

Methods to Identify User Needs and Decision Mechanisms for the Adoption of Electric Vehicles

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Outline

- 1 Introduction
- 2 Overview on methods to explore user needs for EV
- 3 Selected case study results
- 4 Discussion
- 5 Limitations, conclusion and outlook

1 Introduction

- Increasing electric vehicle (EV) sales.
- EV users like...
 - EV driving characteristics,
 - EV characteristic to reduce CO₂ emissions (particularly on the local level),
 - positive public relations effects.
- EV users dislike...
 - limited range,
 - high purchase prices.
- Knowledge on user needs is still highly relevant.
- Literature is rapidly increasing.
- This research intends to...
 - (1) provide an overview on existing methods.
 - (2) identify research question specific advantages of different methods.
 - (3) provide selected case study results.
 - (4) identify gaps in research concerning methods applied.

2 Overview on methods to explore user needs for EV (i)

- In social sciences ***interviews and surveys*** are the most common methods to gain empirical insight in customer needs.



■ ***Interviews:***

- Typically based on semi-structured guidelines.
- Defined set and direction of questions.
- Interviewer remains free to ask more detailed questions.
- However, unsuitable to represent whole populations.



■ ***Surveys:***

- Statistical inference about a population studied.
- Choice intentions.
- Revealed decisions.
- However, no observation how adoption decisions are taken.

2 Overview on methods to explore user needs for EV (ii)



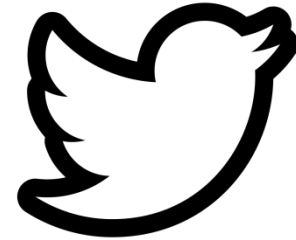
- ***Analysis of sales documentations*** could be an option to find out about how adoption decisions are taken.

- However, intimately personal factors are not accounted for.



- ***Laboratory experiments*** could be useful to evaluate the impacts of intimately personal factors.

- However, limited number of participants.



- Several thousand data sets can be analyzed by ***social media analytics*** in order to gain insight about collective opinions and trends.

3 Selected case study results

■ Analysis of data from...

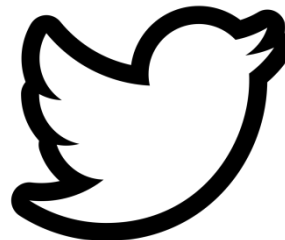
■ surveys



■ sales documentations



■ social media data



3.1 Analysis of survey data (i)

■ Data:

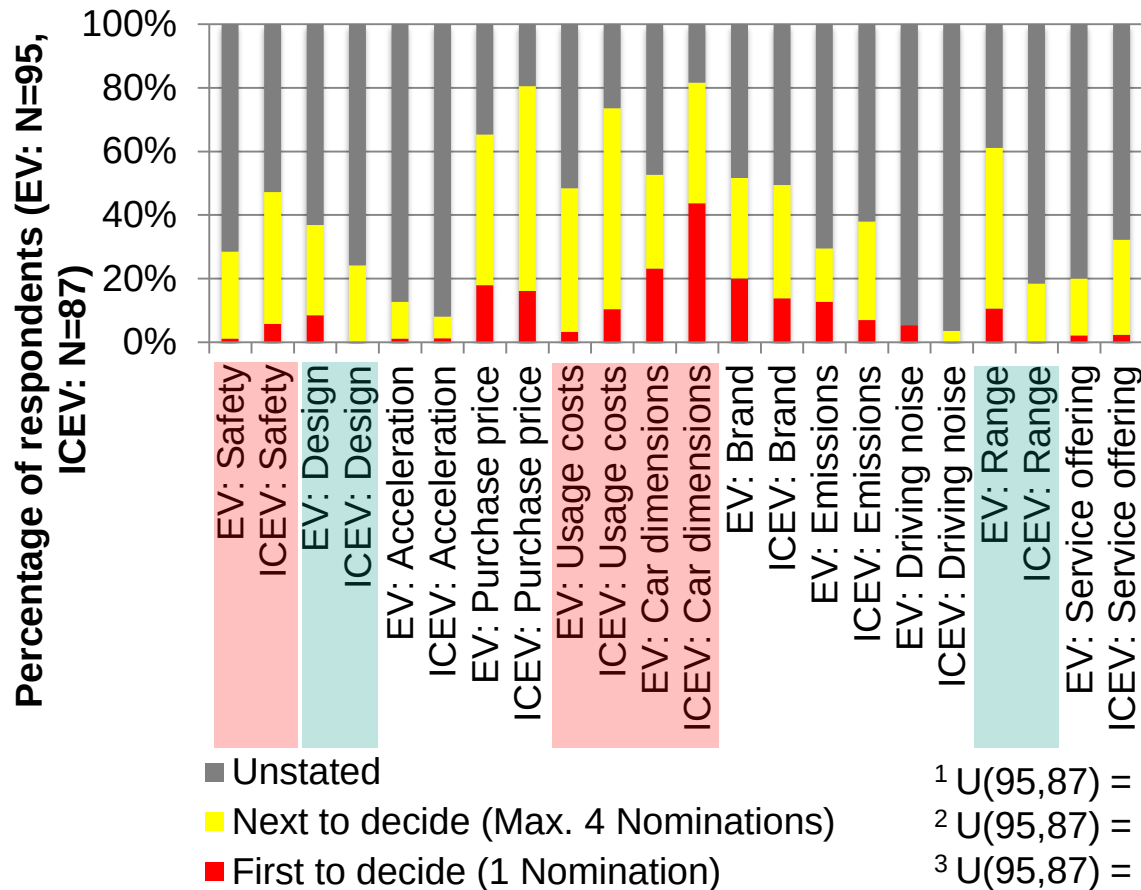
- Field trial with 327 EV in the south-western part of Germany.
- Online questionnaire.
- 109 organizational fleet managers.

■ Method:

- Selection of purchase decision criteria relevant when purchasing EV and conventional cars (ICEV).
- Application of Mann-Whitney U tests for statistical hypothesis testing.

3.1 Analysis of survey data (ii)

Results:



Safety¹, car size² and usage costs³ are significantly less relevant.

Contrariwise, design⁴ and range⁵ are more relevant.

¹ $U(95,87) = 4,952.5$; $Z = 2.732$; $p = .006$; $r = 0.20$

² $U(95,87) = 5,499$; $Z = 4.083$; $p < .001$; $r = 0.30$

³ $U(95,87) = 5,282.5$; $Z = 3.664$; $p < .001$; $r = 0.27$

⁴ $U(95,87) = 3,523.5$; $Z = -2.128$; $p = .033$; $r = -0.16$

⁵ $U(95,87) = 2,289.5$; $Z = -6.005$; $p < .001$; $r = -0.45$

3.2 Analysis of data from sales protocols (i)



■ Data:

- Sales protocols for e-mobility product service systems (PSS).
- E-mobility project in south-western Germany.
- Dataset of 229 organizations.

■ Method:

- Identification and categorization of potentially relevant information.
- Binary logistic regression analysis.
- Objective: Explanations for individual e-mobility PSS adoption decisions.

3.2 Analysis of data from sales protocols (ii)



■ Results:

Nominal variables	Potentially relevant characteristics	Regression results ¹	
	Percentages	B	Sig.
Decision to participate in the field trial	Positive: 50.22 %; Negative: 30.57 %; None: 19.21 %	Endogenous variable	
Democratization level	High: 15.5 % Low: 84.5 %	-	-
Formalization level	High: 29.1 % Low: 70.9 %	0.704	0.091
Metric variables	M	B	Sig.
Days between letter of intent & contract / rejection	122	-0.012	0.000
Total number of contacts	10.21	-	-
Number of reminder contacts	0.62	0.585	0.015
Number of proactive contacts	0.17	1.040	0.089
Number of contacts to persuade	0.37	0.782	0.021
Number of formal contacts	5.03	0.165	0.071
Number of contacts to arrange appointments	3.20	-	-
Number of failed contact attempts	0.8	-	-
Organizations' number of employees	955	-	-
Organizations' founding year	1979	-	-

- Half of the organizations decided to participate.
- Substantial amount of explanatory support and time needed.
- Low levels of democratization and formalization.
- Project participation correlates positively with formalization level, number of contacts and negatively with time for decision-making.

3.3 Analysis of social media data (i)

■ Data:

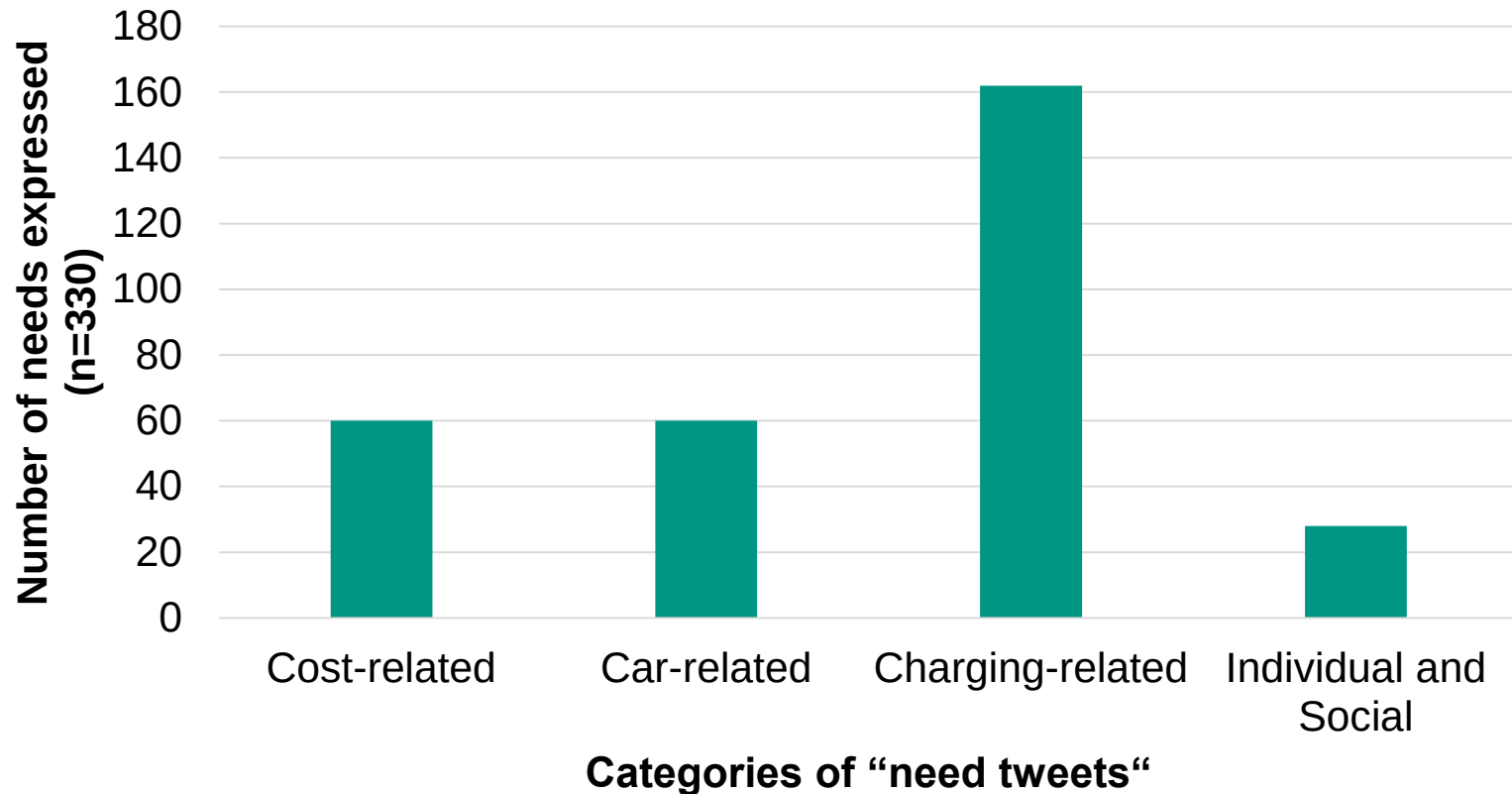
- 2,400 relevant German tweets.

■ Method:

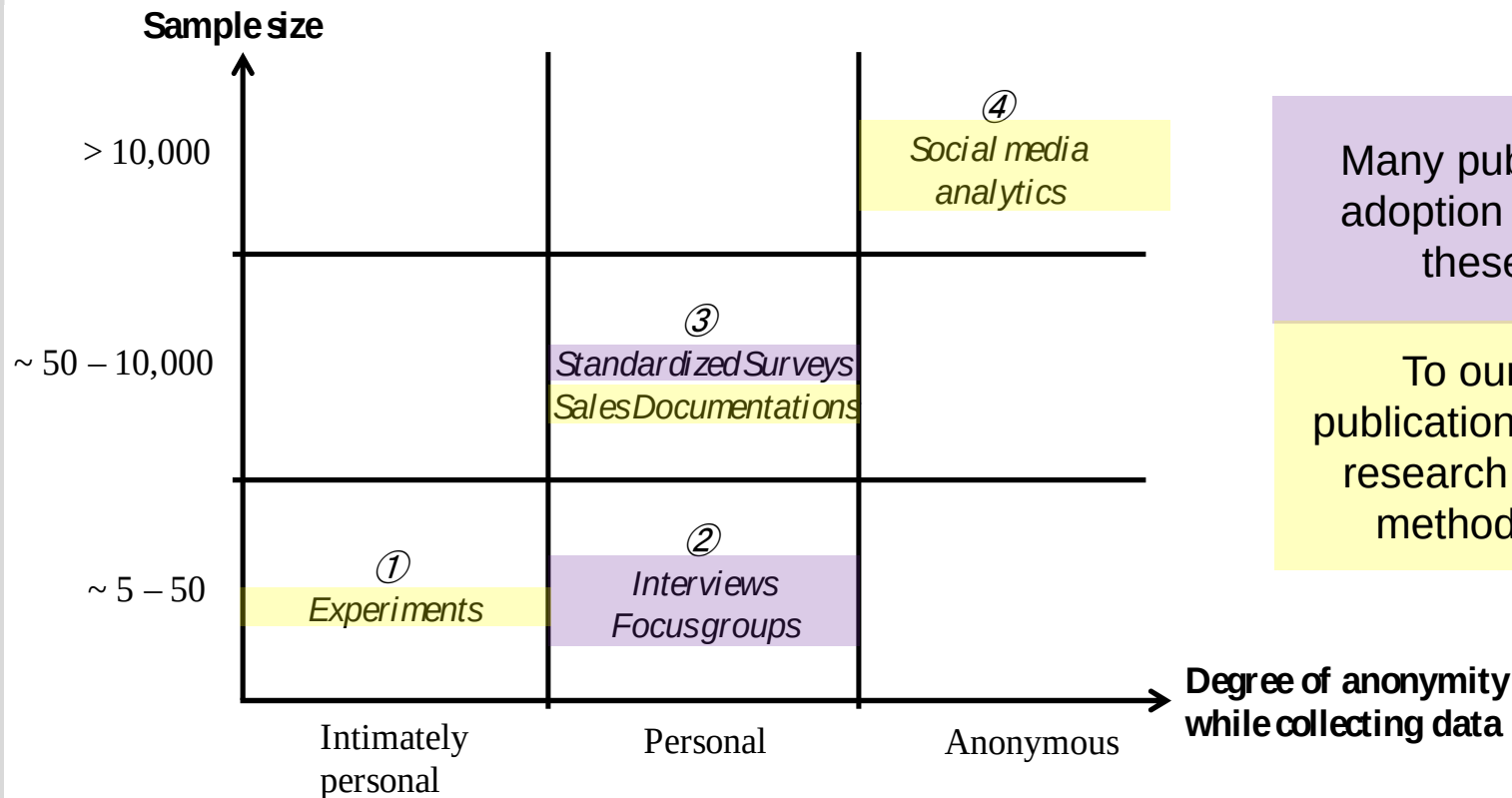
- Tweets labelled by 35 paid individuals on whether or not they contain a need. Labelers agreed on 330 tweets expressing needs.
- These were labeled again on the general need category.

3.3 Analysis of social media data (ii)

■ Results:



4 Discussion



Many publications in EV adoption research apply these methods.

To our knowledge publications in EV adoption research applying these methods are scarce.

- It might be beneficial to support results from traditional methods by results from innovative methodological approaches.

5 Limitations, conclusion and outlook

■ Limitations

- We do not claim to cover the complete set of methods available.
- Case study specific limitations.

■ Conclusion

- Early market phase of products: experiments, interviews and focus groups.
- Already established products: Representative surveys.
- Support results by insights from sales documentation and social media analytics.

■ Outlook

- Improving algorithms for analyzing sales documentations and data from social media.
- Automatization of machine learning methods.

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Thank you.

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