Karlsruhe Institute of Technology

Institute for Industrial Production

User acceptance of wireless electric vehicle charging

Daniel Fett, Axel Ensslen, Patrick Jochem, Wolf Fichtner

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INSTITUTE FOR INDUSTRIAL PRODUCTION (IIP)
Chair of Energy Economics (Prof. Dr. W. Fichtner)

Agenda

1. Motivation
2. Acceptance of wireless charging
3. Structure equation model
4. Multigroup analysis
5. Conclusion

Motivation

[Photo: M Cummings/J Brown, Greencarreports]

electrek

JANUARY 2

Germany's electric vehicle incentive program is off to a slow start: 9,000 out of 300,000 by 2019

Fred Lambert - Jan. 2nd 2017 10:36 am ET @FredericLambert

PLUG-IN HYBRIDS RARELY CHARGED, MOSTLY USE GAS

Posted on Nov 12, 2014 by Janene Pieters

Wireless Charging And Autonomous Electric Cars Go Hand-In Hand

5 months ago by Mark Kane 14

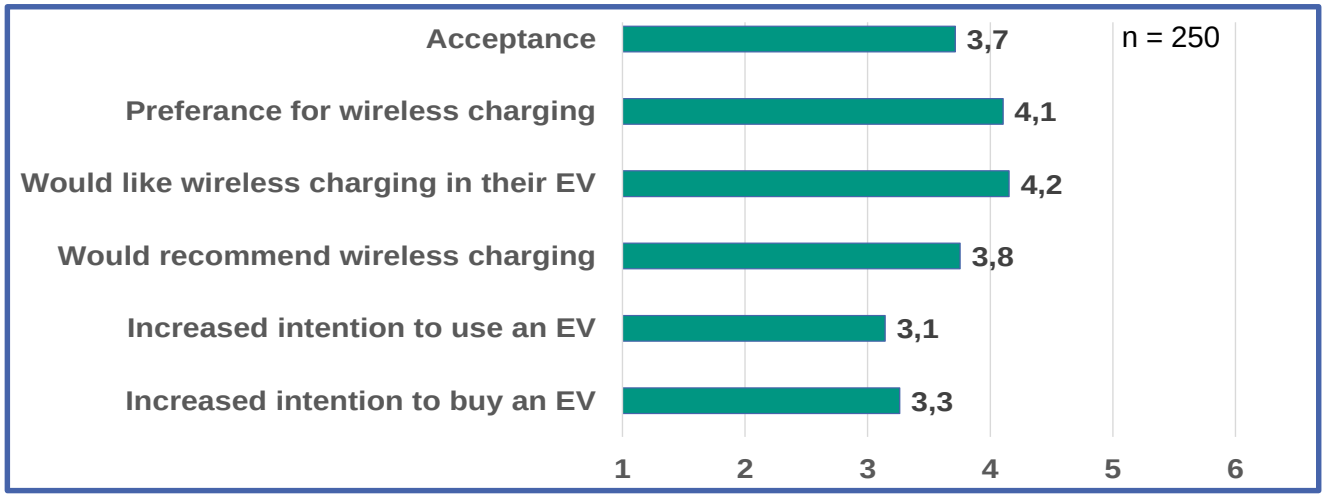
InsideEVs

„…plug-in hybrids and electric cars will never reach their full market potential unless wireless inductive charging spreads across the fleet."

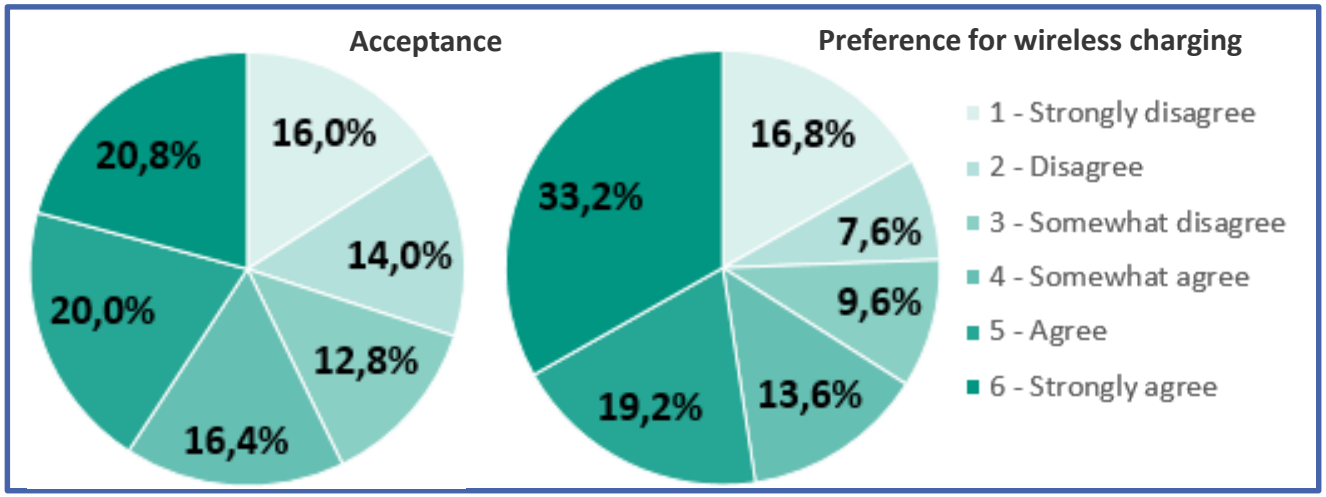
Prof. Dr. Ulrich Hackenberg in *Car and Driver*, 2015

Average user acceptance of wireless electric vehicle charging

Average values of the construct „acceptance“ and its items



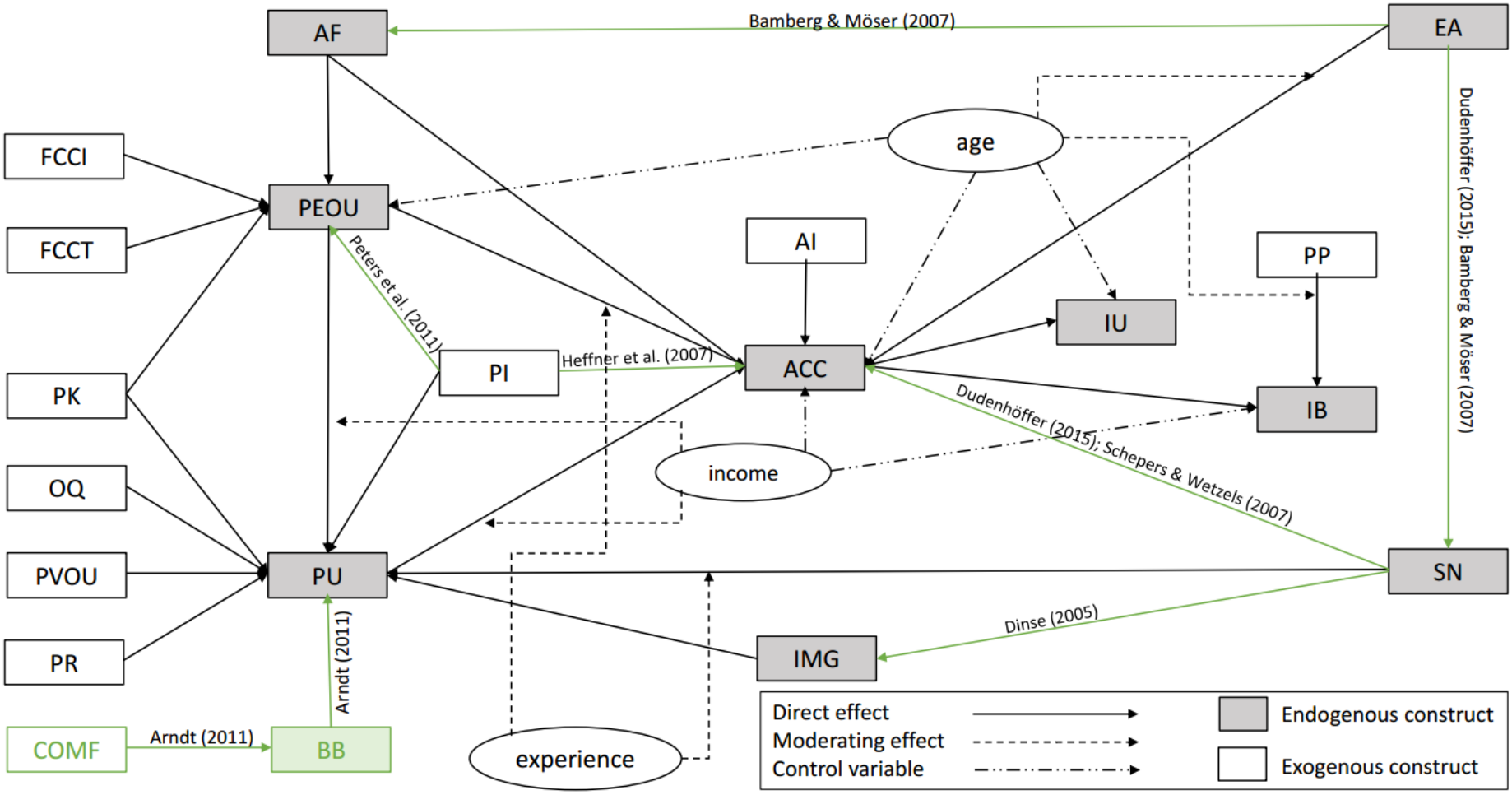
Distribution of the construct „acceptance“ and the preference for wireless charging



Structural equation model for the user acceptance of wireless electric vehicle charging

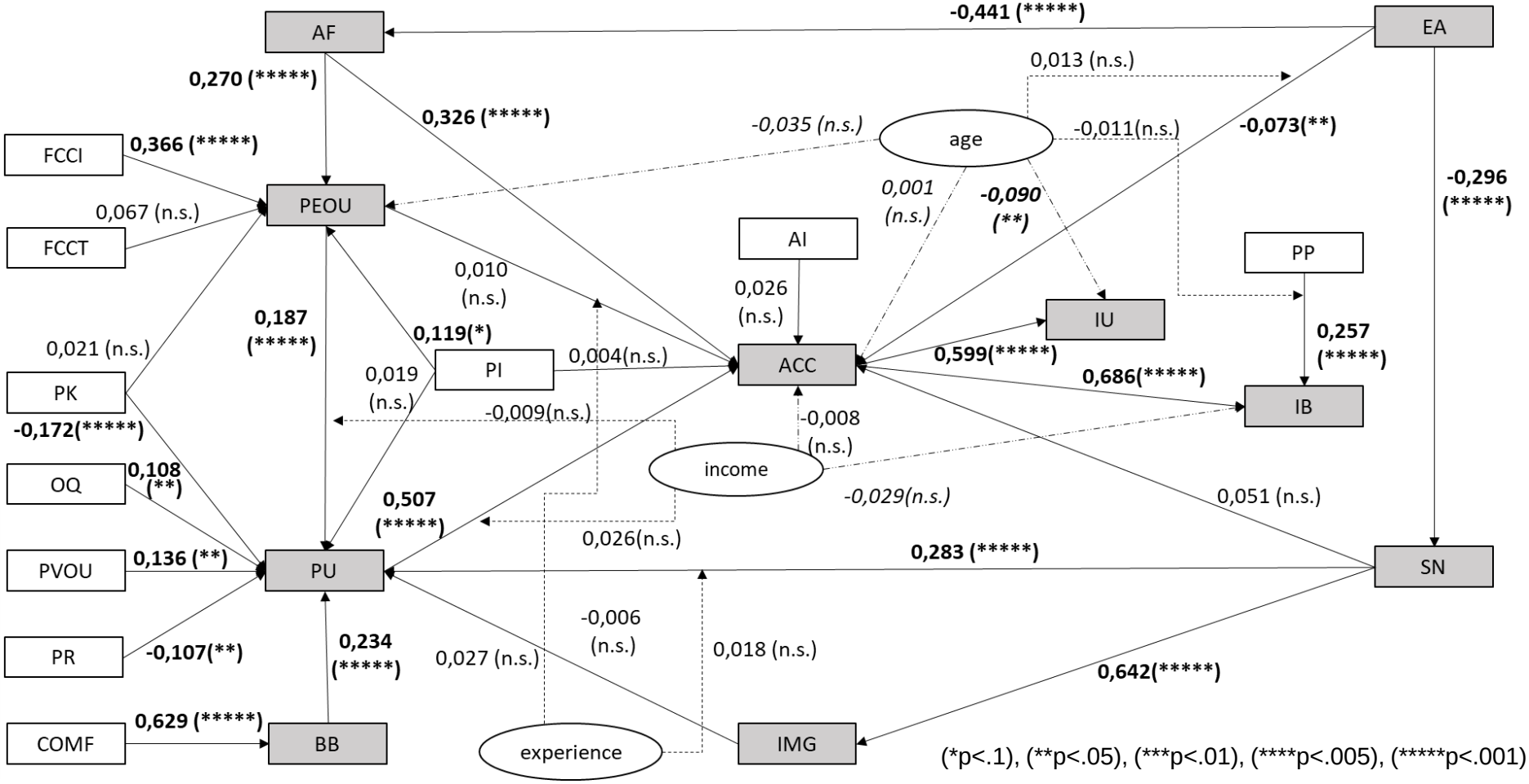
Construct	Definition	Source
Affect	The degree of **emotional and affective liking** for wireless charging	Dudenhöffer (2015), Venkatesh et al. (2003)
Subjective norms	The degree of **approval** for the use of wireless charging that a person perceives **from his social environment**	Fishbein and Ajzen (1975)
Behavioral beliefs	The degree to which a person believes that the use of wireless charging will have **positive effects**	Ajzen (1991)
Personal innovativeness	The degree of **interest** and willingness to try new **innovative products**	Rogers (2003)
Environmental awareness	The degree to which a person's decisions are influenced by **environmental concerns**	Roberts (1995)
Comfort	The degree to which a person believes that wireless charging **increases** the **comfort** of using electric vehicles	Arndt (2011)
Perceived risk	The degree to which a person believes that using **wireless charging is safe**	Fazel (2014)

Structural equation model for the user acceptance of wireless electric vehicle charging



ACC: Acceptance; AF: Affect; AI: Automotive involvement; BB: Behavioral beliefs; COMF: Comfort; EA: Environmental awareness; FCCI: Facilitating conditions charging infrastructure; FCCT: Facilitating conditions charging time; IB: Intention to buy; IMG: Image; IU: Intention to use; OQ: Output quality; PEOU: Perceived ease of use; PI: Personal innovativeness; PK: Perceived knowledge; PP: Price perception; PR: Perceived risk; PU: Perceived usefulness; PVOU: Perceived visibility of use; SN: Subjective Norm;

Structural equation model for the user acceptance of wireless electric vehicle charging



(*p<.1), (**p<.05), (***p<.01), (****p<.005), (*****p<.001)

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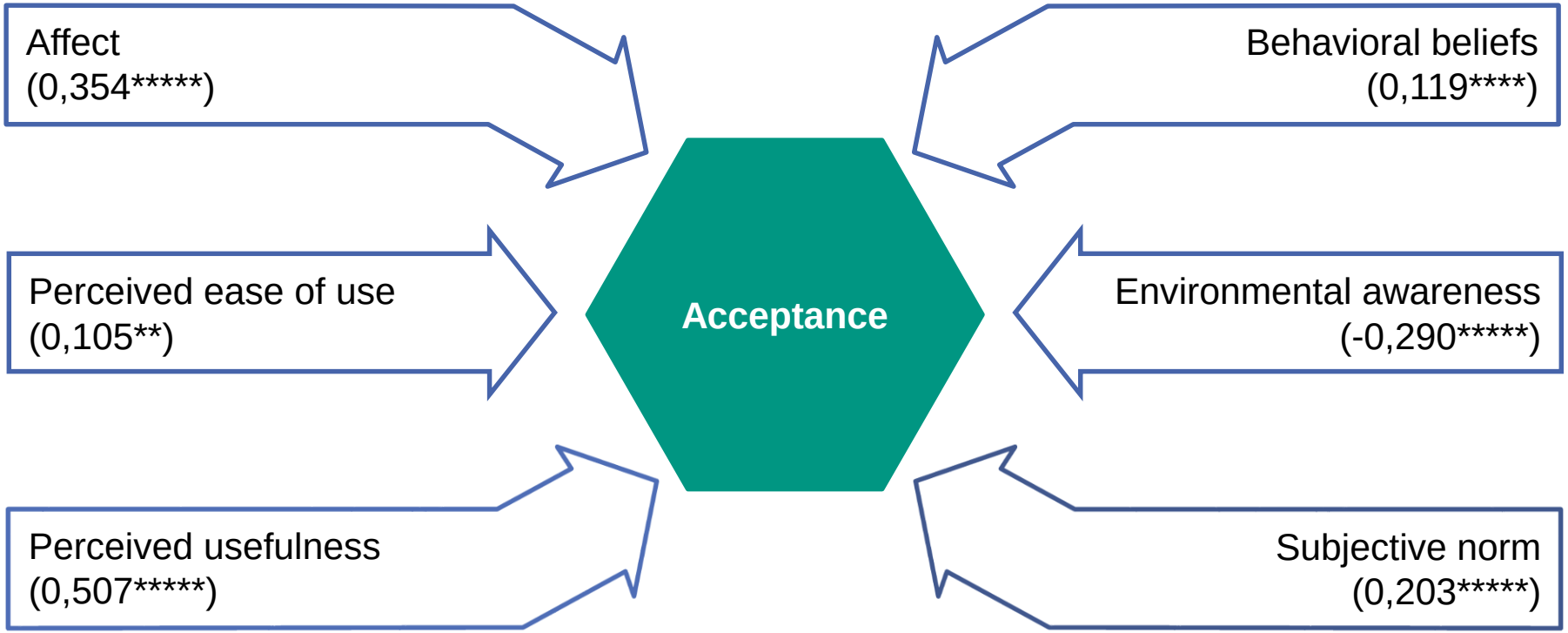
Significant total effects on the user acceptance of wireless electric vehicle charging



Significance level: (*p<.1), (**p<.05), (***p<.01), (****p<.005), (*****p<.001)

- Surprising result: the environmental awareness has a negative impact on acceptance, affective perception and subjective norms of wireless charging

Exemplary results of the multigroup analysis

Frequent vs. non-frequent EV users (n=145; n=105)	• For non-frequent (frequent) EV users the **environmental awareness** has a positive (negative) effect on **acceptance**, **affect** and **subjective norms**. The differences in path coefficients are highly significant • Only for **non-frequent EV users** the **perceived risk** has a negative effect on **perceived usefulness** (and negative total effect on acceptance). The difference in path coefficients is highly significant
Private users vs. commercial (fleet-) users (n=95; n=155)	• The positive effect of **perceived ease of use** and **perceived visibility of use** on **perceived usefulness** is only significant for **commercial (fleet-) users**. The differences in path coefficients are significant. • Only for **private users** the **facilitating conditions charging time** have a positive effect on **perceived ease of use**. The difference in path coefficients is significant.

Conclusion

- About two thirds of the respondents prefer wireless charging and would like to have it in their own electric vehicle.
- More than 40% of respondents state that wireless charging increases their interest to use and buy an electric vehicle
- Especially perceived usefulness, affect and subjective norms increase the acceptance of wireless charging
- For frequent EV users environmental awareness has a negative impact on the acceptance of wireless charging
- For non-frequent EV users perceived technological risk has a negative influence on the acceptance of wireless charging

Wireless charging has the potential to increase the adoption of electric vehicles

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Thank you for your attention!
Any questions or comments?

Contact:
Daniel Fett, daniel.fett@kit.edu, +49 721 608-44692

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