Patterns of work organisation and their relation to communication and mobility patterns
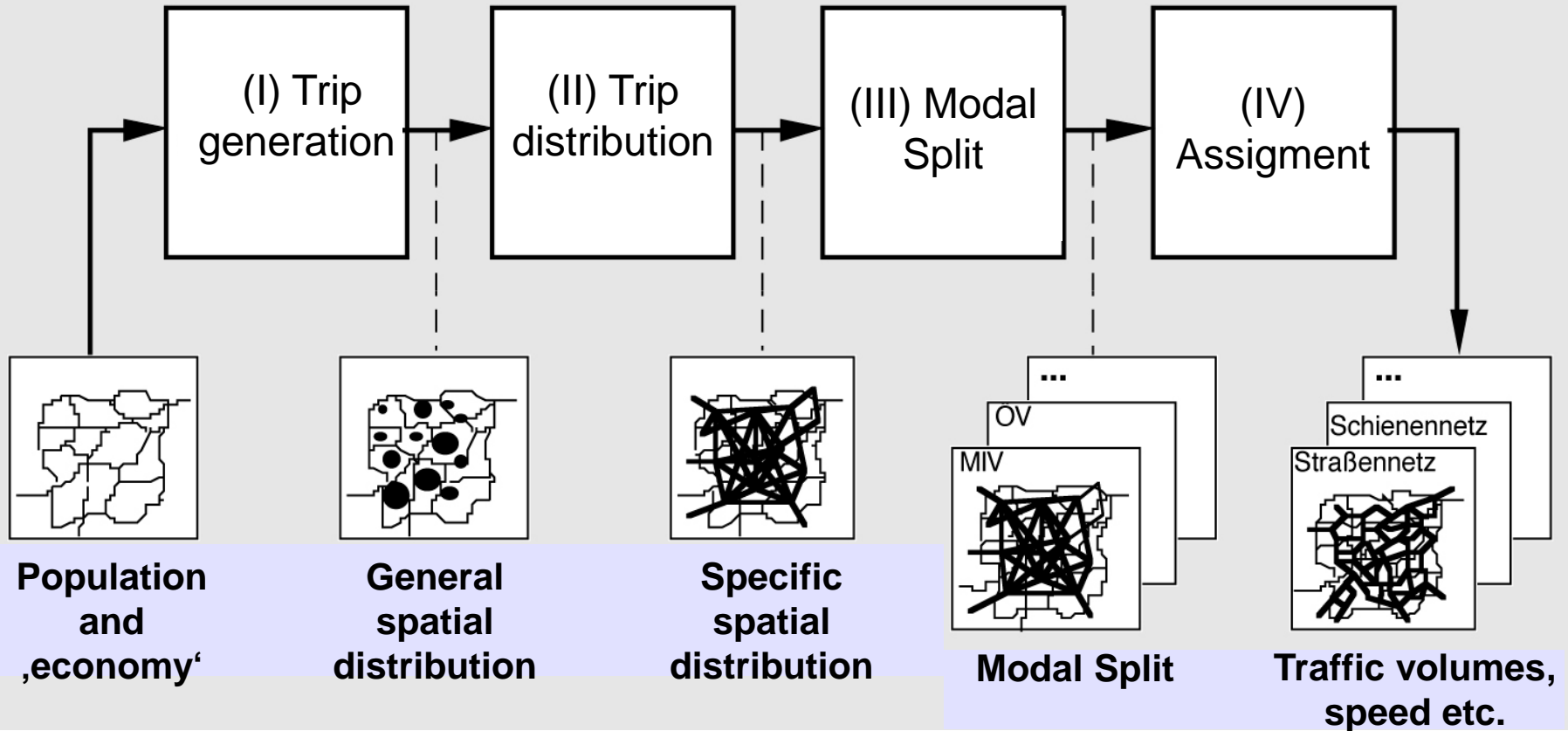
Barbara Lenz, Katja Köhler, Arne Höltl

ICT Expert Group Meeting 2011

**Berlin (Germany), 30 November – 2nd December 2011**

Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

Background

Translated from: Hilty u.a. 1998, p.67

Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

Background

TAPAS (Travel-Activity Pattern Simulation): Agentenbasiertes, mikroskopisches Personennachfragemodell

Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft
DLR
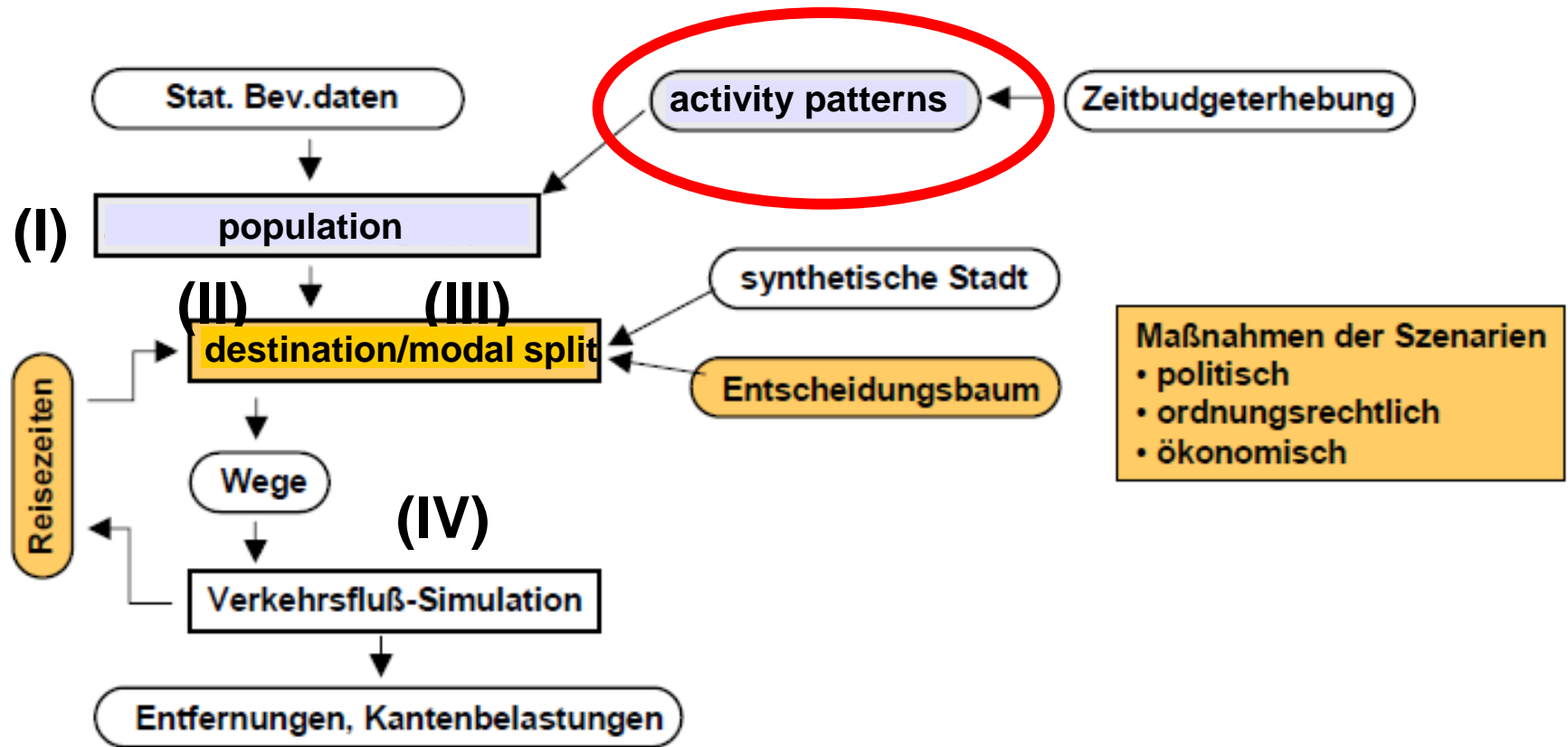
In which way are activity patterns influenced by the use of ICT?

Questions for statistical analysis

- ↗ **Where** do people work? At working place, at home?

- ↗ **How long** do people work during a week?

- ↗ Does the **type of job position** play a role?

- ↗ How important is **ICT for work**?

- ↗ How common are **business trips**?

DLR Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

Methodological Approach

⌐ **Cluster Analysis**

- Method to form groups of individuals resp. objects
- Objects of the same group should be as homogeneous as possible
- Objects of different groups should be as heterogeneous as possible

⌐ **TwoStep Cluster Analysis:**

- Combination of partitioning and hierarchical clustering
- Metric and categorial variables can be processed at the same time
- High number of cases is feasible

Research Approach and Data

⬈ **Data source: ICT-Panel (DLR, TNS Emnid)**

- Two waves: 2003 and 2007

- Sample size N = 3500 persons (1945 panelists)

- Representative study for German population of 14 years and older

- Goals: longitudinal analysis (Intrapersonal and intertemporal)

- Research questions

  - How does ICT usage of a person change over time?

  - Does mobility and activity-based behaviour change at the same time?

- Question categories: ICT usage and availability, mobility, travel information, shopping and commerce, leisure activities, ICT and work
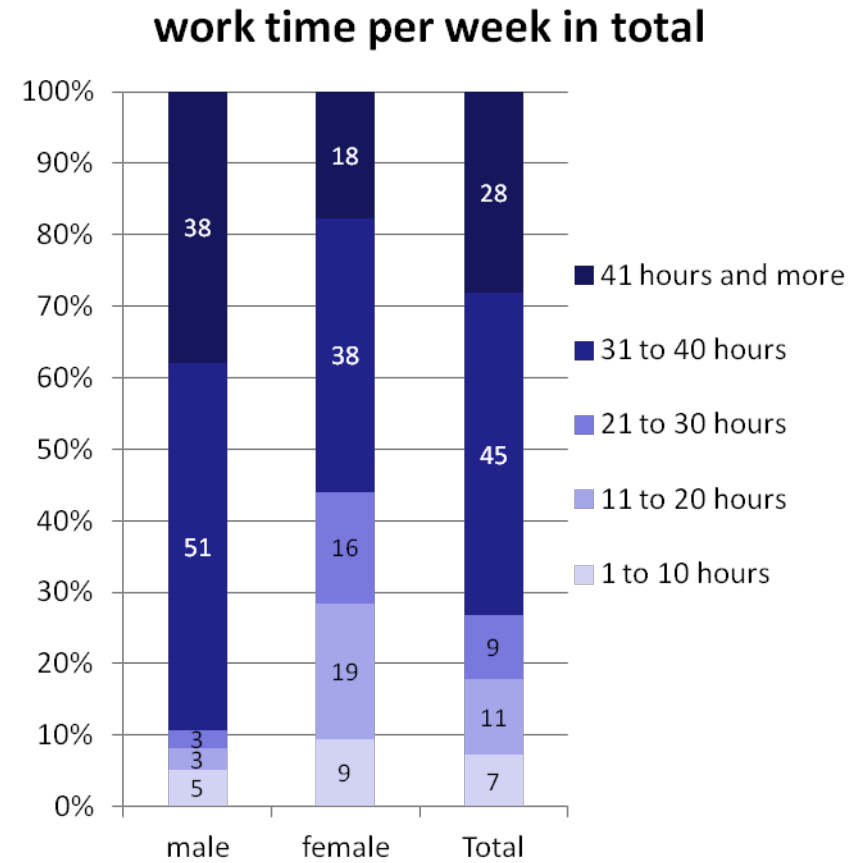
Included variables on work organisation: time-related, spatial and manner-related variables

	variable	categories
When?	Working time per week •In total •At home	hours
Where?	Business trips*	‚never' to ‚daily'
How?	Job-related importance of media* •Telephone •Mobile phone •internet	‚unimportant' to ‚very important'
	Leading position/non-leading position	yes; no

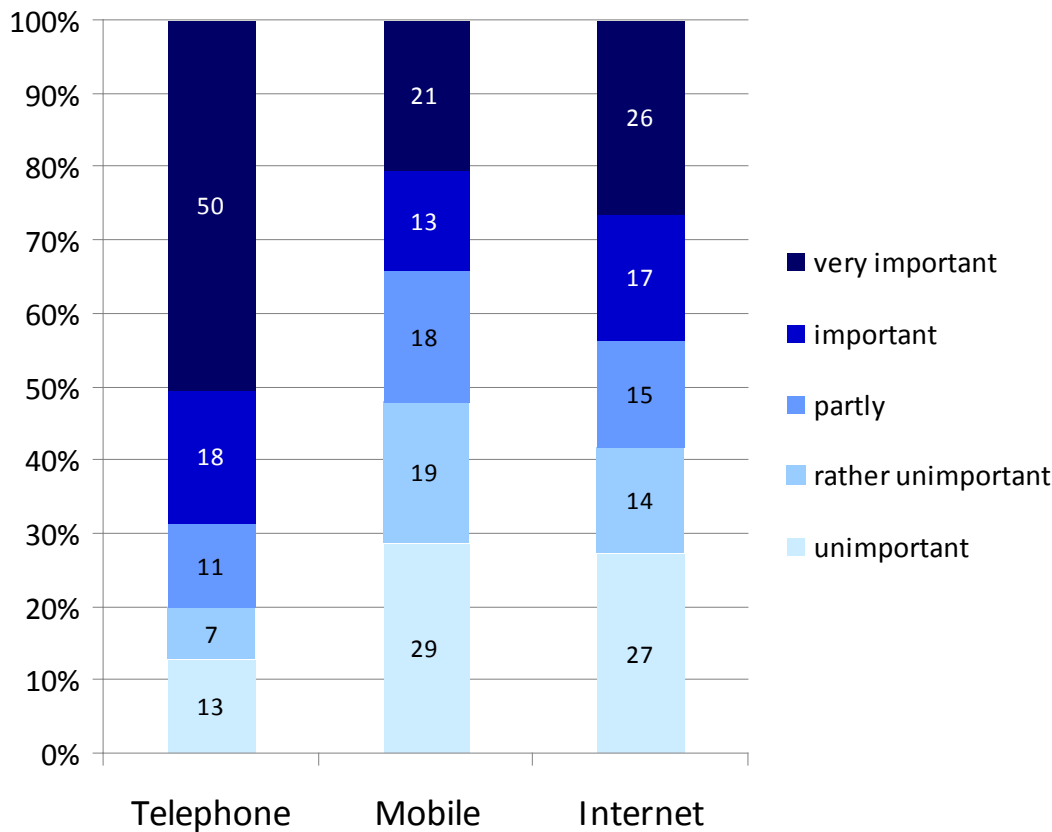*variables were standardised for cluster analysis

Included variables on work organisation

↗ Average working time in total: 36.2 hours/week

  ↗ Men: 40.6

  ↗ Women: 31.4

↗ Average working time at home: 1.9 hours/week (80% never work at home)

↗ Share of persons doing business travels: 58%

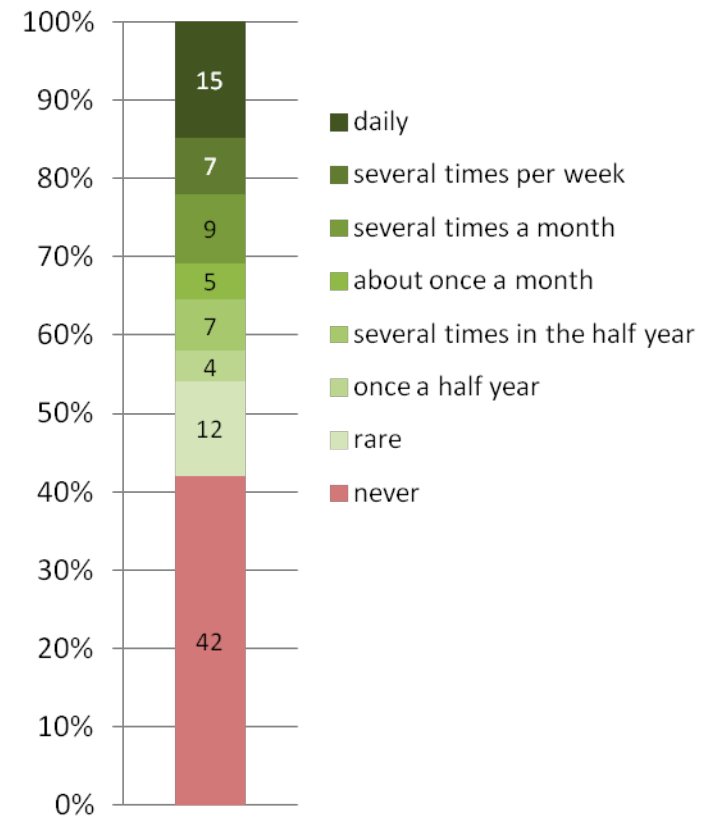↗ Share of persons with leading position: 21%

work time per week in total

Legend:
- 41 hours and more
- 31 to 40 hours
- 21 to 30 hours
- 11 to 20 hours
- 1 to 10 hours

male: 38, 51, 3, 3, 5
female: 18, 38, 16, 19, 9
Total: 28, 45, 9, 11, 7

Source: ICT Panel 2007

Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft
DLR

Included variables on work organisation

Job-related importance of media

Telephone: unimportant 13, rather unimportant 7, partly 11, important 18, very important 50

Mobile: unimportant 29, rather unimportant 19, partly 18, important 13, very important 21

Internet: unimportant 27, rather unimportant 14, partly 15, important 17, very important 26

Legend:
- very important
- important
- partly
- rather unimportant
- unimportant

Frequency of business trips

- daily: 15
- several times per week: 7
- several times a month: 9
- about once a month: 5
- several times in the half year: 7
- once a half year: 4
- rare: 12
- never: 42

Source: ICT Panel 2007

Two-Step Cluster Analysis

- N = 2005 respondents

- non-employed persons were excluded from analysis

- several Cluster Analyses were carried out, a satisfying result was observed for three versions (including categorial and steady variables)

- other analyses did not show sufficient statistical significance

Model Summary

Algorithm	TwoStep
Inputs	7
Clusters	4

Cluster Quality

Poor   Fair   Good

-1,0   -0,5   0,0   0,5   1,0

Silhouette measure of cohesion and separation
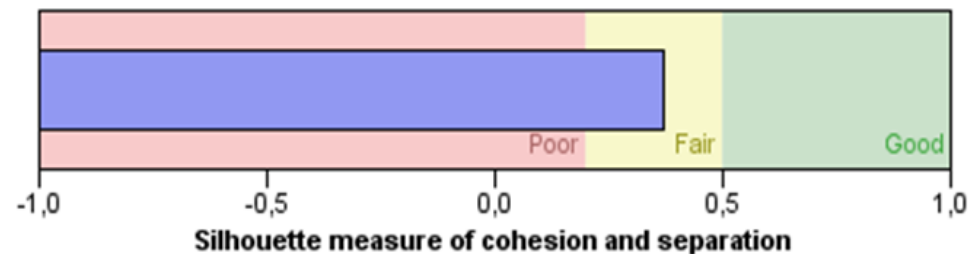
average silhouette = 0.4

Choice of cluster size and number

Cluster Sizes

	Cluster
☐	1
☐	2
☐	3
☐	4

- 28,4%
- 15,3%
- 21,2%
- 35,2%

↗ 4 clusters are better than 3 (choosing 3 clusters usually results in getting one big cluster which includes all "average" answers)

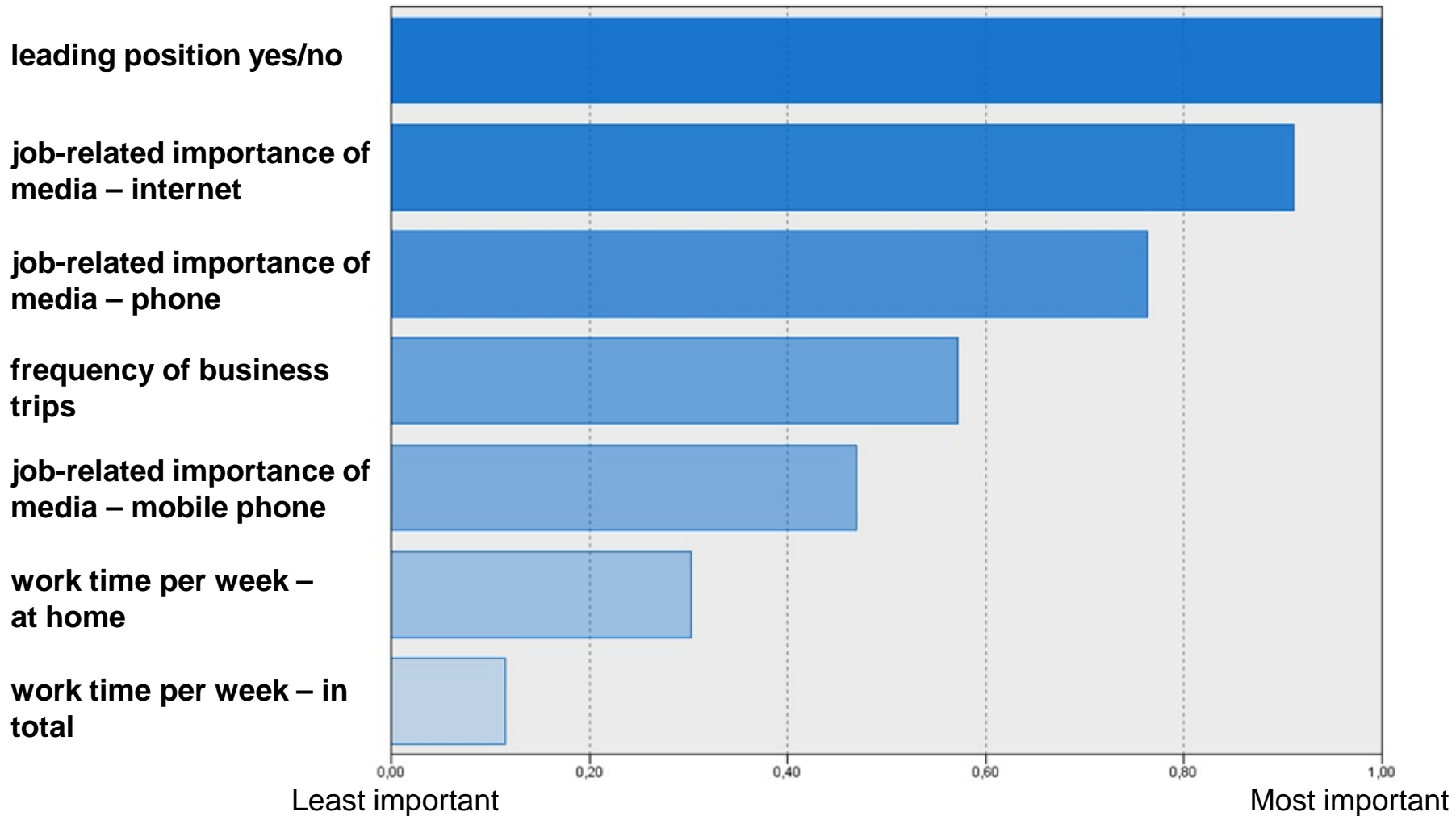↗ clusters are more comparable if their size is similar
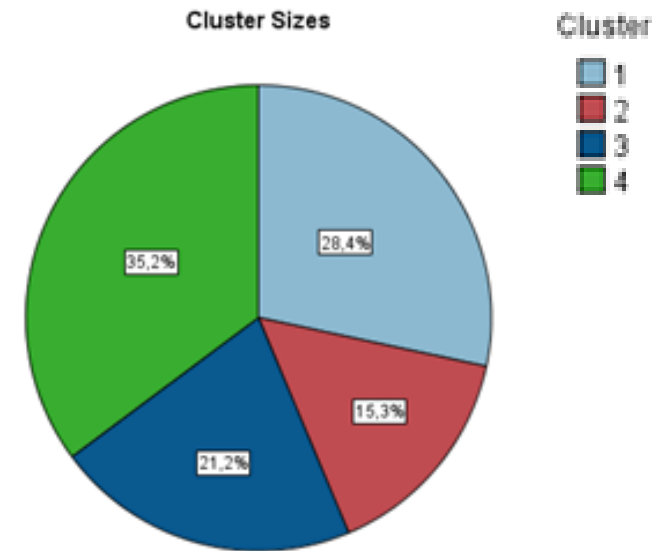
Size of Smallest Cluster	282 (15.3%)
Size of Largest Cluster	649 (35.2%)
Ratio of Sizes: Largest Cluster to Smallest Cluster	2.30

Source: ICT Panel 2007

Predictor Importance

leading position yes/no

job-related importance of media – internet

job-related importance of media – phone

frequency of business trips

job-related importance of media – mobile phone

work time per week – at home

work time per week – in total

0,00   0,20   0,40   0,60   0,80   1,00

Least important   Most important

Source: ICT Panel 2007

Cluster results

Cluster:		1 28.4%	2 15.3%	3 21.2%	4 35.2%
Cluster Name		**'fixed' low ICT users**	**highly 'mobiles'**	**mobile ICT users**	**average persons**
	leading position	no	no	yes	no
importance of	internet	unimportant	rather unimportant	important	important
	telephone	rather unimportant	partly	very important	very important
	mobile phone	unimportant	important	important	partly
frequency of business trips		rarely	several times a week	several times a month	on average (2 to 4 times a year)
working time (average)	at home	0,3 h	7,5 h	2,5 h	0,4 h
	in total	31,9 h	41,2 h	41,1 h	35,6 h

Source: ICT Panel 2007

Deutsches Zentrum
für Luft- und Raumfahrt e.V.
DLR in der Helmholtz-Gemeinschaft

Professional activties by industry sectors – Shares

Professional activity in …	1	2	3	4	total
agriculture / forestry / fishery / mining	1%	3%	3%	1%	2%
processing / producing / fabrication	**31%**	**20%**	**25%**	11%	21%
Technical profession	1%	2%	4%	**6%**	3%
consultancy / marketing / PR	0%	1%	3%	3%	2%
wholesale and retail	**16%**	5%	10%	10%	11%
banking / insurance / financing	1%	4%	4%	**8%**	4%
public administration / education / justice	6%	11%	9%	**16%**	11%
press / radio / television / journalism	0%	0%	0%	1%	1%
data processing / hardware-/software development	0%	0%	2%	4%	2%
building industry	1%	4%	2%	0%	1%
public health / welfare	**10%**	7%	11%	10%	10%
transportation	0%	**16%**	5%	2%	4%
hotel and restaurant sector / tourism	4%	1%	3%	3%	3%
research / science	0%	0%	**1%**	**2%**	1%
Other profession	27%	26%	19%	22%	24%
Total	100%	100%	100%	100%	100%

Yellow marked figures show particular 'affinity' to a cluster

Source: ICT Panel 2007

Deutsches Zentrum
DLR für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

Socio-demographic factors: Qualification

educational qualification

Legend:
- ■ completed academic qualification
- ■ university-entrance diploma
- ■ graduation from primary or secondary school
- ■ no general school leaving certificate

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
completed academic qualification	2%	9%	16%	10%
university-entrance diploma	9%	5%	13%	19%
graduation from primary or secondary school	87%	85%	71%	71%
no general school leaving certificate	2%			

Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft
DLR

Slide 15
ICT Expert Group Meeting 2011 Berlin > Barbara Lenz > 1st Dec. 2011

Socio-demographic factors: Gender

Percentage of men

Source: ICT Panel 2007

Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft
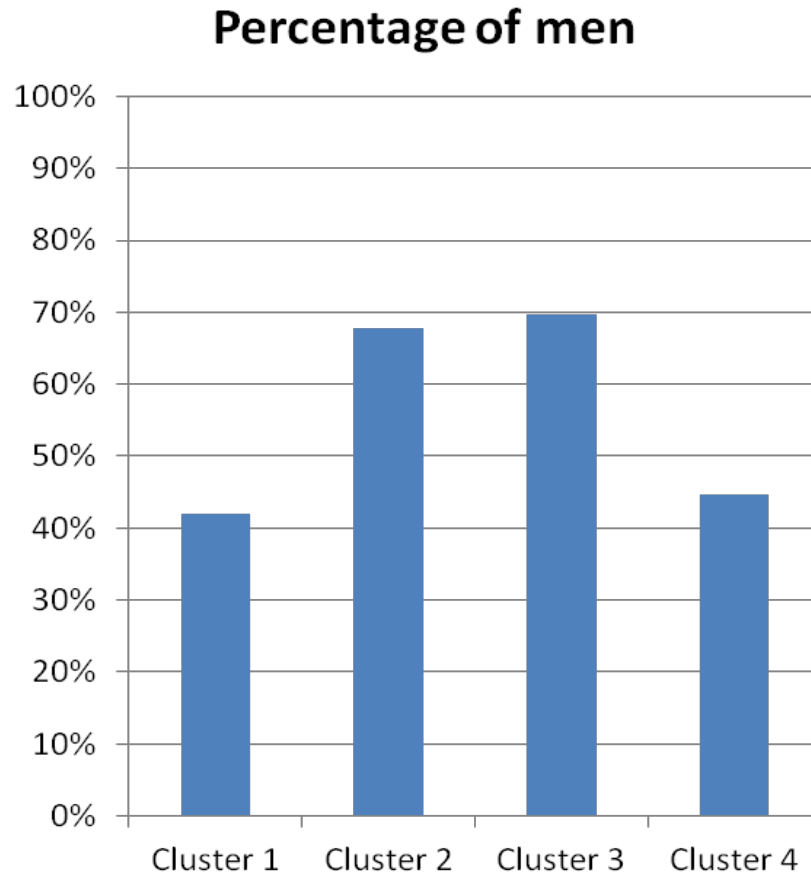
Socio-demographic factors: Personal net income
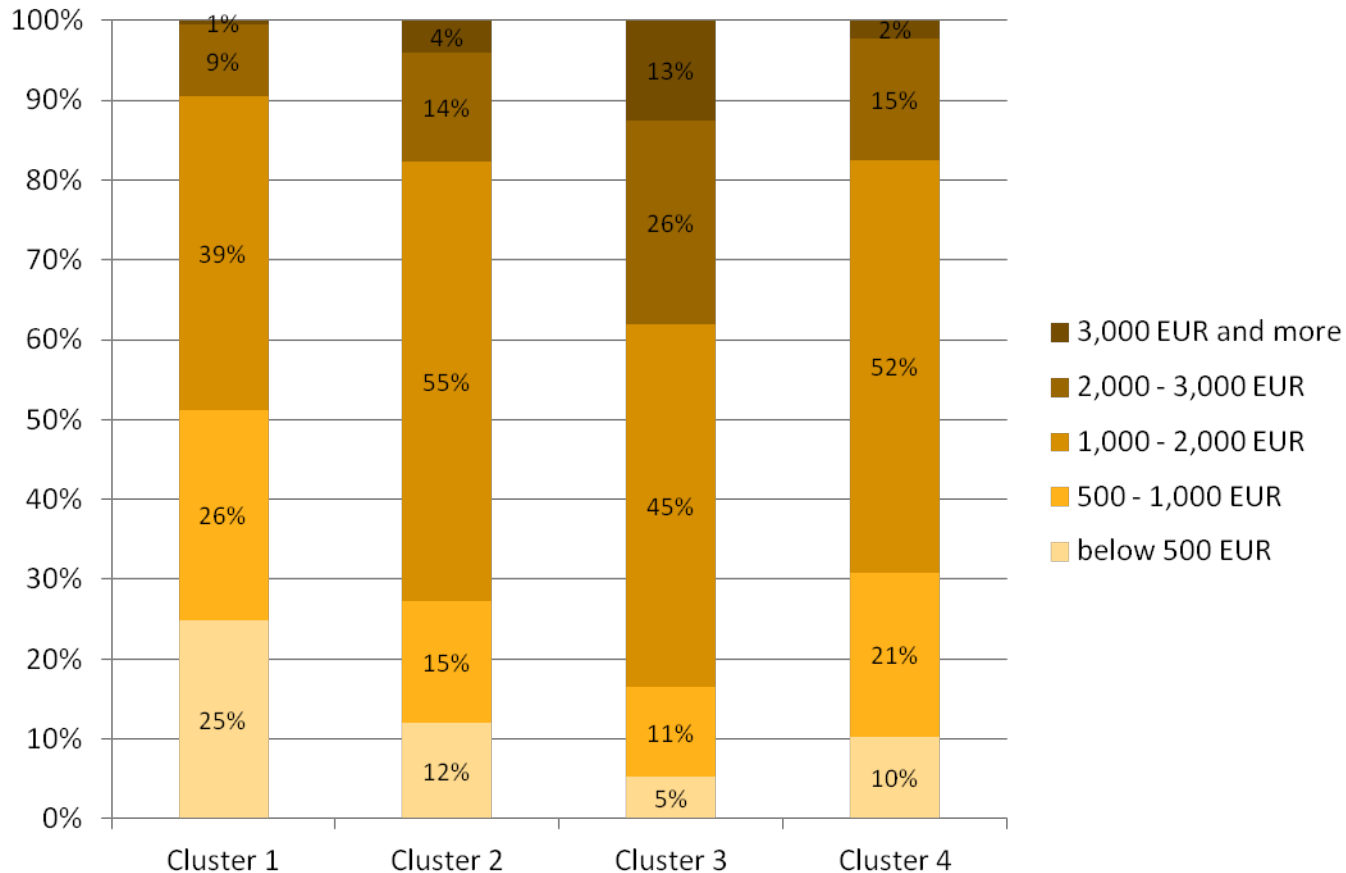
The average number of persons and children per household is approximately equal in all clusters.

Deutsches Zentrum
DLR für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

Factor communication: Job-related usage – en route

Source: ICT Panel 2007
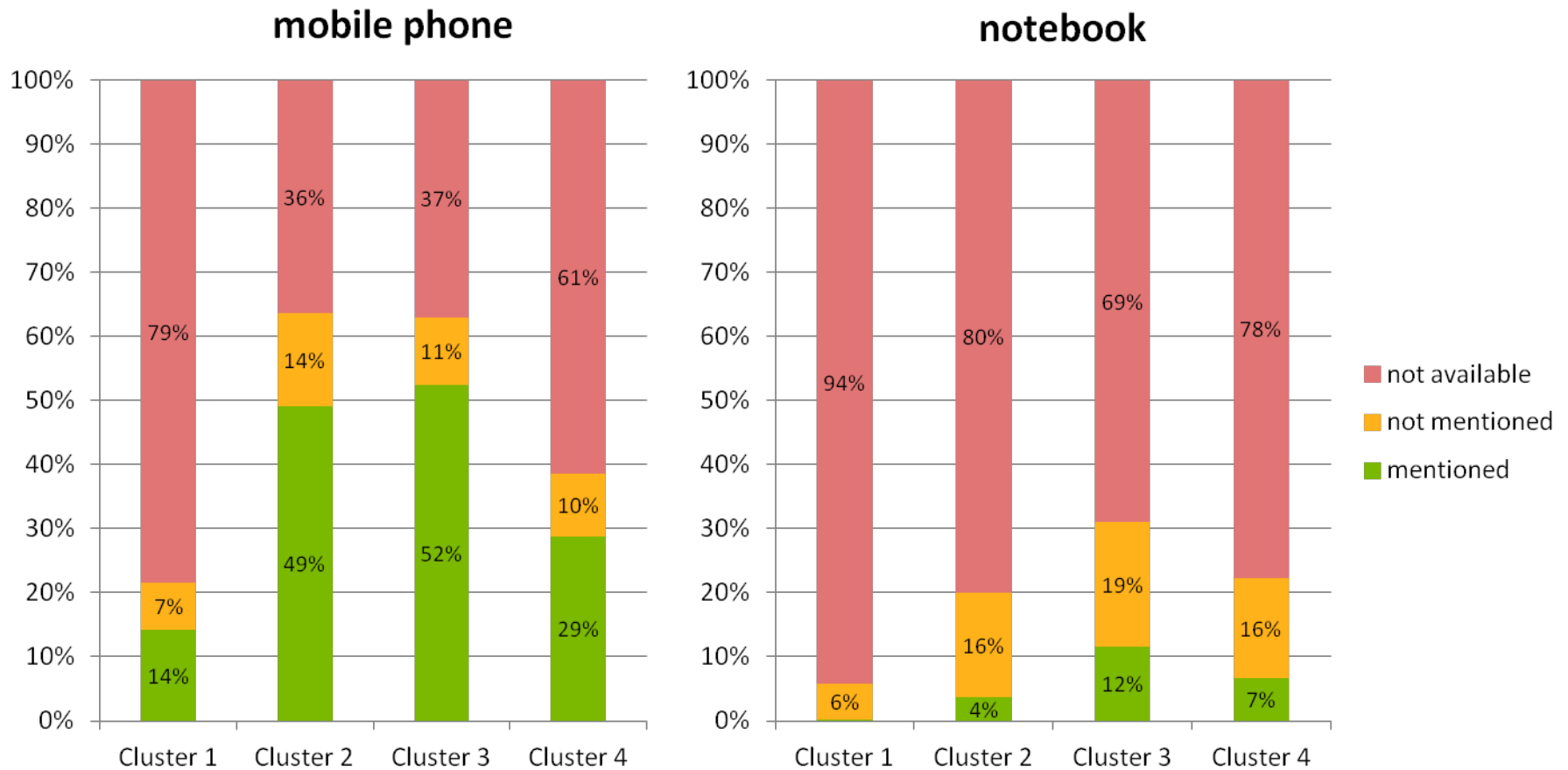
Factor communication: Job-related usage – at workplace

mobile phone

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
not available	79%	36%	37%	61%
not mentioned	15%	23%	21%	17%
mentioned	6%	40%	42%	22%

computer / notebook

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
not available	37%	39%	13%	6%
not mentioned	11%	13%	9%	6%
mentioned	52%	48%	78%	88%

- not available
- not mentioned
- mentioned

Source: ICT Panel 2007

Deutsches Zentrum
DLR für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

Factor communication:
Means of communication for business purposes
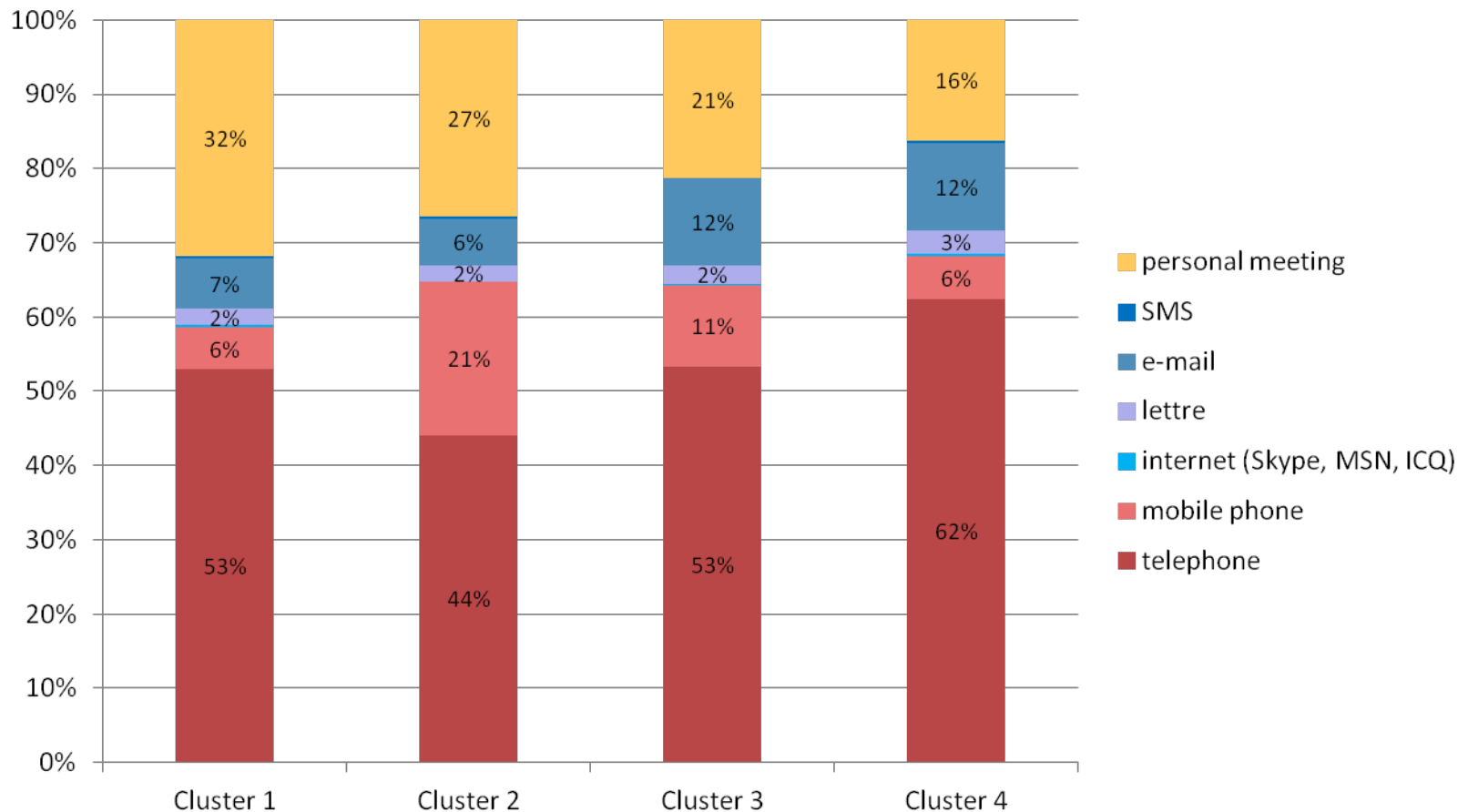
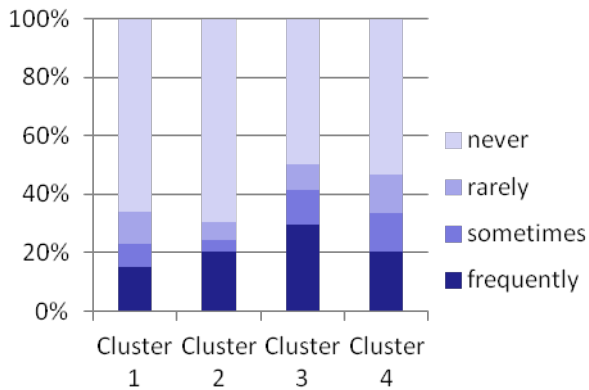# Means of transportation on business trips – short distance

Private car
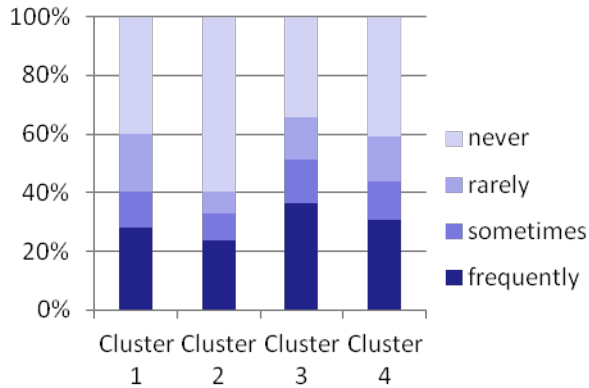
Company car / rental car
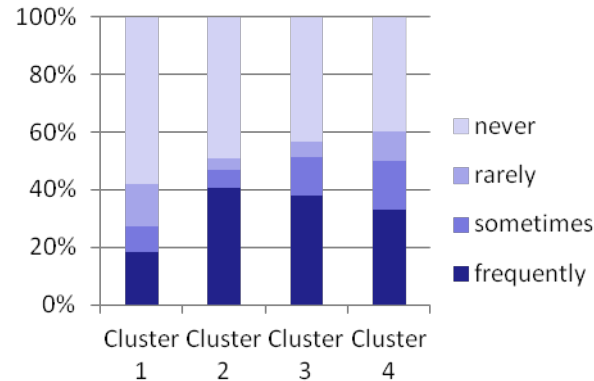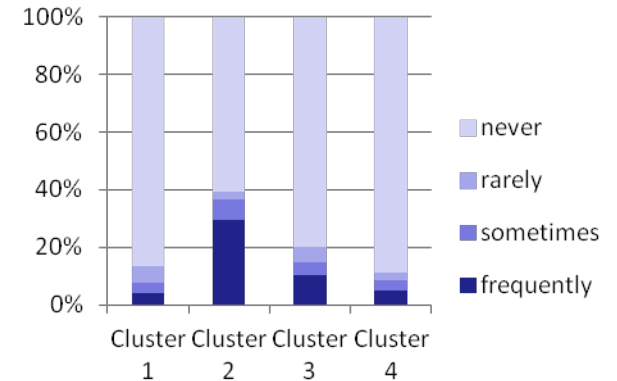
Utility vehicle

Local public transport

Train

Source: ICT Panel 2007

Deutsches Zentrum
für Luft- und Raumfahrt e.V.
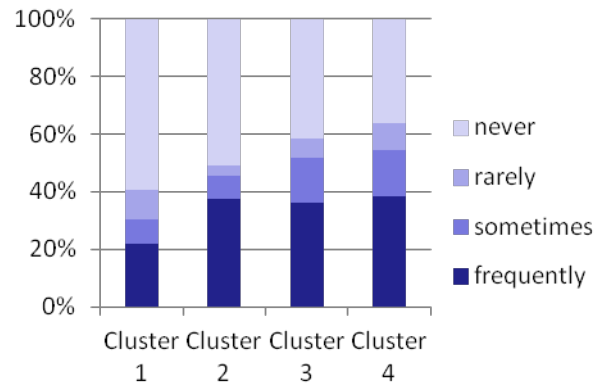in der Helmholtz-Gemeinschaft
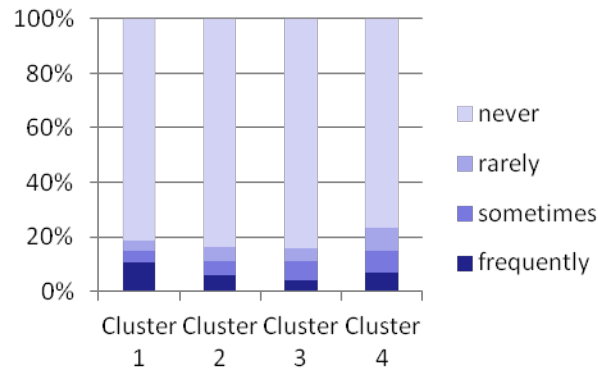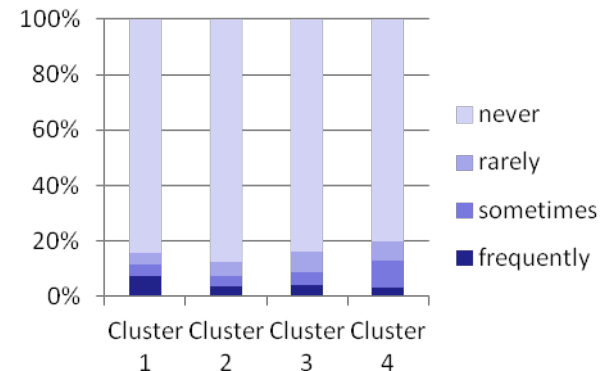
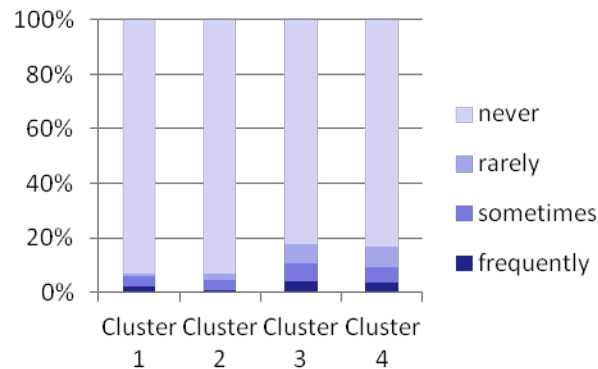# Means of transportation on business trips – long distance

Private car

Company car / rental car

Utility vehicle

Aeroplane

Train

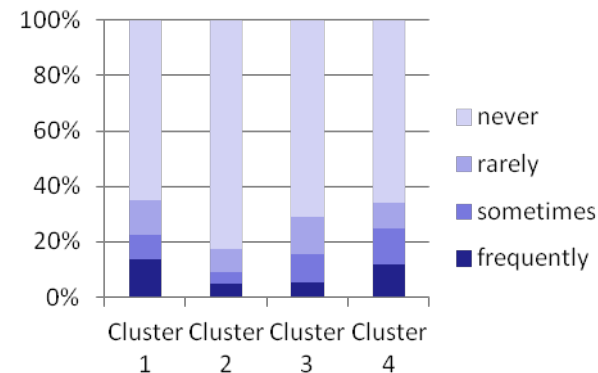Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

DLR
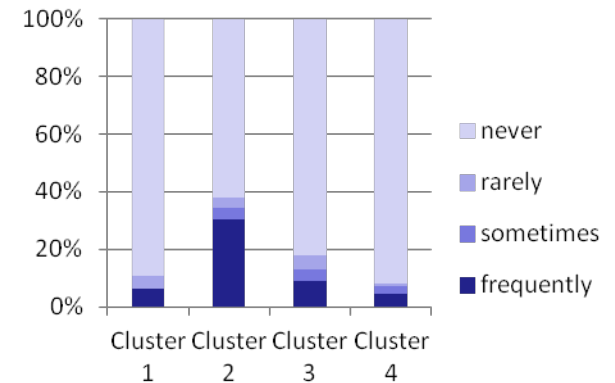
Conclusion and Next Steps

Conclusion

- ⌐ Based on time, space and work related variables four different communication and mobility patterns can be distinguished
- ⌐ Appearance of communication patterns in business sectors differ

Next steps

- ⌐ Regression analysis between pattern variables
  - ⌐ Correlations which are not found with cluster analyses
- ⌐ More deep analysis of communication and mobility patterns in different business sectors
  - ⌐ Comparison with time indication for working times in the panel's "activity diaries"
- ⌐ Correlations between work-related and private usage of ICT