

THE POTENTIAL IMPACTS OF LUAS (Dublin Light Rail System) ON TRAVEL BEHAVIOUR

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Transport problems

The Irish Government is determined to provide a better, effective and more convenient transport for everyone, no matter where they live. It is recognised that the impact of transport on the environment is crucial. One way to try and control road traffic growth in Dublin is through the introduction of a new light rail transit system called LUAS.

Predicting the impacts of this system on travel behaviour is complicated, in particular given the lack of experience of this type of mode in Ireland.

The LUAS system can potentially impact:

- **Land use;**
- **Travel demand;**
- **Traffic and;**
- **Travel behaviour.**

This paper will only focus on travel behaviour.

Study Objectives

- **Find out what people's beliefs would be for Luas.**
- **Discover how these beliefs would determine their attitudes, subjective norms and perceptions of behavioural control.**
- **Show how these factors could affect people's decisions to use Luas (demand for Luas) and the associated changes to people's travel behaviour.**
- **Examine whether people's beliefs, attitudes, subjective norms and perceived behavioural control could play a role in predicting their use of new public transport.**

In the past, there has been widespread evidence for discrepancies between the forecasts of patronage on the new urban public transport systems and the actual patronage.

For example, in the forecasts for Manchester Metrolink and Sheffield Supertram systems, there were errors in the predictions in the number of people using the systems due to incorrect representation of supply conditions at the time of opening.

Forecasting studies of Sheffield Supertram

- Supertram opened in 1994.
- Population of 500,000. Unemployment levels: 12.5%
- The system cost £240.6 million.
- The studies of the Supertram was carried out by MVA consultancy and WS Atkins –
- Predicted 22 million passengers per year – only got 6.3 million passengers per year.-
- More non-work trips than expected.
- Predicted 14.9 million trips would transfer from bus to Supertram – actual transfer amount 1.2 million trips.
- Predicted 0.8 million trips would shift from car to Supertram – actual shift was 1.2 million trips.

Forecasting studies of Manchester Metrolink

- **The Manchester Metrolink studies was carried out by Oscar Faber in 1992.**
- **Cost £140 million.**
- **Annual patronage 12.4 million – predicted 11.4 million.**
- **Trip to the city center on two lines of the Metrolink were lower than expected:**
 - **Bury line trips were 23% lower than expected for some stations**
 - **Altrincham line to the city center were between 12% and 14% lower than expected for some stations.**
- **Off-peak patronage much higher than expected.**

In these cases, the forecasting studies pointed out that there were problems with the assumptions made about the behavioral responses of potential users to the new public transport systems.

For this reason, it was decided to examine the potential impacts of the new LUAS system on the travel behaviour of the people in Dublin using a method called the Theory of Planned Behaviour.

The Theory of Planned Behaviour states:

- **Human action is guided by three kinds of considerations:**
 - behavioural beliefs,
 - normative beliefs
 - and control beliefs.

All behaviour is determined by intention to carry it out.

- **Intention is a function of three factors:**
 - attitude toward the behaviour,
 - subjective norm and
 - perceived behavioural control.

The combination of these three lead to the formation of behavioural intention.

- **Attitudes, perceptions of what other people think and perceptions of how easy an action is to carry out, determines whether someone will choose to carry out the given behaviour.**

Lets look at the three factors that involve in decision making.

Attitude

- Behavioural beliefs
- Outcome evaluations

I believe that using the light rail transit system called LUAS will save time when I go to work.

3 2 1 0 -1 -2 -3

3 = Agree strongly, -3 = Disagree strongly

Saving of time when I go to work is:

3 2 1 0 -1 -2 -3

3 = Very important, -3 = Very unimportant

$$A = \sum (BB * OE)$$

Where: A = Attitude

BB= Behavioural beliefs

OE= Outcome evaluation

Subjective norms

- Normative beliefs
- Motivation to comply

My family think that I should use LUAS for all trips, because it will reduce traffic congestions in Dublin.

3 2 1 0 -1 -2 -3

3 = Agree strongly, -3 = Disagree strongly

In generally, do you want to do what the family wants?

3 2 1 0 -1 -2 -3

3 = Agree strongly, -3 = Disagree strongly

$$SN = \sum NB * MC$$

Where, SN – Subjective norm

NB – Normative belief

MC – Motivation to comply

Perceived Behavioural control

- Control beliefs
- Perceived facilitation effect

When I have a lot to carry walking is

3 2 1 0 -1 -2 -3

3 = Very easy, -3 = Very difficult

I have a lot to carry

3 2 1 0 -1 -2 -3

3 = Always, -3 = never

$$PBC = \sum CB * PFE$$

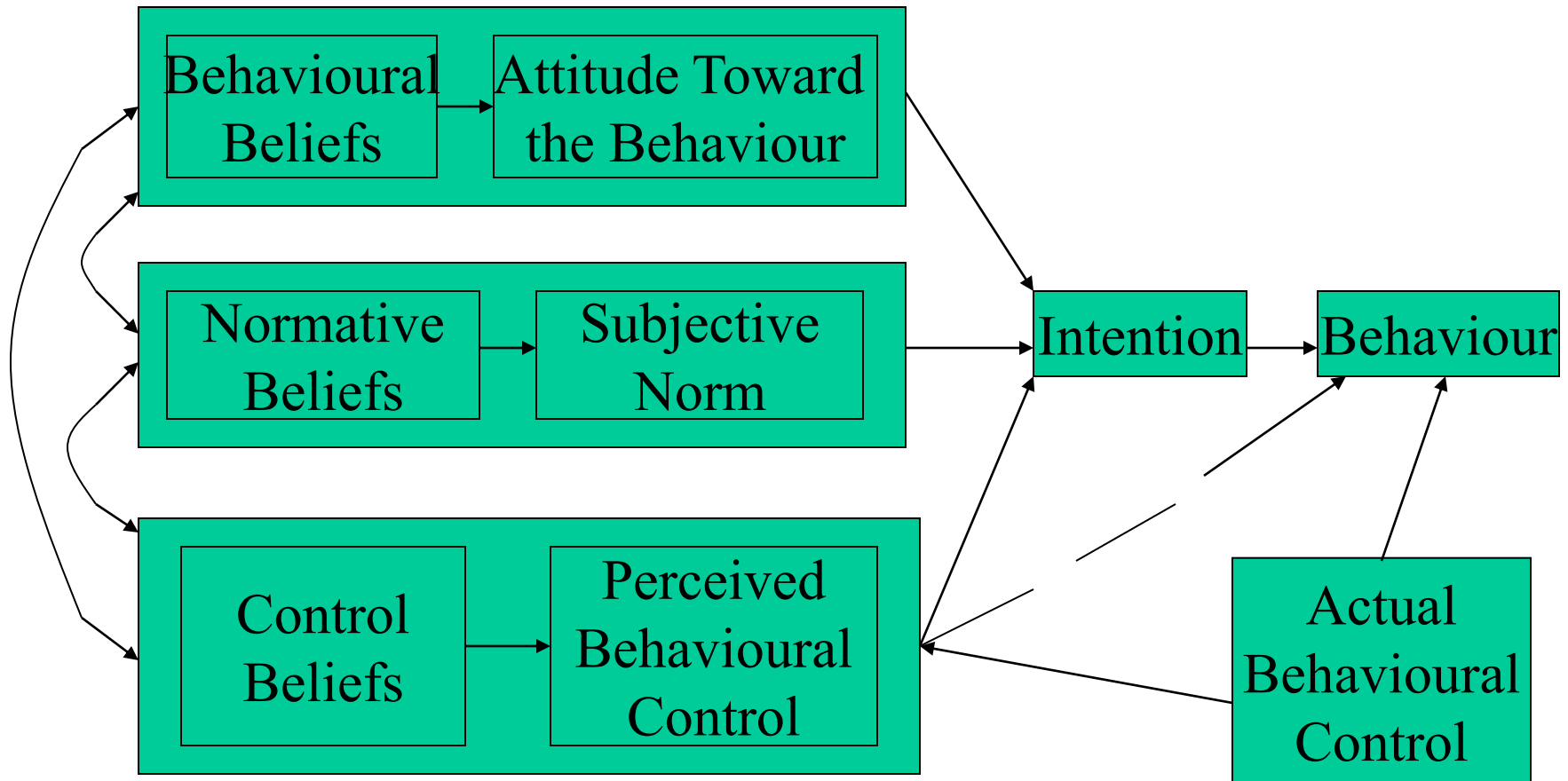
Where, PBC – Perceived behavioural control

CB - Control belief

PFE – Perceived facilitation effect

Diagram: The Theory of Planned Behaviour

Source: Icek Ajzen 2002

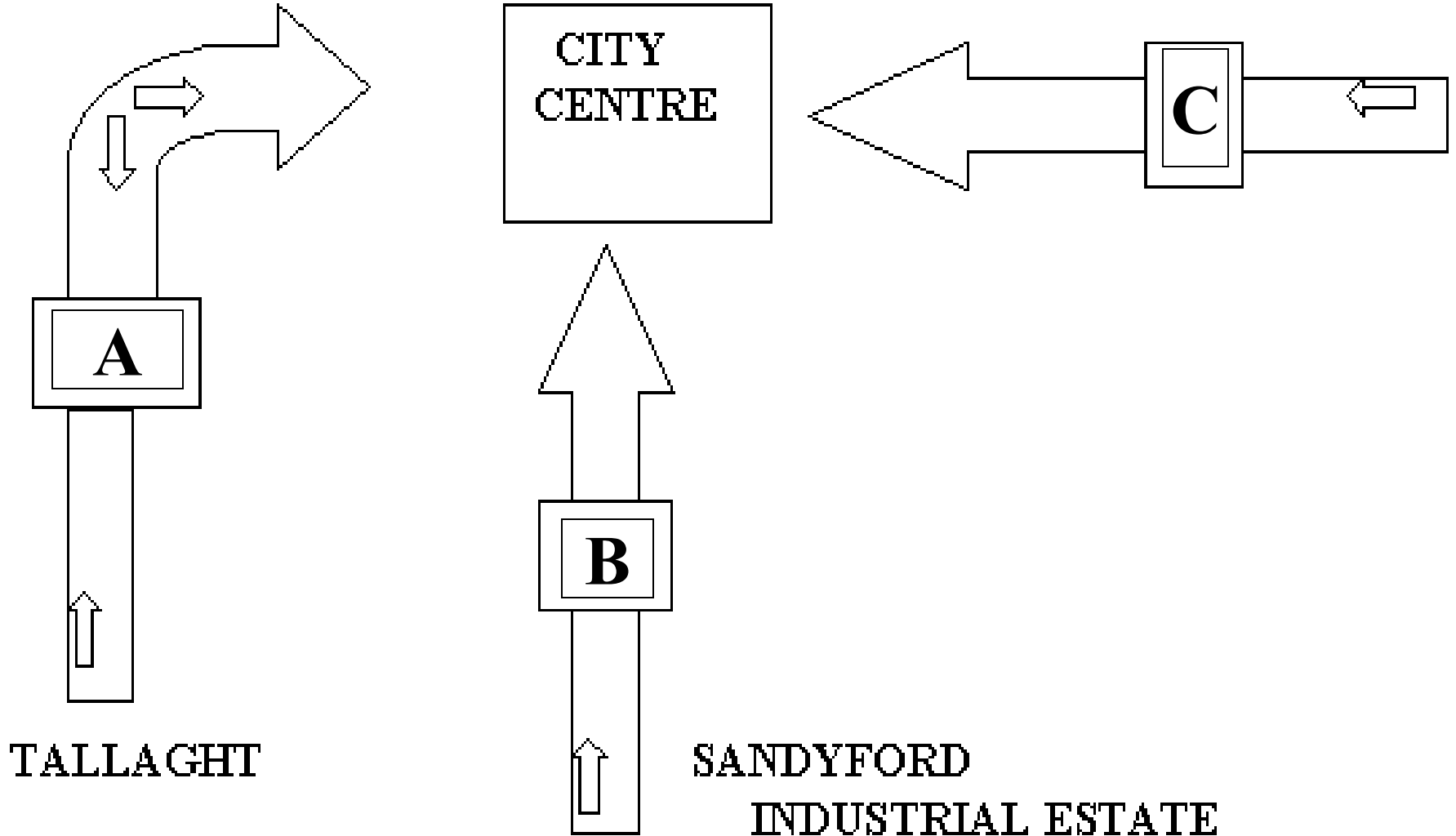


Study

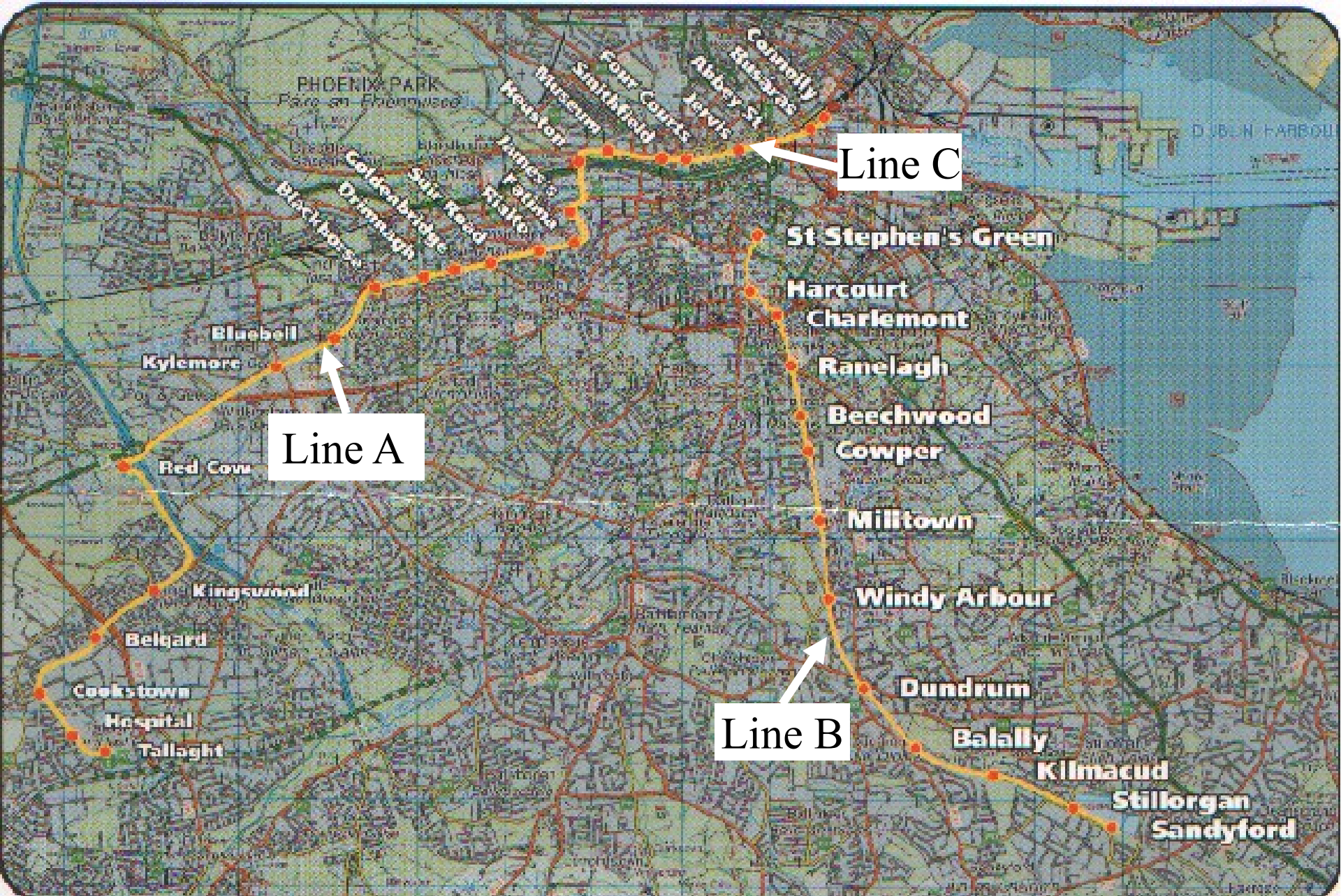
- **Survey of potential users of LUAS**
- **Interviews with potential users of LUAS**

HEUSTON STN.

CONNOLLY STN.



Sketch of LUAS Lines A, B and C



Line A

Line C

Line B

Luas Lines A, B and C

Questionnaire

The questionnaire was designed to measure:

- **The intention of the respondents to use Luas on their commuter trips**
- **People's attitudes to using Luas on commuter trips**
- **People's subjective norms regarding using Luas on commuter trips**
- **People's perceived behavioural control regarding using Luas on Commuter trips**

Scores for the components of the TPB in the study

| Component | Group A (those likely intended to use LUAS) | Group B (those unlikely intended to use LUAS) | Group C (those not decided to use LUAS) |
|--------------------------------------|--|--|--|
| Intention to use Luas | 2.1 | -2.6 | 0.0 |
| Attitude to using Luas | 2.3 | -1.5 | 0.1 |
| Subjective norm | 1.5 | -1.4 | 0.1 |
| Perceived behavioural control | 1.4 | -2.5 | 0.1 |

Scores used in the ordinal regression analysis.

| Original score for attitude, subjective norm, perceived behavioural control and intention | New scores for ordinal regression analysis |
|--|---|
| -3 | -2 |
| -2 | -1 |
| -1 | -1 |
| 0 | 0 |
| 1 | 1 |
| 2 | 1 |
| 3 | 2 |

Behavioural, normative, and control beliefs score between –3 and 3

| I believe that using LUAS on my work trip: | Group | | |
|---|--------------|----------|----------|
| | A | B | C |
| Will improve personal safety | 1.2 | -0.8 | 0.2 |
| Will decrease my chances of being involved in an accident | 1.2 | -0.6 | 1.3 |
| Will save me money | 1.4 | -0.9 | -0.3 |
| Will save me time | 1.8 | -1.3 | 0.5 |
| Will reduce traffic congestion | 1.7 | 0.2 | 0.8 |
| Will be more comfortable | 1.8 | -1.0 | 0.9 |
| Will improve the environment | 2.1 | 0.3 | 1.3 |
| My family thinks it's good for me to use LUAS and I will listen to their advice | 0.8 | -1.0 | 1.5 |
| Dublin Transportation Office (DTO) has issued publicity urging me to use LUAS, but I am not impressed by this publicity and it does not influence my choice | 1.6 | 0.9 | 0.4 |
| My friends think it's a good idea for me to use LUAS and I will listen to their advice | 1.2 | -0.7 | 0.3 |
| I believe that it would be easy to use LUAS to travel to work if: | | | |
| I was in a hurry | 1.6 | -0.9 | 1.1 |
| I was travelling in heavy traffic | 1.8 | -0.7 | 0.5 |
| I lived near LUAS | 2.4 | 0.5 | 1.8 |
| I worked near LUAS | 2.3 | 1.2 | 1.8 |

Regression

- $$S_i = \alpha + \beta x_i + \varepsilon_i$$

Where, S_i – dependent variable (latent variable)

x_i – independent variable

ε_i - stochastic error

α and β - are use as parameters in regression equation

$\tau_1 \dots \tau_{j-1}$ - This is the set of thresholds that is use to transform S_i into the observed variable y according to the equation below:

- $$y = J \text{ if } S_i < \tau_{j-1}$$

Conclusion

From the study using the Theory of Planned Behaviour we are able to understand:

- How travel related factors such as time, comfort, safety etc could play a role when choosing a mode,
- How attitudes and social norms have an impact on people's travel choices
- The impact that constraints (perception of behavioural control) have on the people's travel behaviour and how these impact on their travel decisions.

So, in conclusion some recommendations can be made as to how to promote and patronize Luas, thereby bringing about change in travel behaviour. For the campaign message to be effective, the message should address the identified problems and the negative beliefs of the potential users, so as to change them and improve the impacts of LUAS. The LUAS system, is a dynamic traffic mode.