

The road to illumination: A research on intelligent street lighting

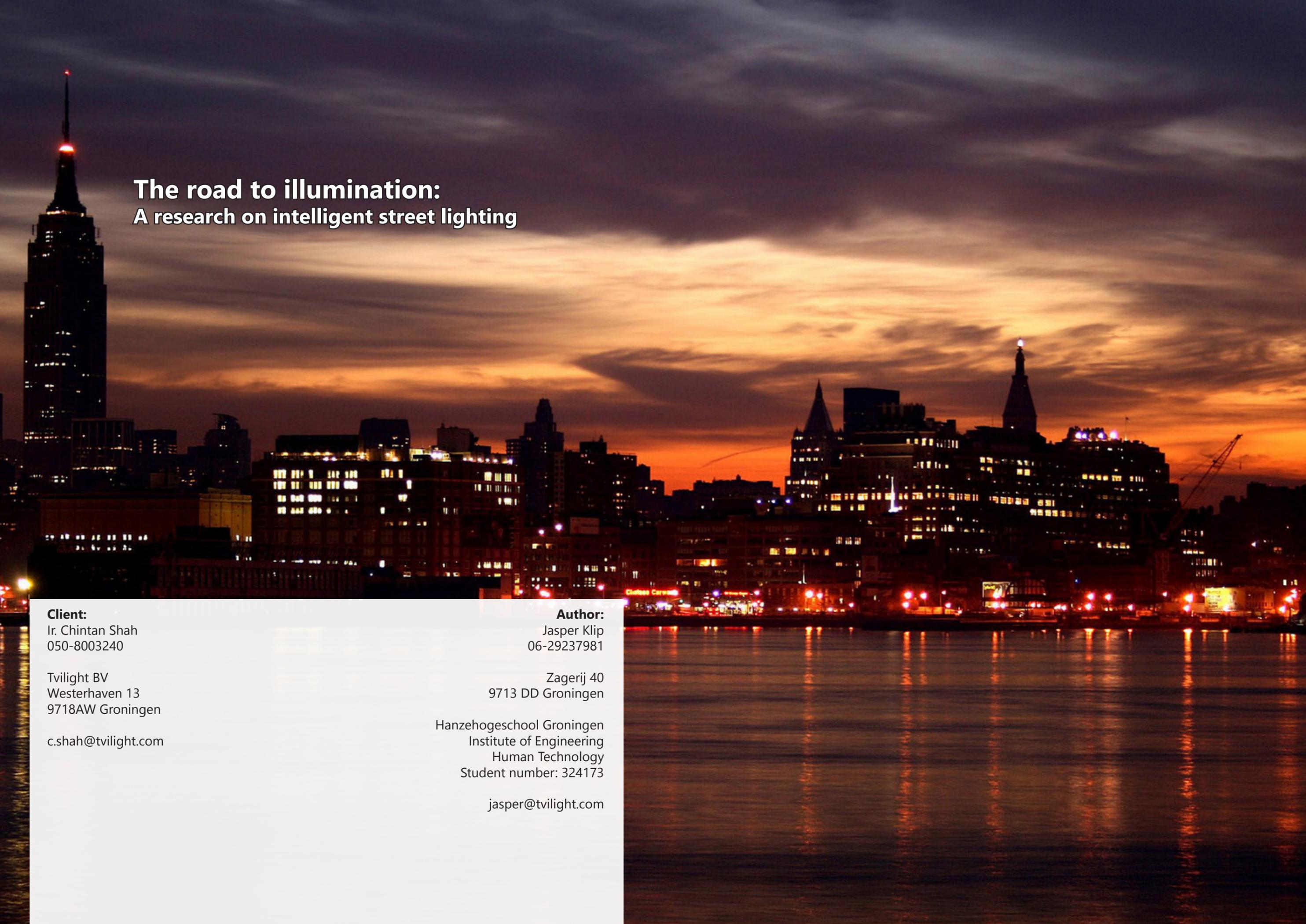
Advisory report

Intelligent street lighting

Twilight
Hanzehogeschool Groningen

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The road to illumination: A research on intelligent street lighting

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Advice

In this advisory report, the advices for Twilight regarding their intelligent street lighting solution can be found. These advices are based on the results and conclusions that can be found in de research report.

The following question was at the center of the research report:

What are the requirements and wishes of the future users of Twilight's intelligent streetlight solution?

The answer to the main question is that the requirements will differ between the different user groups. Municipalities have a responsibility for their inhabitants. For them, safety and being able to perceive and orientate are the most important factors. Intelligent street lighting can provide this, because the settings of every individual light can be changed.

Then there is the question of cost, for municipalities this is almost equally important. The system is bought with tax payer's money, so they have to answer for expenses that seem unnecessary. Intelligent street lighting could be one of those things, as the investment might not have paid for itself in five or even ten years.

"If you ask me, sensor-based dimming is mainly suitable in low-traffic areas with only bicycle paths or nature. We rather don't light those areas at all" – Interview 1

There are (mostly larger) municipalities for which costs are less big of an obstacle and choose to install it because of the secondary benefits: reduction of light pollution or reduction of energy use and greenhouse gas emissions.

The areas where companies or industrial areas want to install intelligent lighting are often different from municipalities. This means that their requirements are different. Parking lots require a different kind of lighting if you want to dim it. It could mean that lights will have a higher luminosity where parking spots are not in use. Or they may want to register traffic density on a given route. This could mean that a different piece of hardware needs to be installed in the dimmer.

For the users of the road it is important that they feel safe and that they can perceive well. Research shows a clear preference for dynamic light distributions in which the pedestrian's own location rather than the direct surroundings is illuminated. This suggests that pedestrians prefer a light distribution in which their personal and action space (<30m) is illuminated rather than their vista space (>30m).

There should be further research in what car drivers prefer.

Municipalities

Since the requirements differ from user group to user group it is recommended to approach the different user groups in a different way.

Safety

The primary user group are municipalities. (Social) safety and payback time are the most important factors for them as is seen in the results of the research report. The focus should be on these aspects of the intelligent street lighting solution.

Municipalities have a responsibility for their citizens and adequate lighting is a big part of this. Lighting has shown to be an important physical environmental feature that has influence on crime rates an perceived personal safety and significantly reduces crime. Public lighting is especially important in residential areas. Dutch research showed that less criminal activities were reported in settings with higher luminance. These results also show that street lighting increases personal perceived safety of pedestrians. This feeling of safety can be explained by less ability for offenders to hide and the ability to flee.

The fear of crime is a much bigger problem than crime itself; one in six of the Dutch population report that they occasionally feel unsafe in their own neighborhood. Fear of crime affects more people than actual crime does.

Fear causes a stress reaction in order to be able to cope or avoid a threatening situation. Fear of crime threatens people's quality of life and restricts mobility.

The use of strategically placed lighting can increase perceived personal safety because bright and accurate diffused lighting has the ability to





reduce shadows and eliminate dark spots.

Payback time

Most municipalities have to work with a tight public lighting budget. This results in little room to invest in experiments, especially if they will not have their investment returned in five to ten years.

"It takes no less than 10 years to get your investment back, so if you want to install intelligent streetlights, you have to do it for light pollution and your image. But nowadays we don't have a lot of money and the euro's that we have could be better spent, for replacing our old stuff." –Interview 4

Here lies the opportunity: offer a basic option with less features and a lower price point. While still providing the basic benefits: a safe environment, less light pollution, energy use and CO₂ emission, it is also cheaper and easier for municipalities to invest in.

While still being offered the choice to add advanced features, they are not bound to buy an expensive product or bypass it completely. This could be done with a basic intelligent system with only sensors for movement detection and a basic software license, all the way up to a fully equipped option.

Advanced features like traffic density monitoring, weather control and advanced software features will not directly affect safety, but it has an impact on the price point of the product. Offering the option to not buy these features would help in convincing municipalities that this intelligent solution is worthwhile.

If removal of premium features keeps the payback time under ten years or lower, it should be a much more considered option for municipalities to look into.

Companies

Further research into companies' requirements and wishes regarding intelligent street lighting is recommended. This research was focused on municipalities, but companies or industrial areas (e.g. ports) are also likely potential future users. Their requirements might differ from those of municipalities.

Companies might be more interested in the advanced features like traffic density monitoring. The information gathered by the intelligent street lighting could be used to streamline the schedules for transport, etc.

As it is with municipalities, safety would also be important for companies, but the payback time might be less important.

Customizability

Another way to meet different requirements, is to offer customizable feature sets. The customer would be able to pick which features he needs or tune the feature set to how much he can afford to pay.

Customizable features could include, but are not limited to:

- Traffic density monitoring (software feature)
- Weather control (sensor based)
- Maintenance control (sensor based & software feature)
- Traffic light coupling (sensor based & software feature)
- Energy savings data (software feature)

Some of these features are already implemented in the current product or are on the roadmap for future versions of the product. Traffic density monitoring and traffic light coupling were mentioned in conversations with public lighting experts.

To sum this advice up:

- Offer different feature packages or
- Offer basic product with customizable add-on features

Future research

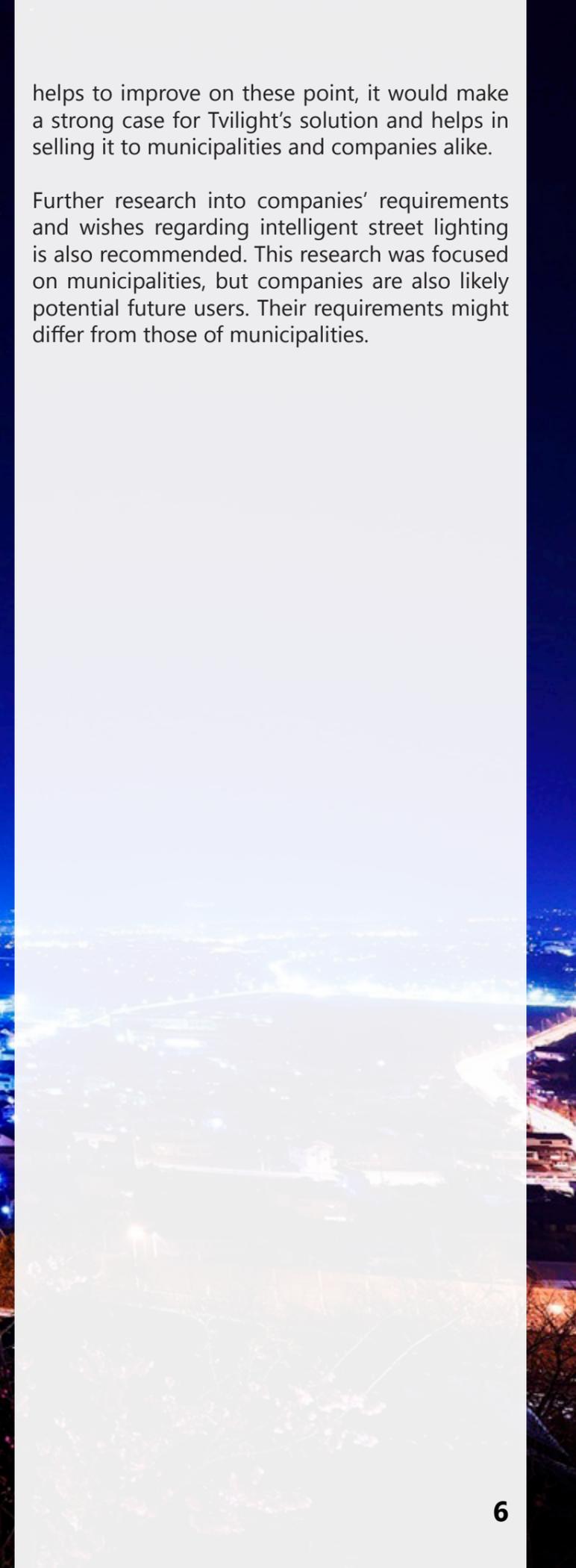
The costs and benefits of Twilight's intelligent system is not entirely clear. There was not enough transparency in what municipalities pay for energy for their public lighting and what exactly Twilight's system costs. Hard numbers of the benefits could help with selling the product, so it would be helpful if this was researched.

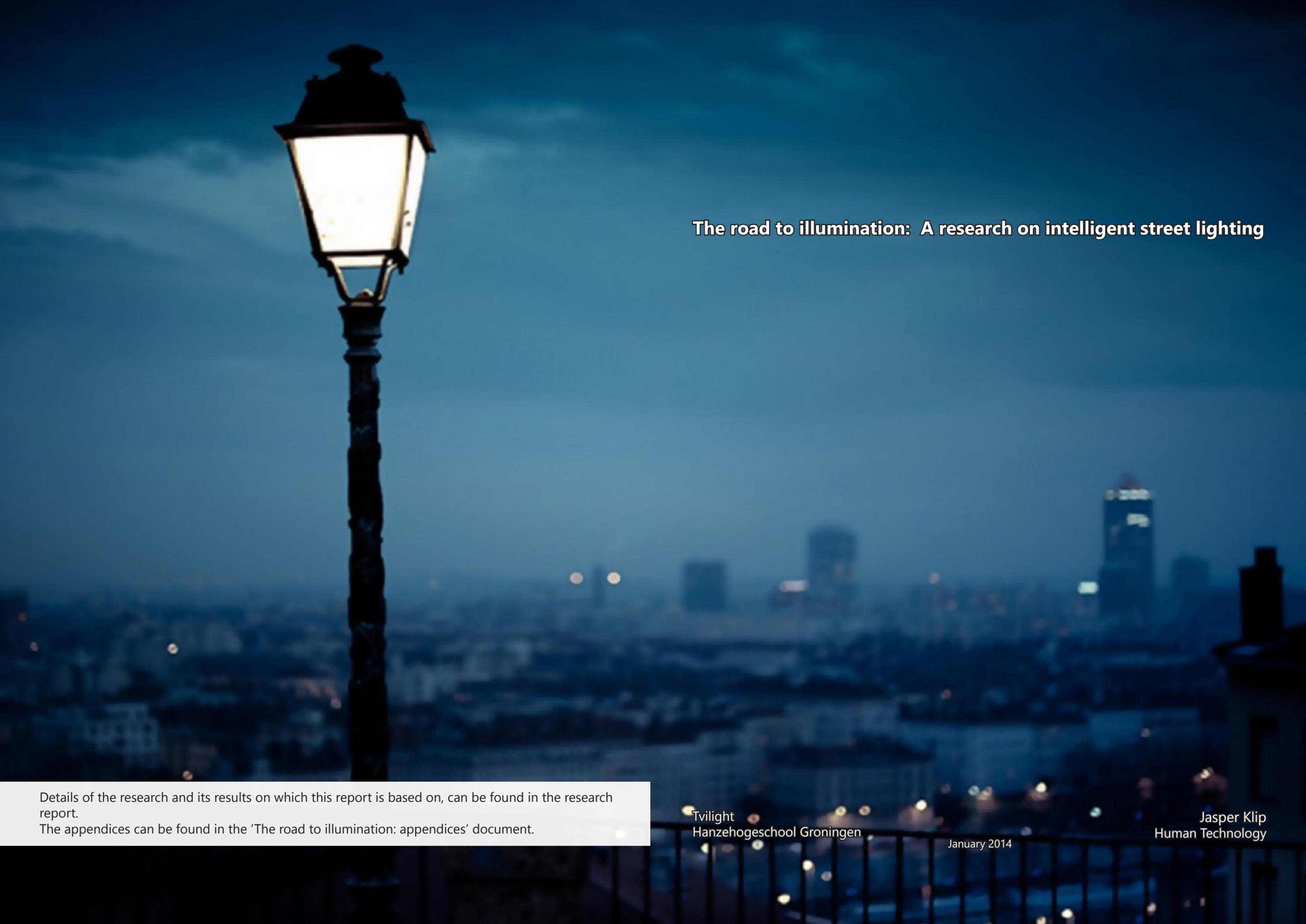
It is recommended to find out more about how people react to intelligent street lighting once it is installed in their neighbourhood. These are the people that use the streets on a daily bases and need to feel safe and should be able to perceive and orientate. If intelligent street lighting



helps to improve on these point, it would make a strong case for Twilight's solution and helps in selling it to municipalities and companies alike.

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A glowing street lamp in the foreground against a twilight cityscape background. The lamp is on the left side, and the city lights are visible in the distance under a dark blue sky.

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Details of the research and its results on which this report is based on, can be found in the research report.
The appendices can be found in the 'The road to illumination: appendices' document.

Tviligt
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