Experiences of EV Users in the French-German context

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Agenda

- Cross-border Mobility for EVs (CROME)
- Fleet test sample description
- Hypotheses
- Methods
- Results
- Conclusion
Cross-border Mobility for EVs

- So far: No interoperability of charging infrastructure:
  - Hardware interoperability not fulfilled
  - Software (service) interoperability not fulfilled
    - Authentication
    - Roaming
    - Billing

- This makes cross-border activity with EV complicated.
**EV models used**

- Online survey of experienced EV users (French and German)
- N=161 respondents using 63 EV
- Data collection period: September 2012 – May 2013

![Pie chart showing EV models and their allocations]

**Figure 1:** EV models the respondents have been using and their corresponding allocations

- Similar distribution of EV users using Smart ED and other EV.
Similar sector- and country specific distribution of EV users participating in the survey.

Figure 2: EV users by country and sector
Figure 3: Respondents’ level of education (n=156)

- French respondents: Higher share of Bachelor or Master degrees.
- German respondents: Higher share with completed vocational education.
Residential municipality size

Figure 4: Respondents’ residential municipality size by country (n=153)

- **French respondents**: Likely to live in big and small municipalities.
- **German respondents**: Likely to live in municipalities with 5,000 - 100,000 citizens.
Hypotheses

Differences between respondents answers according to country of origin and size of the home municipality are observable, particularly concerning…

a) … respondents’ beliefs, attitudes and norms.

b) … levels of satisfaction with EVs’ different characteristics.
Methods

- In order to determine respondents’ beliefs, attitudes and norms, 19 items have been answered.

- Principal component analysis determined the following dimensions (Cronbach’s Alpha / Explained variance of factor)
  
  i. Affinity towards innovations (0.888 / 18.16%)
  
  ii. Attitude towards EV (0.832 / 15.29%)

  iii. Perceived public image of EV (0.793 / 14.79%)
  
  iv. Worries concerning climate change impacts (0.801 / 11.70%)

  i. Price sensitivity (0.506 / 7.60%)

- Differences in the samples have been determined with
  
  i. Nonparametric Mann-Whitney Tests
  
  ii. Independent-Samples T-Tests

<table>
<thead>
<tr>
<th>Cronbach’s alpha</th>
<th>Internal consistency</th>
</tr>
</thead>
<tbody>
<tr>
<td>α ≥ 0.9</td>
<td>Excellent</td>
</tr>
<tr>
<td>0.7 ≤ α &lt; 0.9</td>
<td>Good</td>
</tr>
<tr>
<td>0.6 ≤ α &lt; 0.7</td>
<td>Acceptable</td>
</tr>
<tr>
<td>0.5 ≤ α &lt; 0.6</td>
<td>Poor</td>
</tr>
<tr>
<td>α &lt; 0.5</td>
<td>Unacceptable</td>
</tr>
</tbody>
</table>
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Attitudes / beliefs / norms (country)

Figure 5: Respondents’ attitudes according to their country (n=161)

- French respondents have comparably more worries about climate change impacts and a higher affinity towards innovations.
- German respondents’ perceived public corporate image of EV is higher.
Figure 6: Respondents’ attitudes according to the size of their home municipality (n=153)

- Respondents living in municipalities with more than 20,000 citizens have comparably more worries about climate change impacts.
Respondents grouped in cluster with a higher degree of satisfaction with EVs’ characteristics show higher scores concerning attitude towards EV.
Satisfaction according to country

- High degree of satisfaction with EVs‘ environmental characteristics.
- Medium degree of satisfaction with EVs‘ range and trunk space.

Figure 8: Arithmetic means of respondents’ degree of satisfaction with different characteristics of the EV according to their country (n=146)
Figure 9: Arithmetic means of respondents’ degree of satisfaction with different characteristics of the EV according to the size of their home municipality (n=139)

- Ambiguous evaluations concerning EVs’ sound characteristics.
  - Road safety vs. pleasant driving sound.
Convincing people to use EV in rather urban areas could be easier.

But: In cities ...
   - the parking situation is more restrictive.
   - households are less likely to have a second or third car.
   - car dependency and mileage is lower $\rightarrow$ Unfavorable TCO.

Recommendations:
   - Further development of E-car-sharing concepts in urban areas.
   - Necessity of a ‘system backbone’ managing communication between market participants (e.g. users, carsharing providers, charging service providers) in order to integrate different service providers’ systems and to offer user friendly interoperable solutions.

emones that interoperability of charging infrastructure is possible, even in the cross-border context.
Thank you.
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### Results of principal component analysis

<table>
<thead>
<tr>
<th>Component</th>
<th>1&lt;sup&gt;a&lt;/sup&gt;</th>
<th>2&lt;sup&gt;b&lt;/sup&gt;</th>
<th>3&lt;sup&gt;c&lt;/sup&gt;</th>
<th>4&lt;sup&gt;d&lt;/sup&gt;</th>
<th>5&lt;sup&gt;e&lt;/sup&gt;</th>
<th>Communalities</th>
<th>Measures of sampling adequacy (MSA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>It worries me when I think about the environmental conditions under which our children and grandchildren will probably have to live.</td>
<td>0.14</td>
<td>0.11</td>
<td>0.16</td>
<td>0.80</td>
<td>0.11</td>
<td>0.71</td>
<td>0.78</td>
</tr>
<tr>
<td>If we continue with business as usual, we are heading towards an environmental catastrophe.</td>
<td>0.01</td>
<td>0.05</td>
<td>0.04</td>
<td>0.87</td>
<td>0.01</td>
<td>0.75</td>
<td>0.73</td>
</tr>
<tr>
<td>The citizens can make significant contributions to climate protection by environmentally conscious everyday behavior.</td>
<td>0.06</td>
<td>0.17</td>
<td>0.11</td>
<td>0.81</td>
<td>0.05</td>
<td>0.71</td>
<td>0.74</td>
</tr>
<tr>
<td>I am very excited about technologies</td>
<td>0.71</td>
<td>0.28</td>
<td>0.08</td>
<td>0.02</td>
<td>0.11</td>
<td>0.61</td>
<td>0.83</td>
</tr>
<tr>
<td>I constantly do research on new technical developments.</td>
<td>0.81</td>
<td>0.24</td>
<td>0.06</td>
<td>0.11</td>
<td>0.12</td>
<td>0.75</td>
<td>0.86</td>
</tr>
<tr>
<td>I like to try new products and technical innovations, even if they are not yet as widespread.</td>
<td>0.82</td>
<td>0.20</td>
<td>0.14</td>
<td>0.13</td>
<td>0.00</td>
<td>0.74</td>
<td>0.86</td>
</tr>
<tr>
<td>I often look for information about new products and brands.</td>
<td>0.87</td>
<td>0.01</td>
<td>0.17</td>
<td>0.10</td>
<td>0.09</td>
<td>0.80</td>
<td>0.82</td>
</tr>
<tr>
<td>I am often one of the first persons in my circle of friends and acquaintances, who is getting new technologies as soon as they appear on the market.</td>
<td>0.81</td>
<td>-0.02</td>
<td>0.12</td>
<td>-0.05</td>
<td>0.01</td>
<td>0.67</td>
<td>0.78</td>
</tr>
<tr>
<td>When I purchase products I compare them first and then buy the cheapest.</td>
<td>0.08</td>
<td>-0.09</td>
<td>0.07</td>
<td>0.00</td>
<td>0.84</td>
<td>0.73</td>
<td>0.50</td>
</tr>
<tr>
<td>When I buy a product I always try to buy the maximum quality at the lowest possible price.</td>
<td>0.12</td>
<td>0.19</td>
<td>-0.05</td>
<td>0.15</td>
<td>0.72</td>
<td>0.60</td>
<td>0.71</td>
</tr>
<tr>
<td>Using the electric car is easy</td>
<td>0.13</td>
<td>0.75</td>
<td>0.12</td>
<td>0.21</td>
<td>0.03</td>
<td>0.63</td>
<td>0.81</td>
</tr>
<tr>
<td>The electric car is useful in everyday life.</td>
<td>0.09</td>
<td>0.86</td>
<td>0.15</td>
<td>0.09</td>
<td>-0.02</td>
<td>0.78</td>
<td>0.78</td>
</tr>
<tr>
<td>The electric car is environmentally friendly.</td>
<td>0.12</td>
<td>0.28</td>
<td>0.52</td>
<td>0.14</td>
<td>0.23</td>
<td>0.43</td>
<td>0.85</td>
</tr>
<tr>
<td>The electric car excites me.</td>
<td>0.16</td>
<td>0.80</td>
<td>0.24</td>
<td>0.05</td>
<td>0.00</td>
<td>0.73</td>
<td>0.77</td>
</tr>
<tr>
<td>I prefer driving an electric car to driving a conventional car.</td>
<td>0.17</td>
<td>0.74</td>
<td>0.19</td>
<td>0.06</td>
<td>0.12</td>
<td>0.73</td>
<td>0.78</td>
</tr>
<tr>
<td>The use of electric car is good for the company's image.</td>
<td>0.07</td>
<td>0.11</td>
<td>0.79</td>
<td>0.06</td>
<td>0.23</td>
<td>0.71</td>
<td>0.81</td>
</tr>
<tr>
<td>My colleagues / employees think it is good, that we use electric cars.</td>
<td>0.07</td>
<td>0.17</td>
<td>0.68</td>
<td>0.05</td>
<td>-0.18</td>
<td>0.54</td>
<td>0.79</td>
</tr>
<tr>
<td>By using electric cars our company adopts a pioneering role.</td>
<td>0.12</td>
<td>0.14</td>
<td>0.81</td>
<td>0.02</td>
<td>-0.01</td>
<td>0.70</td>
<td>0.84</td>
</tr>
<tr>
<td>Our company is interested in that innovations like the electric car establish themselves on the market.</td>
<td>0.19</td>
<td>0.12</td>
<td>0.73</td>
<td>0.17</td>
<td>-0.10</td>
<td>0.62</td>
<td>0.81</td>
</tr>
</tbody>
</table>


Outlook

- User specific cross-analysis between objectively measured trip data originating from data loggers and subjective data originating from surveys.

- Evaluation of respondents’ willingness to further adopt EV (future usage as well as private purchase intention) after a longer period of using EV.