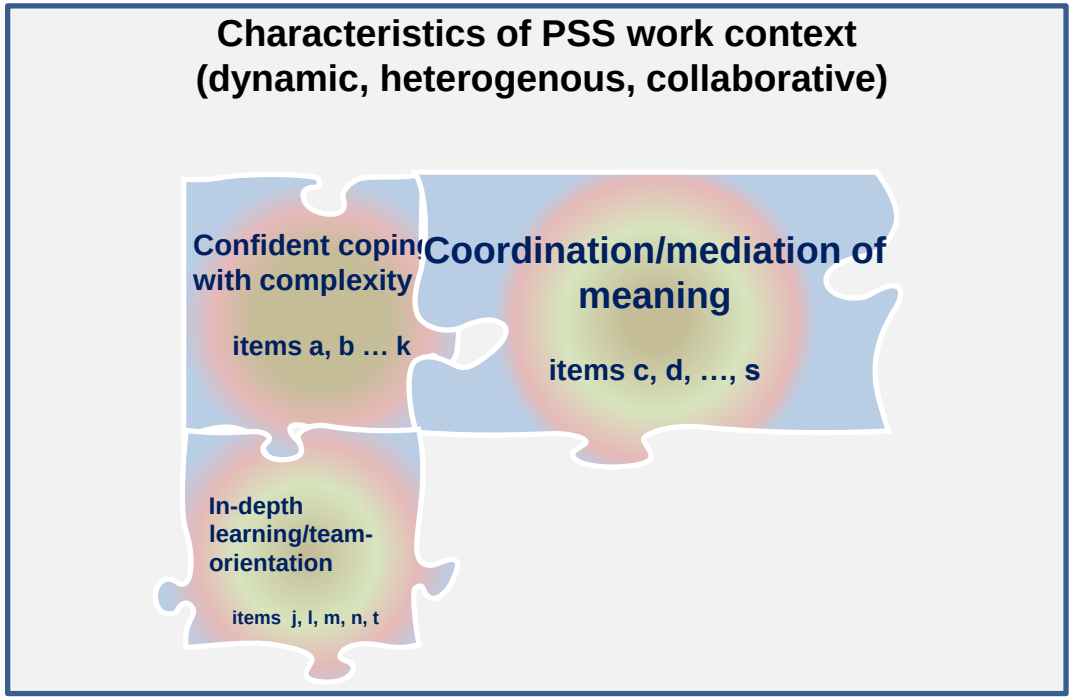


Contextualized reconfiguration of competencies for PSS



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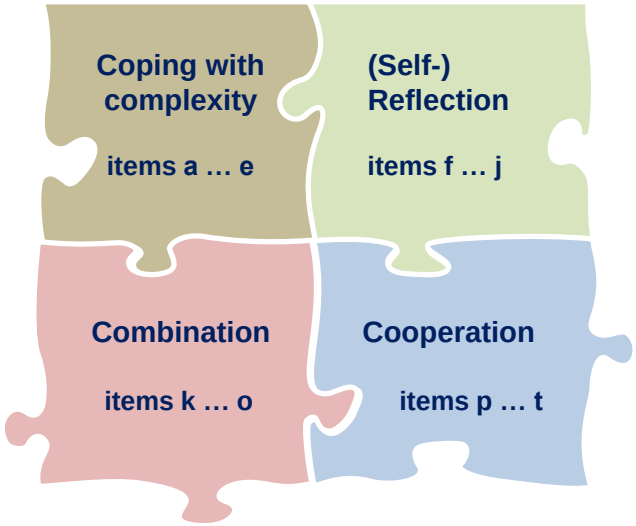

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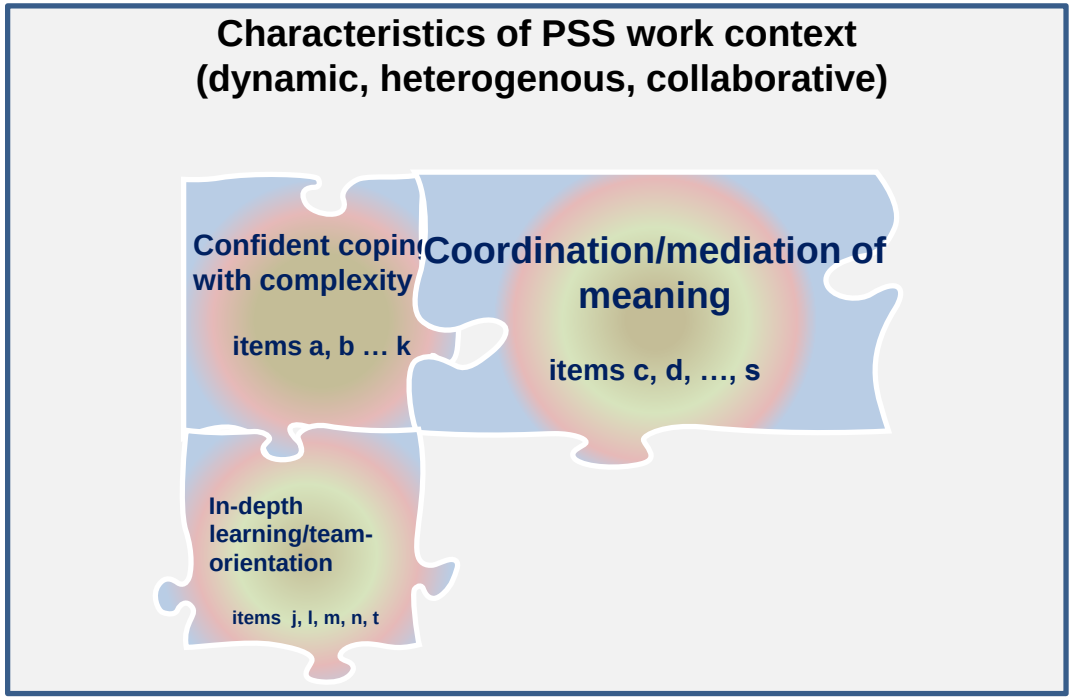
Contextualized reconfiguration of competencies for PSS



In PSS these competence dimensions are higher than in compared fields of production and service.

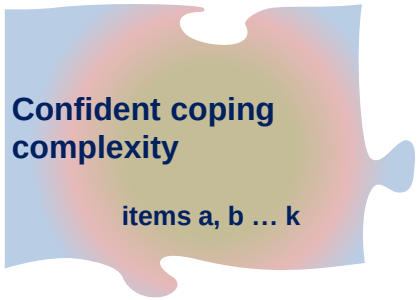
Despite significantly higher mental work load there is no significant increase of perceived work stress.

Findings:

What configuration of individual competencies can be observed?

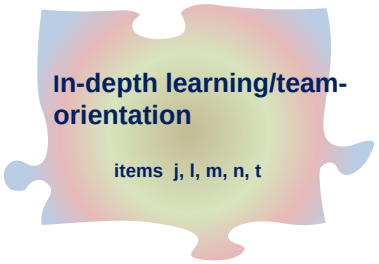
15 items (factor loadings 0.400 – 0.683)
activities for new problem-solving approaches based on the combination and implementation of established work-based experiences paired with a high level of self-reflection:

- ‘For my continuous development, I actively ask others for feedback’
- ‘I am well able to adapt to various people and to work with them’



7 items (factor loadings 0,345 und 0,886)
activities that are aimed at filtering relevant information especially with regard to noticing risks and chances of innovation and organizational renewal within a generally high mode of optimism:

- ‘While processing extensive problems, I consistently evaluate how well I am doing’
- ‘I feel confident to contribute to corporate strategy with my expertise’

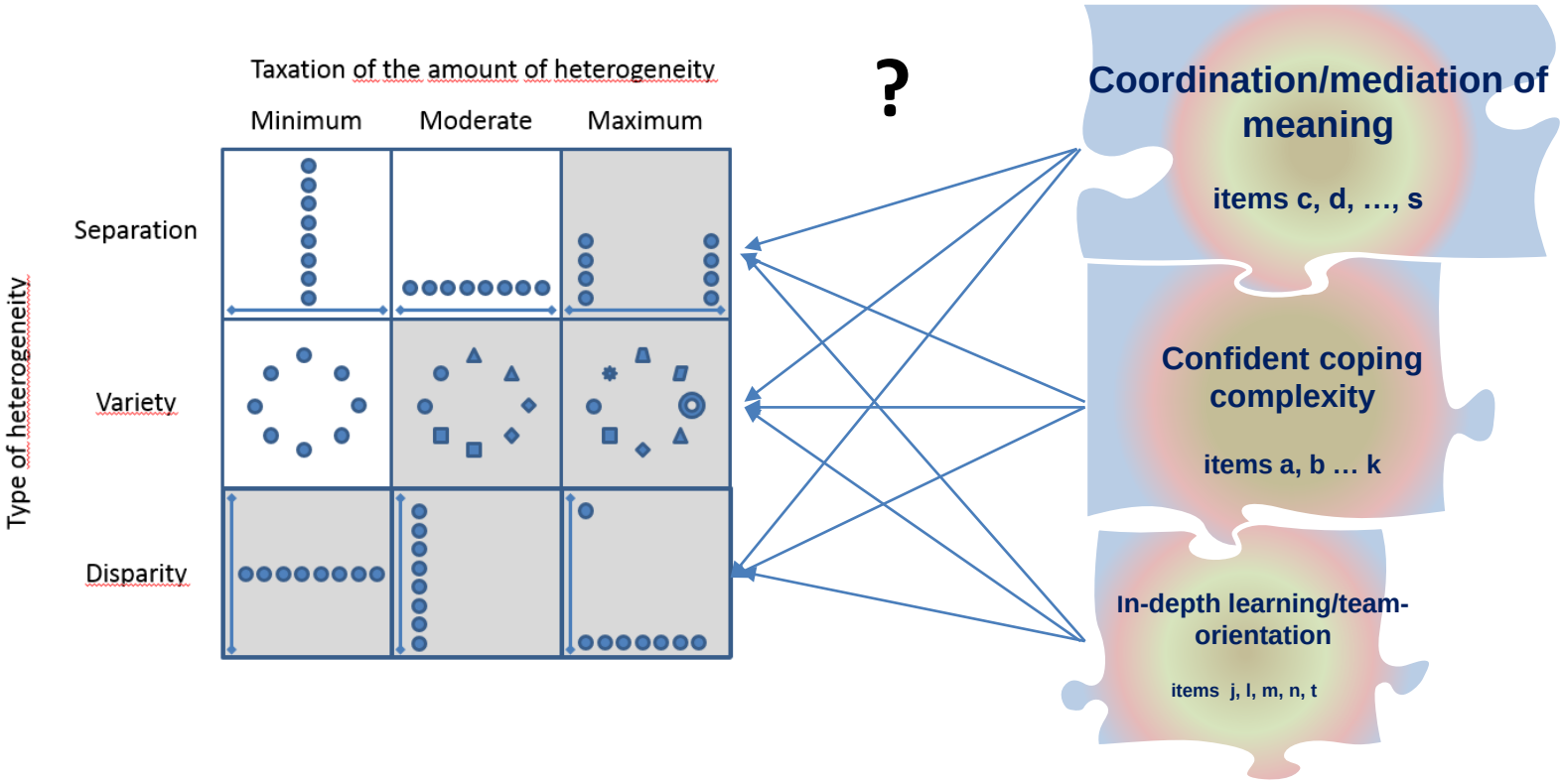


4 items (factor loadings 0.325 – 0.664)
activities that allow to utilize external knowledge and best practices paired with the ability to break with established routines within a generally high aim at improving:

- ‘I always try to learn from others in my daily work’
- ‘I find it easy to ask others for help if problems arise’

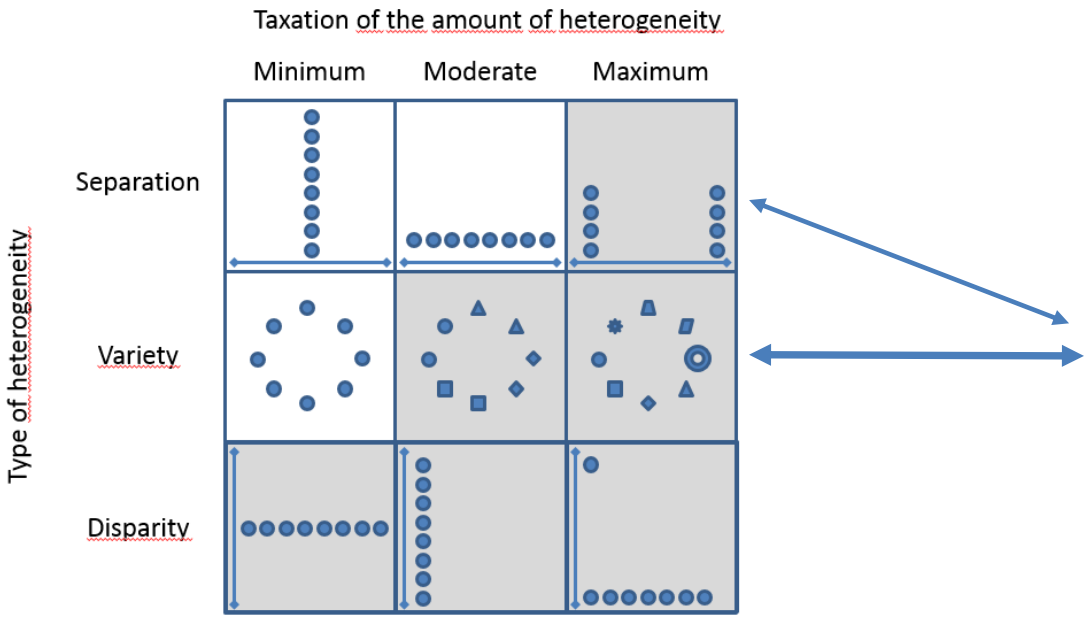
Reminder of the research aim:

Relating competencies to PSS built-in-heterogeneity



Relating PSS built-in-heterogeneity to:

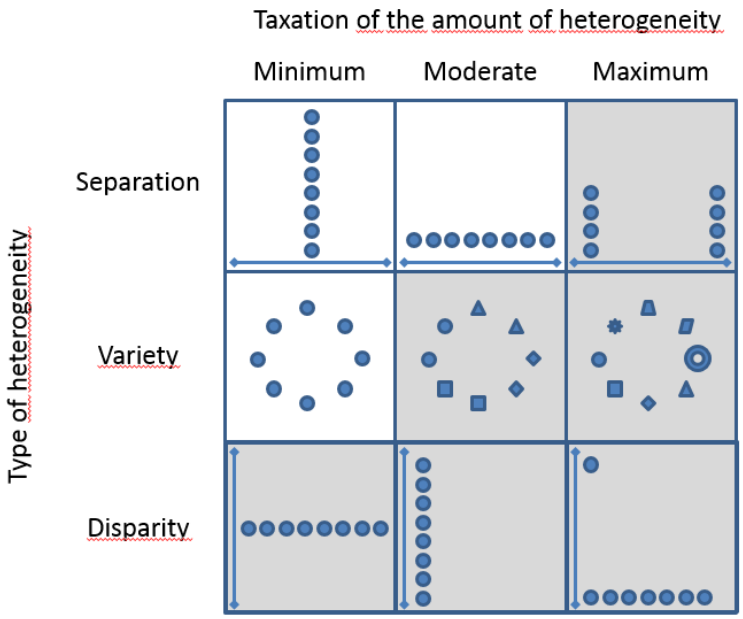
coordination/mediation of meaning



I find it difficult to plan and schedule tasks.	-,463
For my continuous development, I actively ask others for feedback.	,414
Consistently, I take time to think about how I can improve my way of working.	,453
I often use creative methods for developing new problem solutions.	,683
I am good at getting my ideas across to others.	,649
I am able to put myself in someone else's position.	,478
In conflict situations, I am able to arrive at a mutual solution.	,411
I am well able to adapt to various people and to work with them.	,673
I feel obliged to keep a promise.	,446
I approach others about promised support.	,635
I am well able to discuss problems with people from outside of my division.	,400
I get my ideas across to others easily.	,589
I find it easy to build strong working bonds with others.	,628
I succeed in transferring my existing knowledge to novel problems.	,616

Relating PSS built-in-heterogeneity to:

coordination/mediation of meaning



Enables the productive integration of different underlying ways of organizing for enhanced creativity, innovative problem-solving and higher decision-making quality.

Enabling the effective interaction and learning of actors built on utilizing a broad scope of professional backgrounds, work practices and task experiences.

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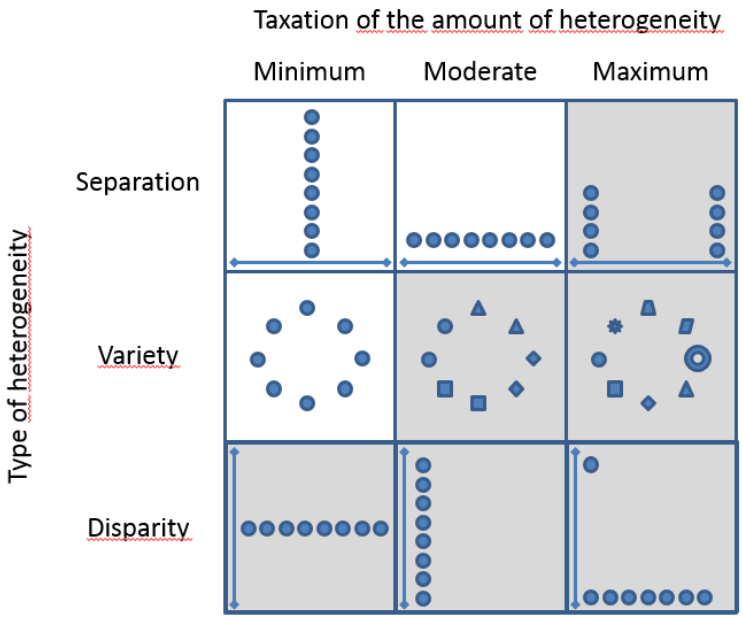
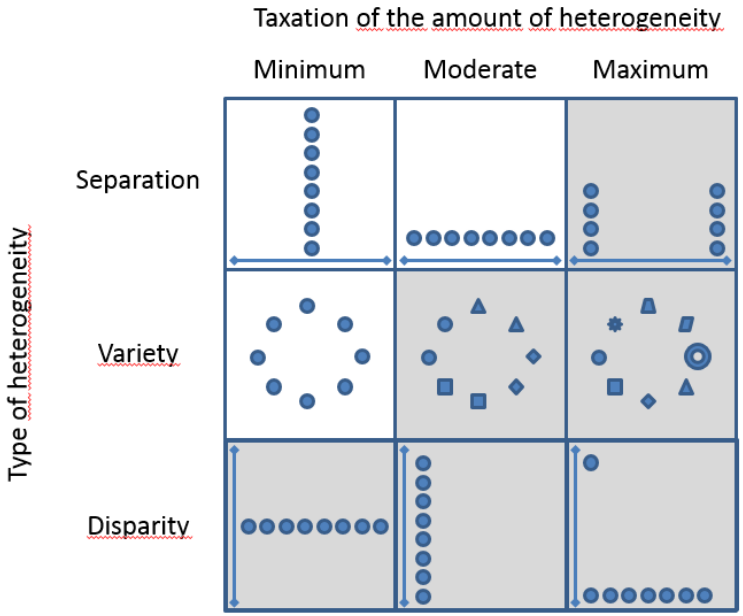


Positive heterogeneity-dynamics are utilized for improved and creative problem-solving approaches.

Negative effects are absorbed by a positive heterogeneity mind-set and specific conflict resolution behaviours.

Relating PSS built-in-heterogeneity to:

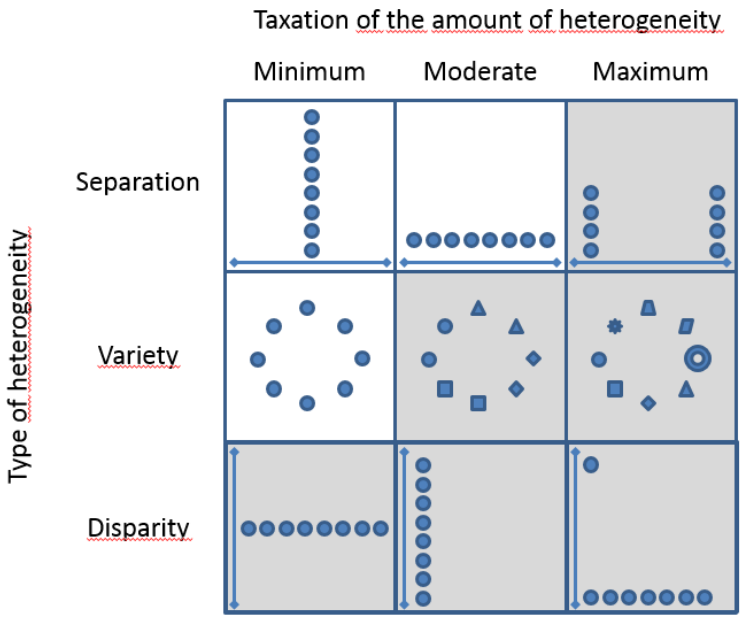
confident coping with complexity



While processing extensive problems, I consistently evaluate how well I am doing.
I find it difficult to filter the relevant information from a great variety of information.
I expect the best in uncertain situations at work.
I emphasize the positive side in professional difficulties.
I am optimistic concerning my future career perspectives.
I feel confident to contribute to corporate strategy with my expertise.

Relating PSS built-in-heterogeneity to:

confident coping with complexity



Establishing and pertaining a positive mindset, even in uncertain and complex situations

Filtering relevant information and constantly reflecting on own performance

blems, I am doing.
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Relating PSS built-in-heterogeneity to:

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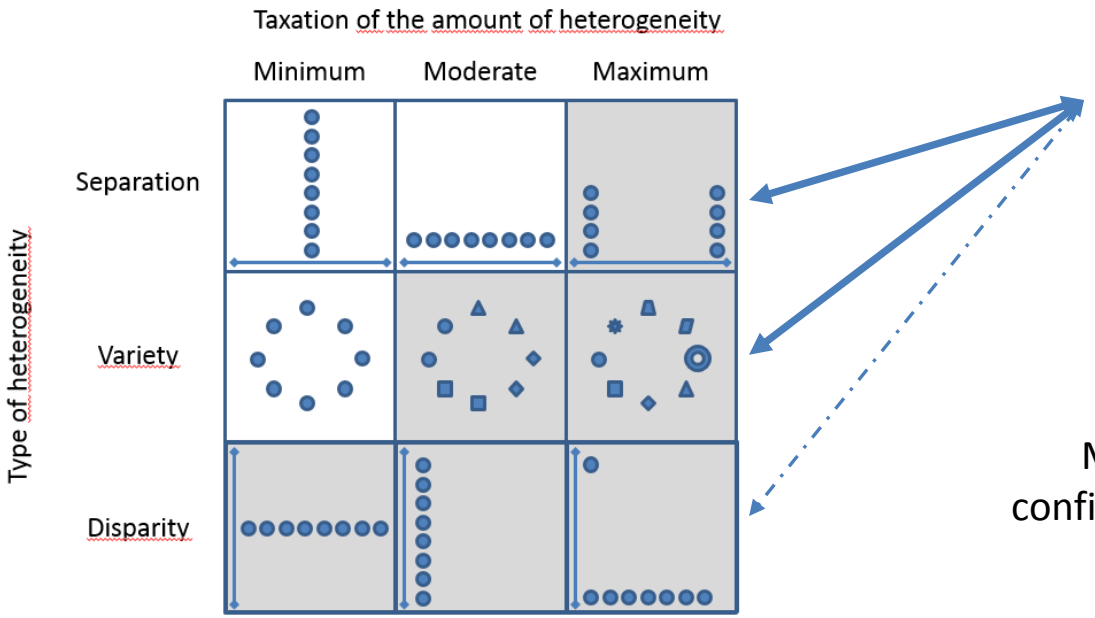
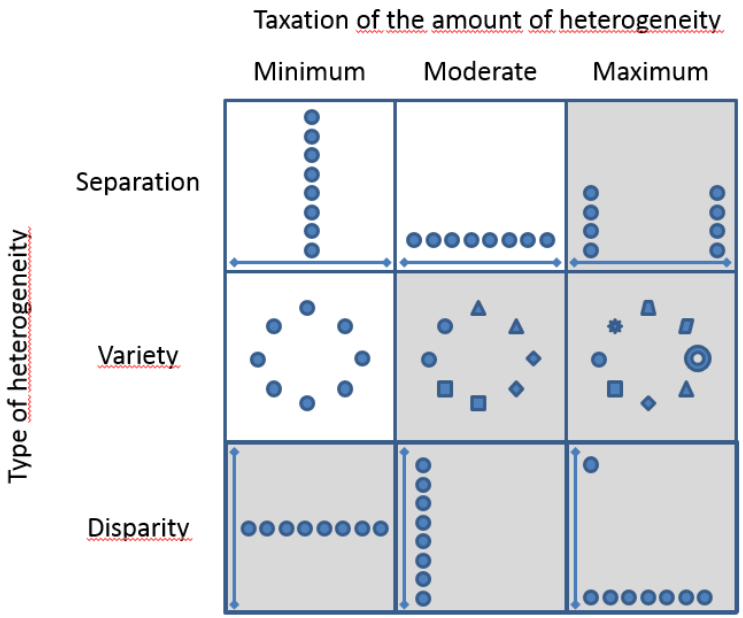


Minimizing negative effects due to a confident mind-set for coping with potential conflicts and risks.

Utilizing positive heterogeneity effects through an optimistic and selective information management while integrating it into an active learning process.

Relating PSS built-in-heterogeneity to:

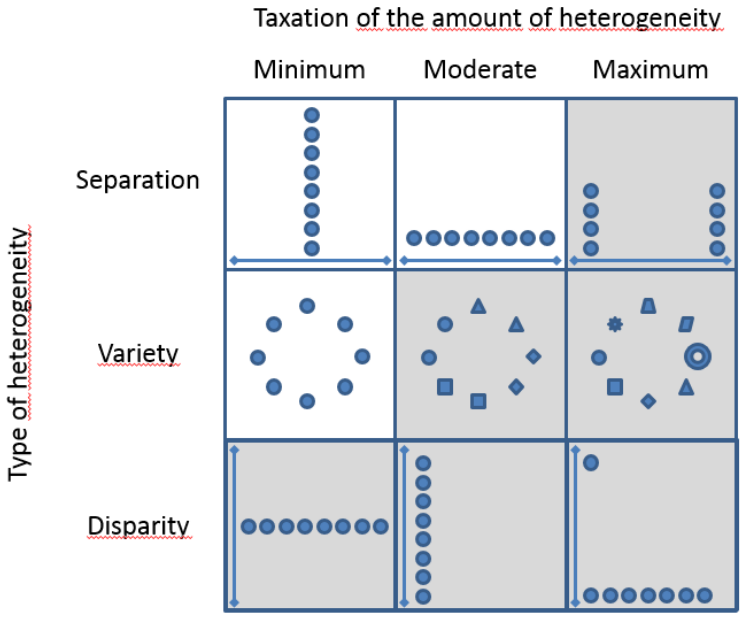
in-depth learning/team orientation



I can handle stressful situations at work in a relaxed manner.
I always try to learn from others in my daily work.
I find it easy to ask others for help if problems arise.
I support team decisions even if I hold a different opinion.

Relating PSS built-in-heterogeneity to:

in-depth learning/team orientation



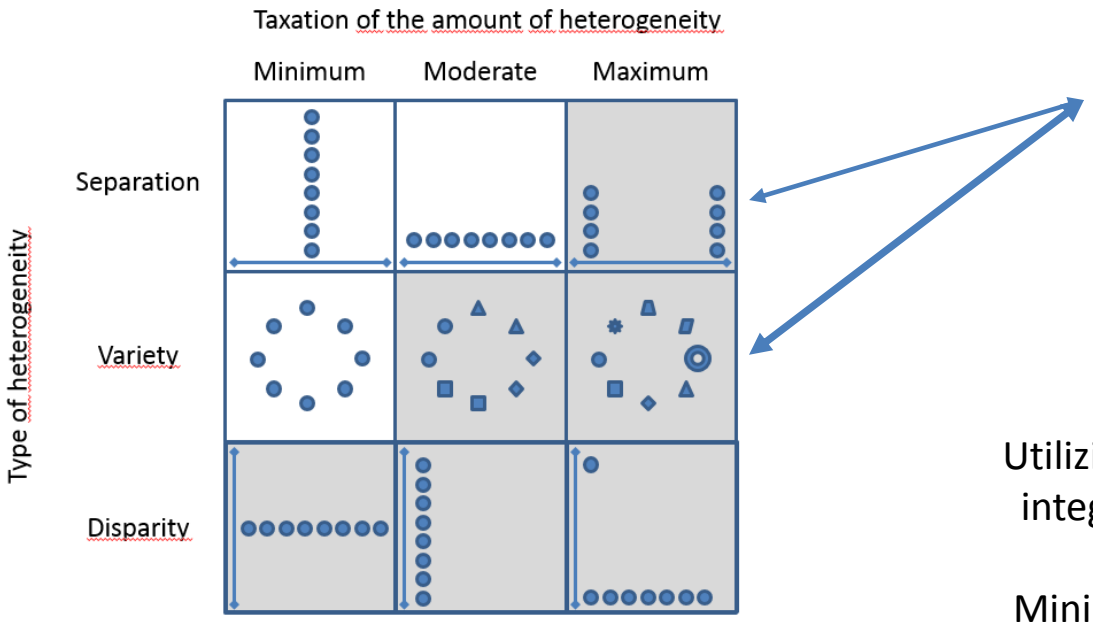
Aims at constant improvement by utilizing external knowledge and best practices paired with the ability to break with established routines.

work in a relaxed manner.
I always try to learn from others in my daily work.
I find it easy to ask others for help if
I hold a

Enables high quality team decisions through the integration or subordination of individual opinions and problem-solving routines.

Relating PSS built-in-heterogeneity to:

in-depth learning/team orientation



In-depth learning/ team-orientation

Utilizing positive heterogeneity effects by the integration of third party knowledge bases.

Minimizing negative effects due to a relaxed working style and minimum egoism in team decisions.

Results and implications for future research

This research identified a specific patterning of competencies for PSS workers:

1. for simultanously minimizing negative and utilizing positive effects of PSS built-in-heterogeneity
2. by mainly directing attention to the utilization of variety as the most and separation as second most resourceful type of heterogeneity in PSS.

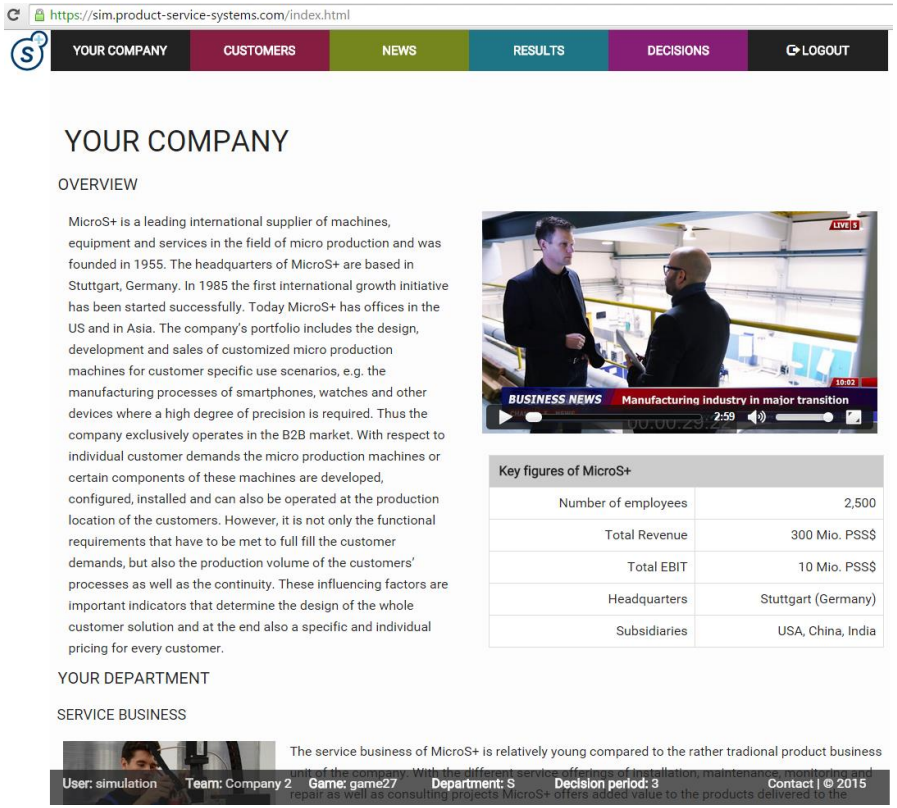
The explication of individual cognitions & actions for PSS workers may serve as a guidline for building PSS competence portfolios and optimizing training.

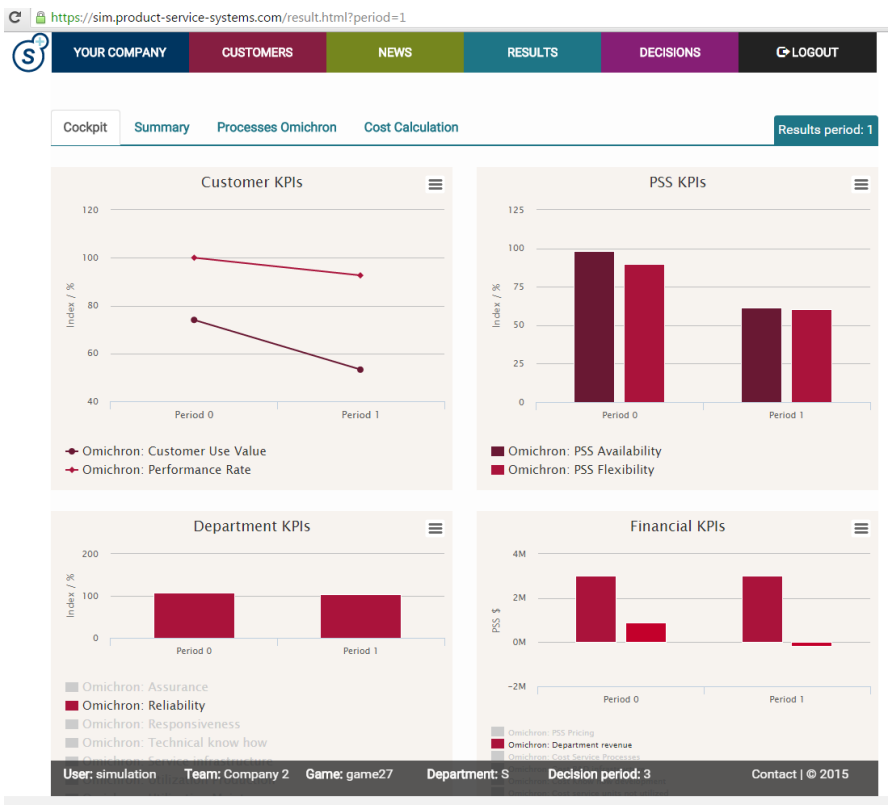
Future research:

1. Further validation of the explorative findings through inferential quantitative designs
2. Further specification of competence patterns as independent variables for PSS (work system) competitiveness

Research in 2 practice:

Validity testing within PSS business simulation





Literature

- Alter S. Challenges for Service Science. Journal of Information Technology Theory and Application 2012; 13:2(3):22-37.
- Alter S. Work System Theory: Overview of Core Concepts, Extensions, and Challenges for the Future. Journal of the Association for Information Systems 2013; 14(2):72-121.
- Baines TS, Lightfoot HW, Benedetti O, Kay JM. The servitization of manufacturing: a review of literature and reflection on future challenges. J. of Manufacturing Technology Management 2009;20(5):545-567.
- Benade S, Weeks RV. The formulation and implementation of servitization strategy: factors that ought to be taken into consideration. J. of Contamporary Management 2010;7:402-419.
- Cova B, Salle R. Introduction to the IMM special issue on “Project marketing and the marketing of solutions”. A comprehensive approach to project marketing and the marketing of solutions. Industrial Marketing Management 2007;36:138-146.
- Gebauer, H. & Friedli, T. (2005), Behavioural implications of the transition process from products to services. *Journal of Business & Industrial Marketing, 20(2),* 70-80.
- Kowalkowski, C. What does a Service-Dominant Logic Really Mean for Manufacturing Firms? *Proceedings of the 2nd CIRP International Conference on Industrial Product/Service Systems, Linköping, Sweden, April 14th -15th, 2010,* 229-235.
- Martinez V. Challenges in transforming organisations into product-service providers. Journal of Manufacturing Technology Management 2010;21(4):449-469.
- Oliva R, Kallenberg R. Managing the transition from products to services. International Journals of Service Industry Management 2003;14(2):160-172.
- Servadio L, Nordin F. Critical issues during servitization: an in-depth case study AMA Servsig, International Service Research Conference Hanken School of Economics, Finland: Helsinki, June 7-9, 2012.
- Ulaga W, Reinartz WJ. Hybrid offerings: how manufacturing firms combine goods and services successfully. Journal of Marketing 2011;75(6):5-23.
- Van Knippenberg D, Schippers M. Work group diversity. Annual Review of Psychology 2007;58:515-541.
- Wilkens U, Gröschke D. Measuring the leverage effect between individual and collective competence. Conference of the Strategic Management Society, Cologne, 2008.

Thank you for your kind interest!

Let`s talk!!!

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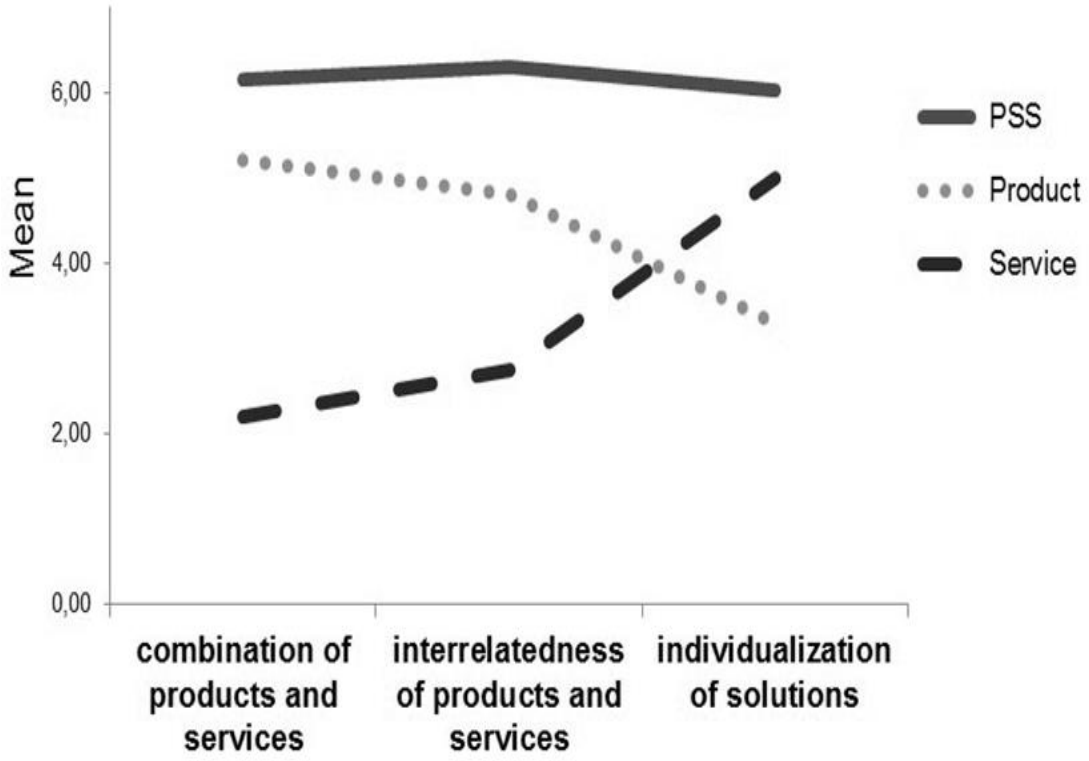
Identifying a sample of PSS workers:
clustering by organizational offering

Clusteranalysis results in the separation of three **distinct work systems**:

PSS (N=68)

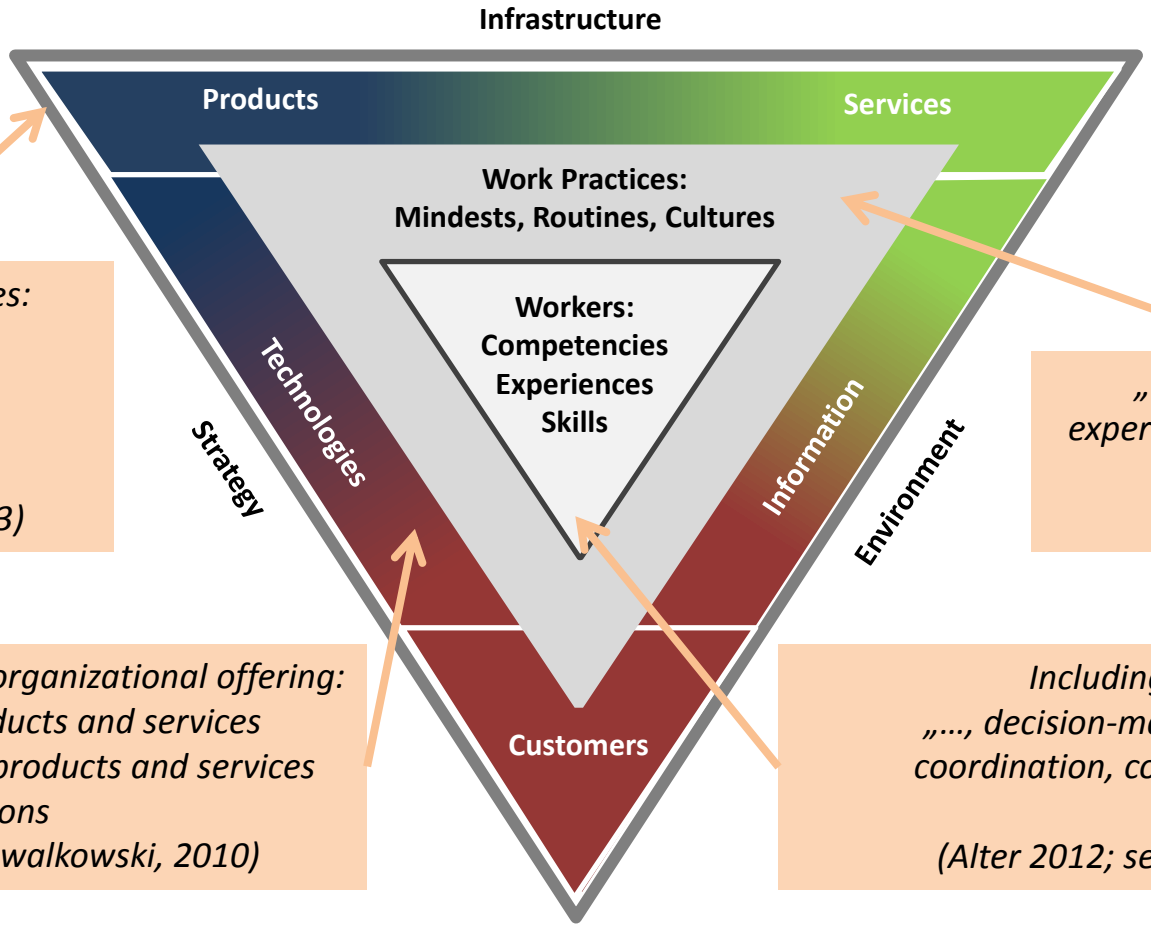
Production (N=51)

Service (N=52)



The PS work system (PSWS):
attributing sources of built-in-heterogeneity

"Product-like vs. service-like is the basis of a series of design dimensions for characterizing and designing the things that a work system … [does and] … produces (Alter, 2012).



Performance challenges:
- *Heterogeneity*
- *Complexity*
- *Coordination*
- *Communication*

(Externbrink et al. 2013)

„… depend on the skills, experiences, and judgement of the primary actors"
(Hill et al. 2006).

Characteristics of the organizational offering:
- *combination of products and services*
- *interrelatedness of products and services*
- *individualized solutions*

(Cova & Salle 2007, Kowalkowski, 2010)

Including perspectives such as: „…, decision-making, communication, coordination, control, and information processing"
(Alter 2012; see also Gebauer, 2005).