

30MILES investment planning tool for sustainable small ports

Manual

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Foreword

This document is a user manual for an investment planning tool for supporting sustainable development of small ports. The tool is developed as part of the project 30MILES (*Small port every 30 miles apart – Development of services for lively water tourism in the Eastern Gulf of Finland*) funded by the Interreg Central Baltic 2014–2020 Programme and Regional Council of Southwest Finland.

The 30MILES tool is based on data from the web-based 30MILES query carried out during July - December 2017. The query was conducted to investigate the views and preferences of boating and non-boating clients of the small ports in Finland and Estonia. The respondents were able to choose the perspective to take. One could answer either as a port guest visiting in the area (Query 1) or as a local resident (Query 2). The structure and questions of the queries are documented in the appendix of this manual. We received 492 completed questionnaires. A statistical summary of the answers can be found from the project web pages.

Sustainability is understood as a holistic, three-dimensional concept, searching for a balance between environmental, social and economic perspectives. Each small port is unique in the sense of its profile and location, as well as the current infrastructure and service level. The cost level of even the same investments vary among the small ports. There may also be several entrepreneurs and other actors running the port. For these reasons, the best investments when aiming to build a sustainable small port are always port-specific and sometimes also actor-specific. The purpose of the 30MILES tool is to help the user with finding profitable investments to maximize the customer satisfaction.

30MILES investment planning tool is an influence diagram (ID) model, i.e. a Bayesian network (BN) augmented for decision analytic purposes. It is a .net -file and can be opened with BN software that support utility and decision nodes of the IDs (see for example this list of available software: <https://www.cs.ubc.ca/~murphyk/Software/bnsoft.html>). The tool is constructed using the software Hugin (<https://www.hugin.com/>) and this manual provides detailed instructions for conducting the analyses using that software.

As the full model is quite complex, problems with running it may occur, depending on the software you use or the capacity of your computer. In that case try reducing the number of investments (with their associated nodes) in your analysis. In any case, it is recommendable to include only those investments you are willing to compare and delete the rest. This makes it easier to interpret the results.

This tool can be freely used for non-commercial purposes. For literary citations, ask the undersigned for the latest reference. The background data is available on request.

In Kotka, 31.08.2018

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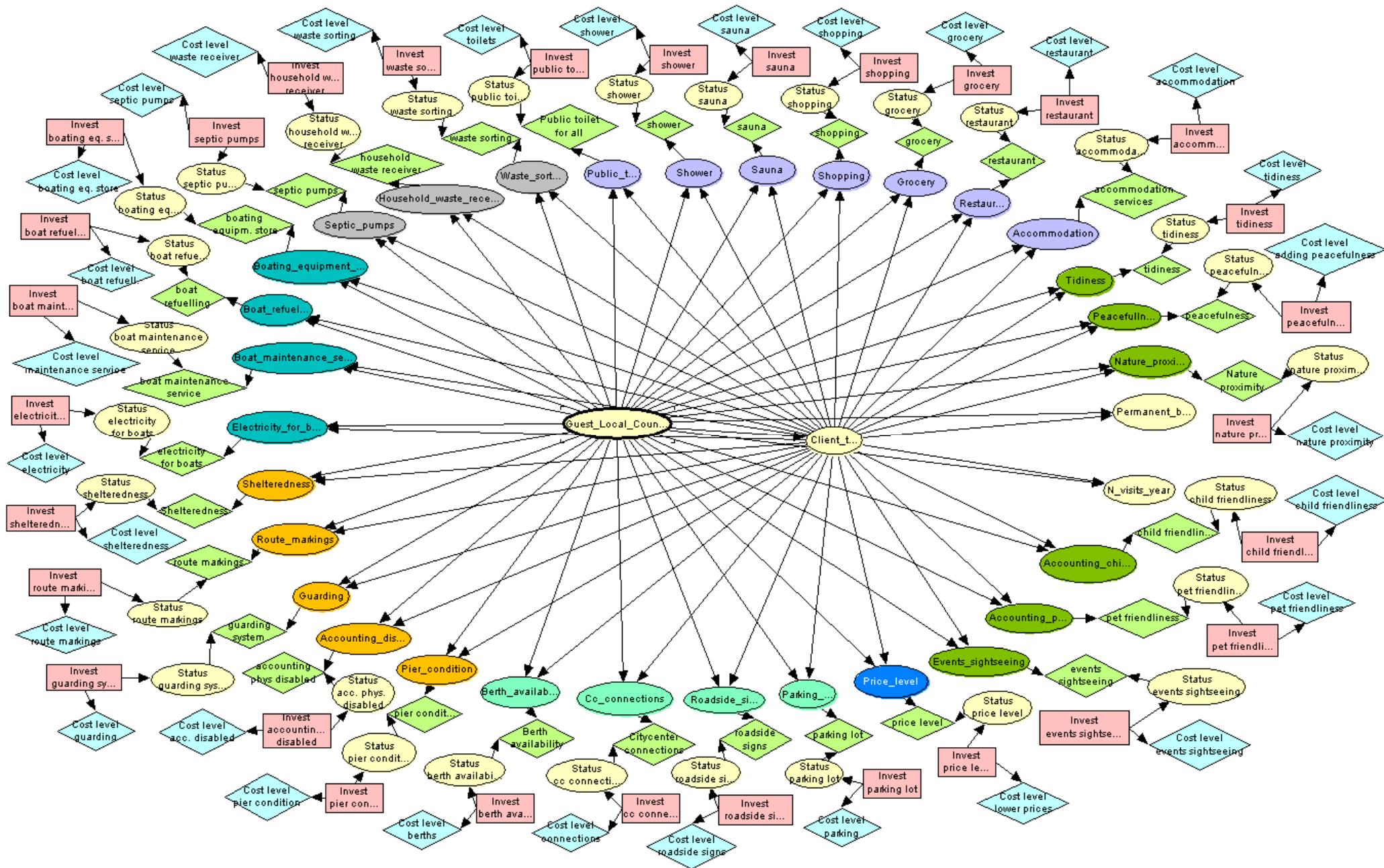


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Graphical presentation of the 30MILES investment optimization tool (full version including all the query questions). For the detailed query questions, see Appendix.

1. Structure and principle of the 30MILES tool


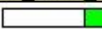






1.1. Elements of the tool


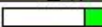




The graphical presentation of the tool consists of three different types of nodes (oval-shaped, diamond-shaped and rectangles) and links (arrows) between them.









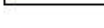

1.1.1. Random nodes (oval-shaped)

The oval-shaped nodes in the middle and on the inner circle represent the questions of the 30MILES query. They are so called random nodes, which means they are represented by a distribution (instead of only one point value). In the tool this distribution is the frequency distribution of the query answers.

In the run mode (*Hugin: press the icon with lightning figure to run the model*) these distributions are shown in the following format (the percentual frequency in the answers shown on the left):

Guest_Local_Country				
	74.90		82.55	Guest_FI
	6.53		84.26	Local_FI
	13.47		84.14	Guest_EST
	5.10		97.68	Local_EST

Client_type				
	66.33		86.70	boater
	26.73		74.39	caravan
	6.94		90.52	other

Nature_proximity				
	13.54		86.16	crucial
	44.59		84.32	high
	33.97		82.63	minor
	7.65		76.47	unimportant
	0.26		77.31	negative

Roadside_signs				
	14.98		81.47	crucial
	23.87		80.86	high
	15.41		84.41	minor
	39.36		85.28	unimportant
	6.38		87.29	negative

In the edit mode (*Hugin: press the pencil icon to return back to edit mode.*) it is possible to study the probability tables of the random variables (*Hugin: activate a node by clicking on it. Open the node menu by right-clicking. Choose "Open table".*).

For an independent node without incoming links, only one frequency distribution is shown. For example, the table of the node *Guest_Local_Country* shows the share of the nationalities and perspectives among the respondents:

Guest FI	0.7489796...
Local FI	0.0653060...
Guest EST	0.1346939...
Local EST	0.0510203...
Experience	490.0

The table above shows that the majority of the responses (75 %) are provided by Finnish respondents, who have chosen the visitor (*Guest FI*) perspective. *Experience* means the total number of observations behind the distribution.

The tables behind the random nodes with incoming links are conditional tables, which mean they show the frequency distribution for each combination of the alternative states of their parent nodes (from which the links come). For example, below is the conditional frequency table of the node *Nature_proximity* that shows the distribution of responses to the question of the importance the harbour being close to nature (Question 6(9) in the visitor query; Question 4(7) in the locals' query. See the appendix.), given client group and nationality.

Client type	boater				caravanner				other	Lo
	Guest FI	Local FI	Guest EST	Local EST	Guest FI	Local FI	Guest EST	Local EST		
crucial	0.1519610...	0.263158	0.0344827...	0.0769230...	0.0860820...	0.2	0.2	0.2	0.0	
high	0.4754891...	0.421053	0.2586209...	0.6153848...	0.4944667...	0.2	0.2	0.2	0.5	
minor	0.3431370...	0.315789	0.6034479...	0.2307689...	0.2580338...	0.2	0.2	0.2	0.333333	
unimportant	0.0294122...	0.0	0.0862068...	0.0769230...	0.1613109...	0.2	0.2	0.2	0.166667	
negative	5.0996514...	0.0	0.0172413...	2.6562093...	1.0631095...	0.2	0.2	0.2	0.0	
Experience	231.0	19.0	61.0	14.0	130.0	1.0	0.0	0.0	6.0	

From the above table it can be observed that we got zero query responses from Estonian caravanners and only one Finnish local perspective respondent is using a camper van when visiting his or her local home harbor. For this reason these three columns are represented by equal distributions (each state being equally likely), showing we do not have information about the preferences of these groups – the message that is in this way taken into account when the model is used for optimization. Anyhow, the model user can well update these distributions manually whenever such information is available.

NB: In some development aspect nodes part of the preference classes (crucial - high - ... - negative) may be missing. This means that none of the respondents had ticked that particular class for the aspect in question.

In addition to the respondent class and preference nodes in the middle and on the inner circle of the tool, there are so called "status nodes" to be evaluated and filled by the model user. These will be closer explained in section 1.2. of the manual.

1.1.2. Decision (rectangle-shaped) nodes and utility-cost (diamond-shaped) nodes

The purple rectangle-shaped nodes represent the investment decisions. Each decision node of the tool have two mutually exclusive states, being the alternative decisions (“yes” or “no”) for whether to invest in developing the aspect in question or not.

There are two types of diamond-shaped nodes in the model. The green ones are for measuring utility gained through the investment, based on how the query respondents have valued the aspect. The blue diamond-shaped nodes, in turn, are for defining the cost level of the investment in question. The utility nodes get values from 0 to +10, whereas the magnitude of the costs are estimated on the scale from 0 to -10.

The reason of using this zero to ten -scaling and not direct euros is that the utilities and costs should be somewhat comparable for the investment optimization and ranking purposes, as they are evaluated against each other. In case the user is able to estimate, how many additional clients each investment would bring per year, and how much each of them approximately would spend money during their visit, it is also possible to run the analysis by using euros as the unit – given that the costs of the investments to be compared are somewhat known too.

In the current version of the tool, the utility scoring is made (although the user is free to modify it too) as follows:

child friendliness(U2)

Accounting chi	crucial			high			minor			unim
Status child fri	High	Moderate	Poor	High	Moderate	Poor	High	Moderate	Poor	t
Utility	10.0	5.0	0.0	8.0	4.0	0.0	4.0	2.0	0.0	

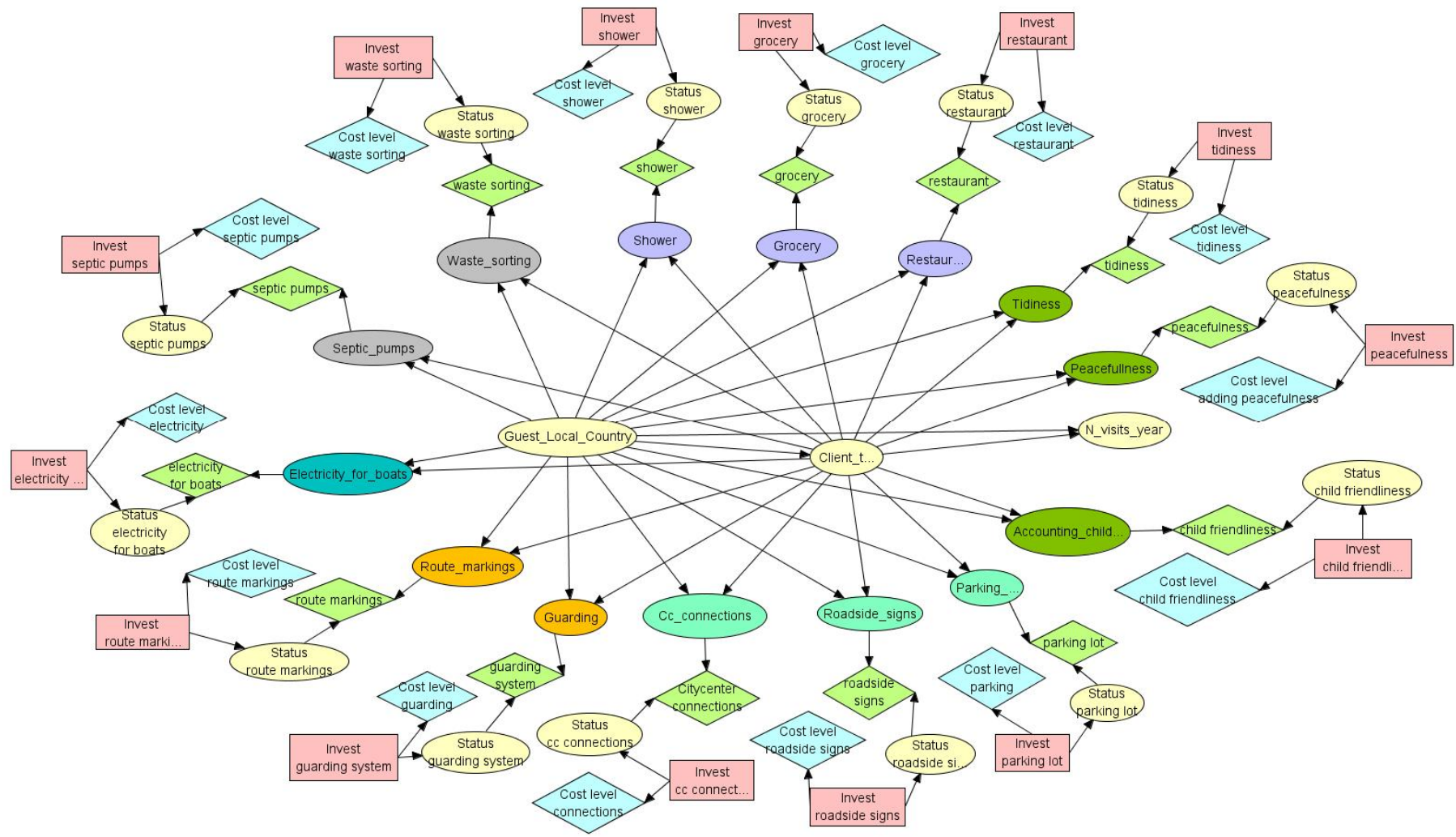
Accounting chi	unimportant			negative		
Status child fri	High	Moderate	Poor	High	Moderate	Poor
Utility	0.0	0.0	0.0	0.0	1.0	2.0

This means that in case respondent has stated accounting children in the port is crucial to her, and the status of that aspect in the port is high, 10 points (for this particular respondent) is added to the total utility. On the other hand, if some other respondent has stated that she finds children disturbing, and thus sees the child friendliness of the port as negative, high status of this aspect adds zero points for this respondent. The final utility calculated for the aspect child friendliness is the average over these scores.

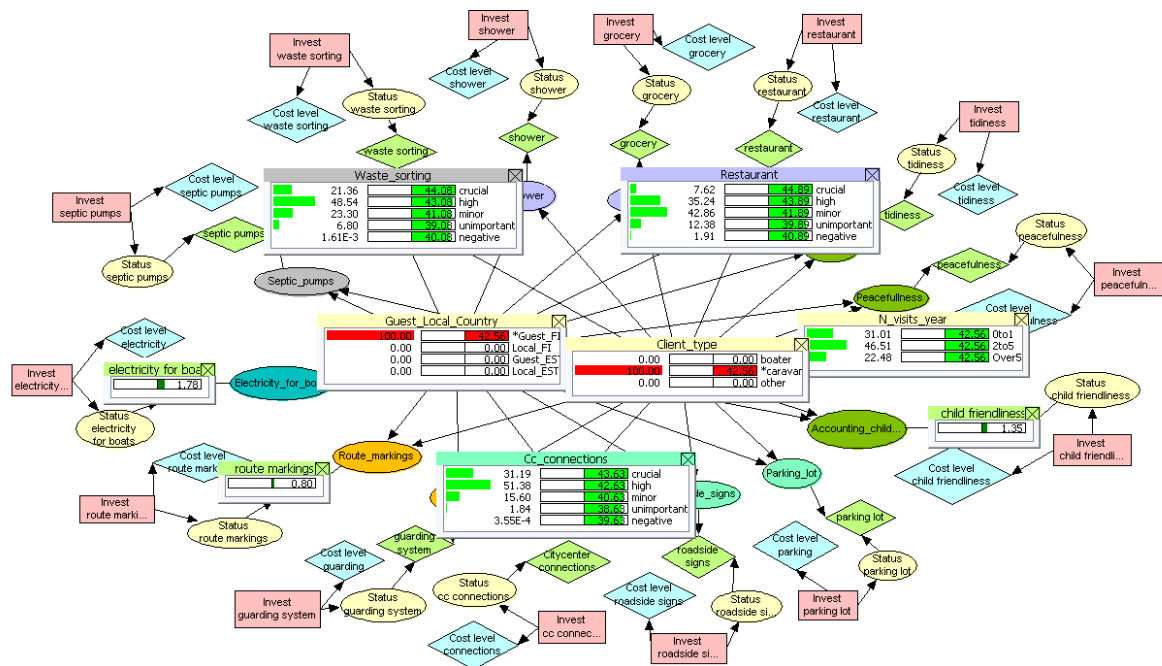
2. Conducting analyses with the 30MILES tool

This chapter provides a step-by-step example of running an analysis with the 30MILES tool:

1. Select a suitable set of development aspects (query questions, see the appendix) you wish to compare. This can be done by deleting those aspects you wish to exclude. (*Hugin: activate a node you wish to delete and press “Delete” on your keyboard.*) For example, if the aspect child friendliness is to be excluded, delete the oval nodes “Accounting children” and “Status child friendliness”, the diamond-shaped nodes “Child friendliness” and “Cost level child friendliness”, as well as the rectangle-shaped node “Invest child friendliness”. As the result you have a model including your development aspects of interest only. For example:



- At this point, it is possible to run the model to just study the data, without inserting any port-specific information yet. (*Hugin: click the lightning icon to run the model.*) You can for example study the preference distributions of the respondents for different development aspects (*Hugin: activate a node by clicking on it in the run mode, right-click and choose "Open monitor windows" to see the distribution. Alternatively, use the node list pane on the left.*). For the green utility nodes, the resulting average scores over these distributions are presented (On the scale 0 – 10. See the scoring logic presented in section 1.1.2). You can also concentrate on some particular client group only by locking it (*Hugin: double-click the class you wish to select and it turns to red. See the figure below.*). All the distributions and utilities are updated accordingly, to correspond the selection. In the figure below, the Finnish visitor-caravanners are selected and their preference distributions and averages shown. NB: If you wish to run an analysis, where all the respondent groups are equally weighted (and not according to their share in the responses), go to edit the frequency table of the node "Guest_Local_Coutry". Insert number 1 or 0.25 for each of the classes (*in Hugin you can also use the function "Reset table" in the Edit-menu*).



- This is the first step of running a tailor-made analysis for the port of your interest. To add port-specific information, go back to edit the model (*Hugin: the icon with pencil figure returns you from the run mode to the edit mode*). At this point you should have in your mind some potential actions to take (the investment) to develop each aspect you have included in your analysis. First, you should evaluate how these investments would develop the current status of the port. That information is inserted to the node table of a status -node (*Hugin: Activate the node by clicking on it, right-click and choose*

“Open tables”). In the node table you specify the current status prior to making the investment (the column *D Invest waste*... = “No” in the figure below) and after making it (*D Invest waste*... = “Yes”). As an example, the figure below shows how the current status of waste sorting in the port is evaluated to be on a poor level, whereas the investment under consideration would bring it to the high level. NB: Although basically any relative scale can be used in the tables, it is easiest to think each column summing up to one. Anyhow, if there is uncertainty related to the status before or after the investment, the status estimate being e.g. “somewhere between High and Moderate”, you can insert e.g. 0.5 for Moderate and 0.5 for High (or 0.3 and 0.7, as long as the values sum up to 1). This way the uncertainty is taken into account in the calculations. Corresponding estimation should be done for all of the Status nodes in your analysis.

Statuswaste sorting(C1_19)

D Invest waste	Yes	No
High	1.0	0.0
Moderate	0.0	0.0
Poor	0.0	1.0

Now you can run the model again and check the average utility scores of each investment (the value assigned for the green diamond-shaped utility nodes after the run). The highest utility score shows which investment would be the most effective in increasing the client satisfaction in your port. If you wish to personalize the analysis a bit more, try modifying the node tables (the distributions) of the two nodes in the middle of the network, “*Guest_Local_country*” and “*Client type*”, to correspond your assumed (or wished) body of clients.

4. The final step in creating your port-specific investment optimization analysis is to estimate the cost levels of the potential investments you are comparing with each other. This information should be inserted in the node tables of the blue diamond-shaped cost nodes. Here the cost level is specified as a point value (i.e. not as a distribution). To keep the costs comparable with the client satisfaction scoring, using the same scale (but negative) is necessary. Thus the highest thinkable cost level should be given the score -10, whereas 0 means “no costs”. To make different types of investments comparable against each other, the costs should be thought on a yearly-basis. The purchase value should be divided with the estimated life of the devices, buildings etc., if applicable and the yearly maintenance costs should be added on top of that. In the example below, the yearly maintenance costs of the current waste sorting system (*D Invest waste*... = “No”) are scored to be -1.5, whereas the planned investment would double (to -3) these costs (for example, the maintenance costs may be the same, but the purchase value divided by the expected life might increase the cost level).

Cost levelwaste sorting(U31_1_7_8_3)

D Invest waste	Yes	No
Utility	-3.0	-1.5

After completing the cost level evaluation for all the investments in your analysis, run the model once again. Set the tool to correspond the current situation by locking all the investment decisions to their negative ("No") state (*Hugin: double-click on the state to lock it. The colour changes from green to red.*). After that, check the total utility value of the current situation (*In Hugin the value is shown in the bars (the monitor windows) or below them (the node list pane on the left)*). Lock one investment decision at a time to their positive ("Yes") state and keep record, how many points the total utility changed when only that investment is made. The investment alone producing the highest increase in the total utility can be expected to be the most cost-effective one. (*In Hugin you can quickly identify those investments for which the average utility reached exceeds the evaluated cost level. Click the policy optimization icon with the text "spu" in it and check, which investments the tool sets to their positive "Yes" state.*)

3. Final remarks

Note that the 30MILES tool is intended to support systematic thinking and to inform the decision making process. The data behind the tool is based on a general query format, whereas optimal investments are always port-specific. The decision optimization results are strongly dependent on the values inserted in the model by the end user. For these reasons the developer of the tool cannot take any responsibility on the results nor the decisions the end users makes based on those.

Although quite complex, this tool is still a simplification. More detailed port-specific analyses could be conducted e.g. by acknowledging the potential interlinkages between certain development aspects. In some cases one investment may benefit several development aspects. This may further on affect the level of utility gained with the investment planned to develop these aspects, thus the decisions may sometimes have additive or inhibitory effects on each other. This kind of interactions are always case-specific, depending on what the actual investments under consideration are, thus they cannot be included in a general planning tool. Anyhow, the 30MILES tool is flexible and the user can relatively easily modify it.

As the tool is flexible, one can update the customer preference distributions whenever new data of corresponding form is available. This can be done either by utilizing data learning algorithms (e.g. EM-learning in Hugin) provided in the BN software, or by preparing the conditional frequency tables first in Excel or some corresponding spreadsheet software.

Some aspects, such as child or pet friendliness of the port may be experienced as strongly positive by some people, whereas some others find them disturbing and negative. It is important to note that these conflicts can be solved by careful planning and design. In fact, for example in a well-designed child-friendly port the disturbance can be lower compared to a port where this aspect is not acknowledged at all. Thus, when it comes to the 30MILES tool, in some cases the current utility scoring logic may need adjustments, too.

As the sustainable development is first of all a holistic concept, it is recommendable to consider a variety of different types of development aspects together. The development aspects included in the query data are on one hand related to the reachability of the port, safety, supply of

services and activities etc. On the other hand, the so called governance artefacts, such as the waste sorting or septic pump-out stations are developed to direct, but also to enable the environmentally responsible behavior of the boaters and other travelers, which the customers seem to appreciate as well.

A popular small port easily becomes a hotspot of the environmental impacts of boating and other tourism. Status of the surrounding coastal nature, as well as the tidiness and peacefulness of the port are aspects that in the long run tend to suffer while the number of visitors in the area grow. By studying the query data behind the 30MILES tool (the finding supported by the earlier studies among boaters as well), it can be noticed how important these aspects are for majority of the respondents. To ensure the long-term sustainability of a port business, investments are needed to avoid turning the beneficial ecosystem services into ecosystem disservices (such as dirty water and beaches) that can weaken both the quality of the touristic experience and the quality of life among the local communities. Fortunately it seems that many such infrastructural development aspects of the query are appreciated by the clients.

A small port is an interface between coastal community and the sea. The ports actually affect much wider areas than the port itself. They draw visitors to the area and can serve as social living-rooms for the local people. Thus investing in the sustainable development of the small ports should be an interest of the whole community. The ports could also take remarkable role in increasing the environmental consciousness and environmentally responsible behavior of boaters, caravanners and other travelers. By jointly paying attention to this aspect, the network of Baltic small ports could cost-effectively develop the sustainability of the whole coastal tourism sector.

Appendix

A questionnaire for developing service harbours

A service harbour refers here to a guest harbour that is accessible by land and offers services for boaters and other visitors – both locals and tourists.

In the first phase, you are asked to choose the perspective from which you wish to answer. You can mieluusti answer both queries.

Questionnaire 1: GUEST'S PERSPECTIVE

Answer this query if you visit service harbours while travelling by boat or by land.

Questionnaire 2: LOCAL'S PERSPECTIVE

Answer this query if there is a service harbour either in your home municipality or in the locality of your second home.

Thank you for your answers already in advance!

Query 1: Guest's perspective

Question 1. How often on average do you visit service harbours outside the localities of your home and second home?

- over 5 times a year
- 2-5 times a year
- 0-1 times a year

Question 2. How do you usually travel when visiting a service harbour? You can choose multiple options.

- by boat
- by car or motor cycle
- by camper van or trailer
- by public transport
- by bike or foot
- by some other vehicle: _____

Question 3. If your answer to the previous question was 'by boat', specify which sort of a boat you use. You can choose multiple options.

- row-boat
- sailboat
- motor boat
- other sort of boat, what: _____

Question 4. From where do you look for information on the service harbours you visit?

	mostly	sometimes	never
from tourist information			
from travel brochures			
from the locality's web pages			
from the boat harbour's web pages			

from online map applications			
elsewhere in the internet (chats, blogs, other social media)			
from newspapers and magazines			
I have no pre-information on the harbours, I only follow roadside guides			
I receive my information elsewhere, where? _____			

Question 5. I wish there were more information available on service harbours in the following sources (you can choose multiple options):

- at tourist information
- in travel brochures
- on the localities' web pages
- on harbours' own web pages
- in online map services
- elsewhere in the internet (chats, blogs, other social media)
- in newspapers and magazines
- elsewhere, where: _____

Question 6. What is the significance of the following factors for your decision to visit a certain service harbour?

Choose 'decisive' only in case you consider the factor determining your harbour visit, in other words, if it is a necessity.

Choose 'negative' in case you experience the factor somehow disturbing.

	decisive	big	small	unimportant	negative
The route from the sea to the harbour is clearly marked					
The harbour usually has free guest berths					
The harbour's piers are in good condition and easy to attach to					
Clear roadside guides lead to the harbour by land					
The harbour accommodates a parking place or there is one in the immediate vicinity					

The city centre is easily and quickly accessible from the harbour (by foot or public transport)					
The harbour is sheltered from winds and waves					
The harbour area is guarded or monitored					
The harbour is close to nature					
The harbour is peaceful					
The harbour's surroundings and public facilities are tidy					
The harbour provides a pump-out for sewage holding tanks					
The harbour provides a fuel station for boats					
The harbour provides household waste collection					
The harbour provides a waste sorting point					
Electricity is available at the harbour's piers					
The harbour provides aid for boat maintenance when required					
Boat accessories are sold in the harbour					
The harbour provides public toilets					
It is possible to have a shower in the harbour					
It is possible to take a sauna bath in the harbour					
The harbour includes a restaurant					
The harbour accommodates a grocery or there is one in the immediate vicinity					
There are shops in the harbour or in the immediate vicinity					
Accommodating, e.g. in a rental cabin or hotel is possible in the harbour or in the vicinity					
The harbour includes cultural attractions and cultural or other events take place there					
The disabled are taken notice of in the planning of the harbour area					

The harbour provides activities for children					
The harbour takes notice of pets					
The harbour's services are fairly priced					
Another factor, what? _____					

Question 7. Based on my experience, the most important development needs in service harbours are:

Other comments or ideas related to developing service harbours:

Thank you for your answers!

Query 2: Local's perspective

Question 1. How often on average do you visit the service harbours in your locality?

- over 5 times a year
- 2-5 times a year
- 0-1 times a year

Question 2. Do you have a permanent berth for your boat in your locality's service harbour?

- Yes
- No

Question 3. How do you usually travel when visiting the service harbour in your locality?

You can choose multiple options.

- by boat
- by car or motor cycle
- by camper van or trailer
- by public transport
- by bike or foot
- by some other vehicle: _____

Question 4. What is the significance of the following factors for your decision to go to the local service harbour?

Choose 'decisive' only in case you consider the factor determining your harbour visit, in other words, if it is a necessity.

Choose 'negative' in case you experience the factor somehow disturbing.

	decisive	big	small	unimportant	negative
The harbour usually has free guest berths					
The harbour's piers are in good condition and easy to attach to					
The harbour is sheltered from winds and waves					

The harbour area is guarded or monitored					
The harbour accommodates a parking place or there is one in the immediate vicinity					
The city centre is easily and quickly accessible from the harbour (by foot or public transport)					
The harbour is close to nature					
The harbour is peaceful					
The harbour's surroundings and public facilities are tidy					
The harbour includes a pump-out for sewage holding tanks					
The harbour provides a fuel station for boats					
The harbour provides household waste collection					
The harbour provides a waste sorting point					
Electricity is available at the harbour's piers					
The harbour provides aid for boat maintenance when required					
Boat accessories are sold in the harbour					
The harbour provides public toilets					
It is possible to have a shower in the harbour					
It is possible to take a sauna bath in the harbour					
The harbour includes a restaurant					
The harbour accommodates a grocery or there is one in the immediate vicinity					
There are shops in the harbour or in the immediate vicinity					
Accommodating, e.g. in a rental cabin or hotel is possible in the harbour or in the vicinity					
The harbour includes cultural attractions and cultural or other events take place there					
The disabled are taken notice of in the planning of the harbour area					

The harbour provides activities for children					
The harbour takes notice of pets					
The harbour's services are fairly priced					
Another factor, what? _____					

Question 5. In your opinion, which sort of positive impacts do your locality's service harbours have in the local life?

Question 6. Does the harbour operation have any negative impacts in your opinion? What?

Question 7. How could the the year-round use of the service harbours be increased in your locality?

Other comments or ideas related to developing service harbours from the local perspective:

Thank you for your answers!