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# A value-based definition of success in adaptive port planning: a case study of the Port of Isafjordur in Iceland

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## Abstract

Multiple stakeholders with a wide range of objectives are engaged in a port system. Ports themselves are faced with many uncertainties in this volatile world. To meet stakeholder objectives and deal with uncertainties, adaptive port planning is increasingly being acknowledged. This method offers robust planning, and thereby, a sustainable and flexible port may be developed. The planning process starts with defining success in terms of the specific objectives of stakeholders during the projected lifetime of the port. In the present work, an integrated framework to reach a consensus on the definition of success, involving stakeholders with different influences, stakes and objectives, is presented. The framework synthesises the problem structuring method with stakeholder analysis and combines these with fuzzy logic to support decision-makers in formulating a definition of success in the planning process. Our framework is applied to the Port of Isafjordur, the third busiest port of call for cruise ships in Iceland. Values of stakeholders about port planning were structured around the value-focussed thinking method to identify stakeholder objectives. The highest level of agreement on the objectives, which is viewed here as success in port planning, was revealed by the fuzzy multi-attribute group decision-making method. Success was defined, prioritising an increase in competitiveness among other planning objectives, such as effective and efficient use of land, increasing safety and security, increasing hinterland connectivity, increasing financial performance, better environmental implications, flexibility creation and increasing positive economic and social impacts.

**Keywords:** Decision-making process, Adaptive port planning, Definition of success, Value-focussed thinking, Iceland

## 1 Introduction

Ongoing globalisation, constant technological improvements and environmental and economic changes, among others, have led to the continuous development of ports to satisfy new traffic demand (Bendall and Stent 2005; Taneja et al. 2012; Woo et al. 2017). The dynamic nature of a port system in this volatile world develops under a high degree of uncertainty, including opportunities and vulnerabilities in port development projects. In addition, non-financial criteria are being increasingly added to financial decision-making processes (Clintworth et al. 2018) whereby various stakeholders or decision-makers with diverse interests and power emphasise their own objectives in port planning.

Adaptive port planning (APP) has attracted attention in recent years as a method to deal with the uncertainties ports face and to fulfil the objectives of port stakeholders. APP delivers robust solutions by integrating uncertainty and flexibility into the planning process (Taneja et al. 2010).

APP has been presented as a method of planning while considering the uncertainties involved in the process (Taneja 2013). Planning starts with the definition of success to satisfy the objectives of port stakeholders going forward. Stakeholder engagement and cooperation in the port planning process has been acknowledged in literature (Wiegmans et al. 2018). Moglia and Sanguineri (2003) point to the challenges involved in achieving the primary objectives in port planning. However, the question remains: How can consensus be reached among a large number of stakeholders on the definition of success in the port planning process? The answer to this research question is still being sought.

Belton and Stewart (2010) noted that, in the first step of any decision-making among multiple stakeholders, problems should be identified, understood and structured. Further, Pidd (2003) defined the problem as its formulation is agreed by stakeholders but its solution is arguable (by them). Problem structuring methods (PSMs) facilitate decision-making processes by identifying and structuring a problem to reach a consensus on a solution among decision-makers (Ackermann 2012; Rosenhead 1996).

To the best of the authors' knowledge, the benefit of PSMs has not been fully recognised in the field of port planning. Hence, this research identifies the most suitable PSM to address the research question. A systematic decision support framework to formulate a definition of success in APP is presented herein. Success is achieved if the outcome of APP fulfils the needs and desired objectives of stakeholders.

The proposed framework provides valuable insights to support the decision-making process, to reach a consensus among multiple stakeholders on a definition of success in APP using a systematic approach. The approach is based on the integration of three methods: (1) stakeholder analysis to identify the port stakeholders and measure their influence and interests during the planning process, (2) value-focussed thinking (VFT) method in order to reveal values of port planning[1] for all (relevant) stakeholders and, subsequently, set the means objectives for further analysis, and (3) fuzzy logic to reveal

[1] For instance (1) environmental value: balanced port (infra)structures to relieve pressure on the coastal area, positive environmental impacts, respect to the ecosystem, including bird and marine life, (2) social value: positive effect on the quality of life, job creation, safe and secure environment in the port area and quick response to emergencies, (3) Economic value: attraction of international and national port users, enough service and utility for different types of vessels, ability to operate in bad weather conditions and aesthetic port area to attract tourists. The values from these three categories are first examined as subobjectives, and then the sub-objectives are clustered into different means objectives as discussed in this paper.

the highest level of agreement on the means objective among the key stakeholders to define a fundamental objective. Although focussing on one case, the research has been carried out in such a way that the framework is applicable to other similar cases.

The remainder of this manuscript is structured as follows: Sect. 2 outlines a literature review by characterising the relevance of several problem structuring methods and the VFT method in the port planning process. Section 3 states the area of study, Sect. 4 addresses data collection and methods, Sect. 5 discusses the findings, and Sect. 6 draws conclusions on the definition of success in APP for the Port of Isafjordur in Iceland.

## 2 Literature review

A literature review was carried out to create a platform for introducing the multiple methods that structure a problem in a decision-making situation to address the research question as defined in the introduction: How can consensus be reached among a large number of stakeholders on the definition of success in the port planning process?

PSM is considered as qualitative operational research (OR) modelling (Smith and Shaw 2018), soft OR or a soft systems methodology (Marttunen et al. 2017). An appropriate PSM enriches a decision-making situation by diminishing errors when solving a wrong problem, minimising the ill-defined decision problems, generating models that yield new understanding of the situation and introducing efficient ways to acquire well-recognised objectives. For the last 20 years, PSM has been increasingly applied to address uncertainty (Mardani et al. 2015) and cover conceptual and practical aspects (Marttunen et al. 2017). In a complex decision-making situation where there are a variety of goals from different stakeholders, PSM can facilitate the decision-making process.

Smith and Shaw (2018) introduced four frameworks to analyse the characteristics of PSM, namely systems characteristics, knowledge and involvement of stakeholders, values of model building and structured analysis. Identifying stakeholders and obtaining knowledge from them may lead to growing consensus in structuring the problem (Checkland 1985.) By means of facilitation, participation, dialogue and analysis of the elements of a problem, PSM structures the issues across stakeholders (Ackermann 2012; Rosenhead 1996).

Different problem structuring methods have been applied in literature, including strategic options development and analysis (SODA) (Eden and Ackermann 2001), soft systems methodology (SSM) (Checkland and Scholes 1999; Checkland Winter 2006), strategic choice approach (SCA) (Friend 2011), robustness analysis (Rosenhead 2001), drama

theory and confrontation analysis (Bennett et al. 2001) and problem structuring group workshops (Shaw 2006).

Regarding the purpose of the present study, which is to formulate a definition of success in APP, the VFT method was selected as an appropriate PSM. The main reason is that proper decisions are usually taken when decision processes are structured and modelled based on values (Keeney 1996). Stakeholders care about the values of port planning, which are the primary driving forces in the decision-making process. The main stakeholder values of port planning should be identified, evaluated, harmonised and then prioritised (Arecco et al. 2016; Slinger et al. 2017). Güner (2018) noted that value judgements are the logical structures that shape opinions of decision- makers, and applied value judgement to assess the efficiency of Turkish ports. Thus, VFT was adopted in herein to tackle the problem and analyse different stakeholder values to define success in APP.

Using the VFT method, all possible ideas, proposals and opinions are garnered for a decision situation, and the decision's objectives are identified in accordance with specified values. Values can be purposes, desires, concerns and important inputs that matter the most to stakeholders (Keeney 1992, 1996) and may be taken into account by decision-makers. Then, means objectives are characterised as actions (or ways) that need to be implemented to achieve a fundamental objective. Finally, the fundamental objective[2] of port stakeholders is defined as the end that decision-makers want to accomplish in a specific decision situation (Keeney and McDaniels 1999).

Thinking about decision situations should therefore begin with elicitation of values (Alencar et al. 2017). The VFT method provides a systematic approach for identification and specification of the values of actors, structuring and categorising these values, converting them to the means objectives, recognising the relationships among objectives, prioritising the means objectives to achieve the fundamental objective and enhancing the validity and reliability of the outcome (Keeney, 1992, 1996; Sheng et al. 2005). In this problem structuring method, the fundamental objective was considered as the driving forces in final decision-making (Marttunen et al. 2017). Value-focussed thinking is a proven method that is being widely applied in various disciplines, as listed by Sheng et al. (2005), as well as in the literature, such as strategic management (Kunz et al. 2016),

[2] For instance, in the context of port planning and design, a fundamental objective could be to reduce port congestion. To achieve this objective, different means objectives include increasing cargo distribution to neighbouring ports, improving port connectivity to the hinterland with different types of modalities and upgrading port and terminal facilities.

quality management practice (AlMaian et al. 2016), environmental management and wall structures (Hassan 2004).

## 3 Methods and materials

### 3.1 Stakeholder analysis

As the power and interests of port stakeholders could be very different regarding the values of port planning (Ferretti 2016), VFT does not directly provide a definition of success (the fundamental objective) in the APP. To enhance the validity and reliability of this PSM, stakeholder analysis should be taken into account. To determine the definition of success, the power and interests of key stakeholders on the means objectives (described in Sect. 3.2) play a critical role in the planning process, as their means objectives should be prioritised in framing the fundamental objective. Without considering the power and interest of the stakeholders, attempts to reach the fundamental objective are thwarted.

The work presented herein focusses on the key stakeholders who are either decision-makers (on concluding the definition of success in APP) or the main influencers for port development. An extensive stakeholder analysis for Icelandic ports was conducted. Although the purpose of this paper is not to delve too deeply into stakeholder analysis, the process of analysing the stakeholders is briefly described.

Among other methods of stakeholder identification such as literature reviews, expert interviews and focus groups, the snowball sampling approach is an acceptable and quick way to identify a comprehensive list of stakeholders (Lienert et al. 2013). Following this technique, a preliminary list of stakeholders based on similar and previous studies was developed. Then, the stakeholders in the initial list were asked to add possible missing stakeholders to the list. Newly added stakeholders were analysed by a group of experts. Those considered as stakeholders were kept on the list and contacted to add any missing stakeholders to the list. The process continued until no further stakeholders could be added. Then, the identified stakeholders were categorised/grouped by their level of influence and stake in the decisions (Frooman 1999).

Next, the power-interest matrix (Eden and Ackermann 1998) and fuzzy logic decision surface (Poplawska et al. 2015; Ross 2004) were developed to map the stakeholder groups based on the collected inputs from the interviews with representatives from all stakeholder groups. The assessment of stakeholders was based on their affiliation in the short- and long-term planning processes and the subsequent port development. The

stakeholders were asked to weight the groups in terms of their power and interest in different themes of port planning. The themes were identified during the meetings with the stakeholders and expert group, as well as from the literature review (Arecco et al. 2016; Slinger et al. 2017; Taneja 2013).

### 3.2 Identification of values, sub-objectives and means objectives

Stakeholders identification and their engagement in the planning process lead to the disclosure of values, and consequently, to the construction of means objectives of APP. Interviews are an essential source of data gathering (Yin 1994). Face-to-face semi-structured open-ended interviews were conducted with all those who had a stake in the planning of the Port of Isafjordur to ensure that a wide range of values would be captured. The engagement of representatives from all stakeholder groups created authentic contexts that covered the dynamic view of the socio-economic significance of the port (Santos et al. 2018). The interviews were audio-recorded to process the information based on the VFT method carefully and for further documentation.

The interviewees were informed about the project by email and phone before the interviews. During the interviews, an introduction was also given to the interviewees. Then interviews carried on asking the port stakeholders "What are the values of port planning from your standpoint?" All concerns and points of view raised by them were collected and carefully analysed to provide a comprehensive list of values regardless of their priorities. It is important to point out that no attempt to differentiate the stakeholders based on their skills and experience was made. Any quantitative values and qualitative statements of values, e.g. $X$% increase in financial performance of the port, were systematically probed and counted. The aim was to capture different perspectives of stakeholders with different interests and power that could affect the port planning decisions. Stakeholders were encouraged to use lateral thinking to glean as many values as possible, and to specify a comprehensive set of values that would result in a comprehensive and diverse list.

The following steps were taken to remove redundant values and consolidate similar ones: Through an in-depth content analysis, common sub-objectives of port planning were obtained from the values. Note that the values could be an idea, thought, need, concern etc. of the stakeholders (Alencar et al. 2017) about port planning, whereas the sub-objectives were what the stakeholders would wish to achieve, and they should be addressed in the planning. Then, the sub-objectives were clustered in terms of their relation to port planning. The sub-objectives were categorised in an initial list of independent, well-defined, complete and concise means objectives. Several interviews

among a group of multidisciplinary experts and authors were held to analyse and define specific means objectives. A literature review in the field of port planning, from peer-reviewed scientific publications (Arecco et al. 2016; Slinger et al. 2017; Taneja 2013), as well as international laws and regulations, (PIANC 2018) and European directives (European Commission 2018) were used to dive deep into the topic to complement the procedure of reaching a unique terminology for the means objectives and adjust them in line with prominent literature.

To take into account the priority of different stakeholder groups on the means objectives and visualise potential conflict among stakeholder groups, radar plots were used. Using radar plots also helped to pinpoint strong means objectives as well as to identify the weak ones held by minorities in terms of the number of stakeholders in groups to achieve a conclusive fundamental objective.

### 3.3 Framing the fundamental objective

The means objectives were considered as the main drivers in achieving the fundamental objective. The stakeholders with the highest power and interest in the means objectives in the port planning process were targeted for framing the fundamental objective. It should be emphasised that the contribution of other stakeholder groups, which were not considered key stakeholders, were clustered in the form of means objectives.

Once the key stakeholders were identified, a focus group meeting was held to select one representative from each key stakeholder group. The selection of the representatives was based on their power and interests, as well as on their short- and long-term roles in the planning process and the subsequent port development. Then, the list of clustered sub-objectives was sent to the representatives to (1) identify any possible new values and provide feedback on the list of sub-objectives and (2) review the identified sub-objectives of port planning and obtain an overview of other stakeholders' attributes. To discover the importance of the means objectives from the perspective of key stakeholders, separate meetings were held with the representatives. In these meetings, representatives were asked to prioritise the means objectives and explain their reasoning. Materials and ordering lists of the means objectives from the meetings then formed the basis toward achieving the fundamental objective.

### 3.4 Fuzzy logic and final level of agreement on the means objectives

The fuzzy multi-attribute group decision-making method was applied to define the final level of agreement among the preferences of representatives regarding the fundamental

objective. The method is widely advocated in literature (Bender and Simonovic 2000; Blin 2008; Sun et al. 2018; Wan et al. 2018). By using this method, the relationship among the key stakeholders' preferences on the means objective was revealed. The fuzzy model of a group decision, as proposed by Blin (2008), was adopted in the context of port planning. The model provides a common acceptable decision from different individual stakeholders with a multiplicity of objectives. In the model, *n* stakeholders have a preference ordering of $P_k$, where $k \in n$ and a set of means objectives, *X*, are ordered. Klir and Folger (1988) stated that preference *S* is defined as a fuzzy binary in terms of membership grade function as follows:

$$\mu s: X \times X \rightarrow [0,1], \tag{1}$$

where the membership grade $\mu s(x_i, x_j)$ is the degree of preference of the means objective $x_i$ over $x_j$. Individual preferences were aggregated by the relative popularity method (Kahraman et al. 2003). The relative popularity of means objective $x_i$ over $x_j$ was calculated by dividing the number of individuals who preferred means objective $x_i$ to $x_j$ shown as $\mathrm{N}(x_i, x_j)$, by the total number of individuals, *n*:

$$\mu s(x_i, x_j) = N(x_i, x_j)n \tag{2}$$

Based on the relative popularities of the means objectives, two clusters of high and low importance were defined. Clustering of the means objectives is an approximate method that dismisses extra unnecessary mathematics to find out all possible orders. After defining the fuzzy relationship *S*, the non-fuzzy preference is obtained from the component of *S* as follows:

$$S = U_\alpha \alpha S_\alpha \tag{3}$$

where $\alpha$-cuts of the fuzzy relation *S* form the crisp relations $S_\alpha$, and $\alpha \in A_S$ is measured by $\alpha$, where $\alpha$ is the level of agreement between the individual key stakeholders on a crisp ordering $S_\alpha$.

To maximise the final level of agreement among the key stakeholders' preferences for the means objectives, the classes of crisp total orderings were intersected with the pairs in the $\alpha$-cuts $S_\alpha$ with smaller values of $\alpha$. This process was continued until a single crisp total ordering was obtained. The pairs $(x_i, x_j)$ that lead to an intransitivity should be eliminated. In this process, the maximum level of agreement among key stakeholders for the preference, which is potentially considered as the fundamental objective, is obtained

from the largest value $\alpha$ for a specific ordering (Kahraman et al. 2003; Klir and Folger 1988).

As the definition of success in APP specifies the desired objectives of the port stakeholders, a qualitative approach to find the means objectives and a quantitative method to achieve the highest level of agreement among the objectives might not be enough. Therefore, to reach a consensus on the fundamental objective, the final level of agreement on the means objectives was discussed individually with the representative of each key stakeholder group. The definition of success was achieved when the highest level of agreement was approved by the key stakeholders. Otherwise, a common meeting with the representatives of key stakeholders was held to reach a consensus.

## 4 Area of study

The Isafjordur Port Authority manages four ports of different sizes and capacity, including the Port of Isafjordur, the Port of Sudureyri, the Port of Flateyri and the Port of Thingeyri, located in the northwest of Iceland (Fig. 1). The Port of Isafjordur is the biggest port and distribution centre in the region. The main functions of the port comprise fishing activities, cargo handling and cruise ships servicing. The port is the third busiest port of call for cruise ships in the country. The other three ports provide services mostly to fishing and sailing boats.

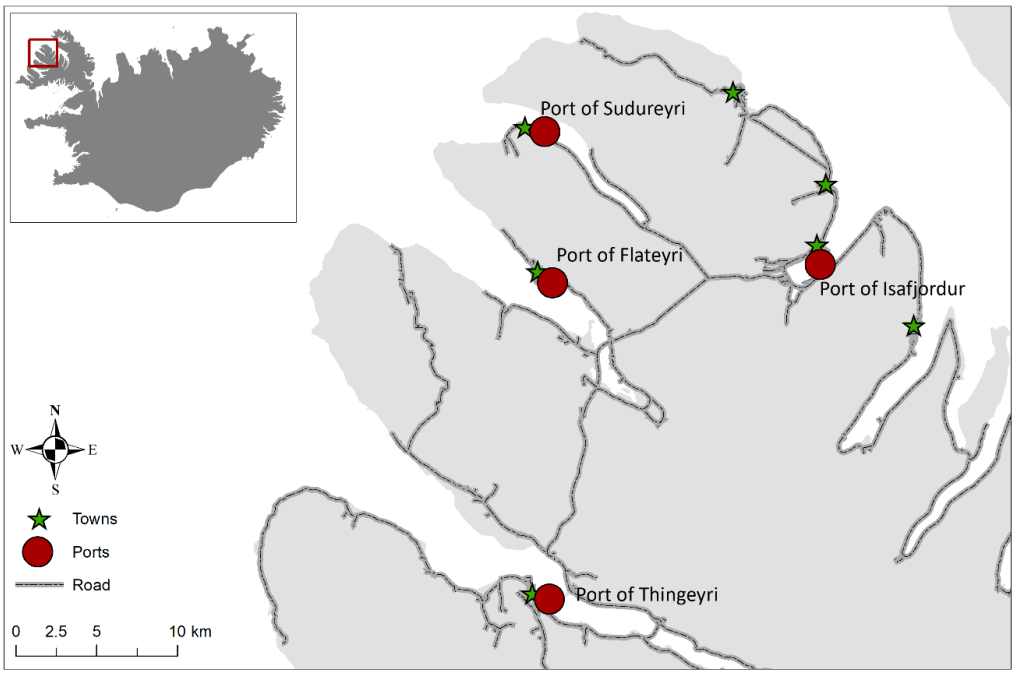


Fig. 1 Location of ports (the study area is shown on the map of Iceland)

The Port of Isafjordur is the destination of cargo ships on a regular basis, the so-called coastal shipment of the country. The hinterland of the port comprises the whole country. The port is faced with a rapid increase in demand by cruise liners, marine recreational activities, fishing and aquaculture industries and transport companies (Port of Isafjordur Authority 2019). However, restrictions in infrastructure, operations and services of the port limit its potential capacity for the optimum throughput. The inability to meet demand is a loss of opportunity that might affect the competitive position of the port among the other ports in the country as well as among Nordic countries in Europe. In this regard, the Port Authority has expressed its decision to further develop port areas to meet both today's and future demands. The Port Authority has decided to implement APP for the planning of the Port of Isafjordur.

## 5 Results and discussion

### 5.1 Means objectives of port planning

Based on the results from the stakeholder analysis, the Icelandic port stakeholders have been classified into five groups: (1) internal stakeholders, (2) external stakeholders, (3) legislation and public policy stakeholders and (4) community stakeholders. The terminology of classification was based on the method presented by Denktas–Sakar and Karatas–Cetin (2012)[3]. As a result of the stakeholder analysis, described in Sect. 3.1, the internal, external and legislation and public policy stakeholder groups were identified as the key stakeholder groups.

In the present study, 51 face-to-face semi-structured and open-ended interviews were conducted. Table 1 presents the position of the interviewees in their companies/ organisations and their stakeholder group. This exhaustive effort to interview all (relevant) stakeholders was carried out for the first time in Iceland. In total, 314 values were elucidated from the 51 interviews. From these values, 61 specific sub-objectives were identified. Collectively, a set of eight means objectives were determined, namely: increasing competitiveness, increasing effective and efficient use of land, increasing safety and security, increasing hinterland connectivity, increasing financial performance, better environmental implications, creating flexibility and increasing positive economic and social impacts.

[3] An academic stakeholder group was added as it plays an important role in the port planning by generating new ideas and developing knowledge through their research (Slinger et al. 2017).

Table 1 List of interviewees related to the adaptive port planning of the Port of Isafjordur

| No. | Company/Organisation | Position | Stakeholder Group |
|---|---|---|---|
| 1 | Icelandic Transport Authority | Head of Maritime Security | Legislation and public policy |
| 2 | Icelandic Transport Authority | Port installations and maritime navigation specialist | Legislation and public policy |
| 3 | Icelandic Road and Coastal Administration | Senior coastal engineer | Legislation and public policy |
| 4 | Icelandic Coast Guard | Managing Director | Legislation and public policy |
| 5 | National Planning Agency | Director of the division of master planning, Expert in master planning | Legislation and public policy |
| 6 | Westfjords Health Administration | Health officer | Legislation and public policy |
| 7 | Environmental Agency of Iceland | Nature, water and sea specialist, advisor | Legislation and public policy |
| 8 | Westfjords Iceland Nature Research Center | Director, Ecologist | Legislation and public policy |
| 9 | Marine & Freshwater Research Institute-Isafjordur | Head | Legislation and public policy |
| 10 | Municipality of Isafjardarbaer | Former Mayer and chairman of the town council | Internal |
| 11 | Municipality of Isafjardarbaer | Port director | Internal |
| 12 | Municipality of Isafjardarbaer | Deputy director of environmental and asset management | Internal |
| 13 | Municipality of Isafjardarbaer | Environmental specialist | Internal |
| 14 | Municipality of Isafjardarbaer | Director of Customs | Internal |
| 15 | Municipality of Isafjardarbaer | Planning and building specialist | Internal |
| 16 | IHE Delft, Institute for Water Education | Instructor and logistics project manager | Academic |
| 17 | University of Iceland | Transportation and logistics management | Academic |
| 18 | University center of the Westfjords | Director | Academic |
| 19 | Icelandic Regional Development Institute | Regional development specialist | External |
| 20 | Port Association of Iceland | Chair | External |
| 21 | Westfjords Development Association | Managing Director | External |
| 22 | Agricultural Association of Fisheries | Manager | External |
| 23 | Westfjords Tourist Information Office | Director | External |
| 24 | Gara Cruise Agency | Managing Director | External |
| 25 | West Tour Agency | Chief Executive Officer | External |
| 26 | Transport company, Eimskip (Headquarters) | Senior Manager | External |
| 27 | Transport company, Eimskip (Isafjordur) | Area manager, Port operator | External |
| 28 | Transport company, Eimskip (Isafjordur) | Employee | External |
| 29 | Transport company, Samskip (Isafjordur) | Supervisor for West Iceland | External |
| 30 | Industry (Skaginn 3X) | Director of the operation | External |
| 31 | The main power company in the region | Director of Energy, electrical engineer | External |

(Continued)

Table 1 List of interviewees related to the adaptive port planning of the Port of Isafjordur (continued)

| No. | Company/Organisation | Position | Stakeholder Group |
|---|---|---|---|
| 32 | Marine product company Hradfrystihusid-Gunnvor | Production Manager, Fleet Manager, employee | External |
| 33 | Marine product company Arctic fish | Chief Financial Officer | External |
| 34 | Marine product company Habrun | Manager | External |
| 35 | Marine product company Kampi | Production Manager, Operation Manager, Quality Managers, Accountant | External |
| 36 | Marine product company, Kerecis | Director of Manufacturing | External |
| 37 | Marine product company Islands Saga | Manager | External |
| 38 | Marine product company Klofningur | Managing Director | External |
| 39 | Marine product company IS 47 | Owner | External |
| 40 | Marine product company, West Seafood | Owner | External |
| 41 | Kayak center | Manager | Community |
| 42 | Local heritage museum | Manager | Community |
| 43 | Blue Bank company | Manager | Community |
| 44 | Local fish market | Manager | Community |
| 45 | Local rescue team | Employee | Community |
| 46 | Local store | Manager | Community |
| 47 | Harbor employee in Isafjordur | Boat owner | Community |
| 48 | Harbor employee in Thingeyri | Local | Community |
| 49 | Harbor employee in Isafjordur | Local | Community |
| 50 | Construction company | Manager | Community |
| 51 | Marine & Freshwater Research Institute-Isafjordur | Local | Community |

In the Appendix, the sub-objectives, clustered in the form of means objectives, are presented. In Table 4, IS, ES, LS, AS and CS are, respectively, the internal stakeholder, external stakeholder, legislation and public policy stakeholder, academic stakeholder and community stakeholder. Numbers in the colour-scaled table of the Appendix under the stakeholder groups represent the percentage of stakeholders in a group that pointed out a sub-objective. The colour-scaled table shows the level of agreement within the interviewees of each stakeholder group regarding whether a sub-objective was relevant to achieve the fundamental objective. The objective tree is shown in Fig. 2.

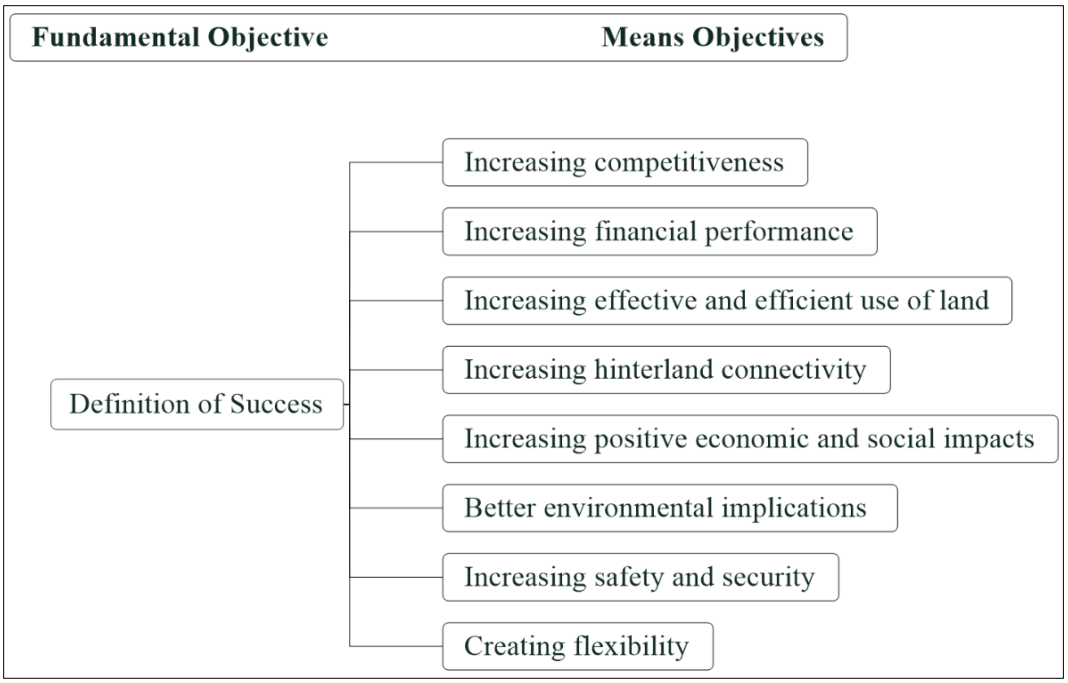


Fig. 2 Overall objective tree of port planning

## 5.2 Attributes of stakeholder groups

The preferences of stakeholder groups for the means objectives clarified their concerns in the decision-making process. Hence, this helped the problem structuring process toward achieving the fundamental objective. The numbers in the radar plots indicate the aggregate number of stakeholders in a group that pointed out a sub-objective (and consequently a means objective) in the interviews.

### 5.2.1 Internal stakeholder group

Increasing competitiveness was a prioritised means objective for the internal stakeholder group. Cruise calls to the Port of Isafjordur have been increasing exponentially during the last few years (Port of Isafjordur Authority 2019). Fish farming and aquaculture are thriving in the region (Icelandic Directorate of Fisheries 2018). This increases the volume of (un)loading cargoes and containers in the port. Although the port has a strong competitive position in the region, the growing port activity encourages the internal stakeholder group to emphasise the competitiveness and the importance of expanding its market share. In this regard, the internal stakeholder group showed preference to increasing hinterland connectivity as well. Moreover, effective and efficient use of port land has become important for the competitive position of the port, as land is limited in the port area. As shown in Fig. 3, the internal group strongly expressed a focus on the

means objectives of effective and efficient use of land. There was also a preference to increase safety and security and financial performance and to improve environmental implications. These means objectives were not strong, however.

Considered as a small port, Isafjordur operates without any major issue with respect to these means objectives. However, they may carry more weight and require more attention in the future with increased port activities. The preference for increasing positive economic and social impacts was quite limited compared with other means objectives. The reason might be that this group expects that port planning per se enhances positive economic and social impacts. The extra cost of creating flexibility and its long payback period on investment (Taneja et al. 2012) might hamper the attribute of the internal stakeholder group on this means objectives.

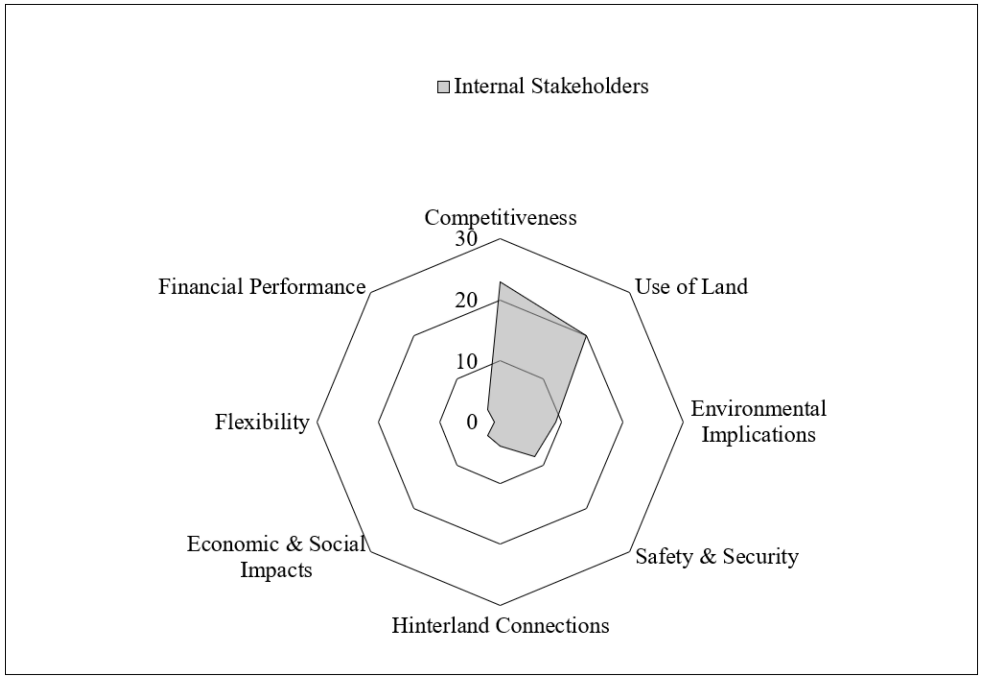


Fig. 3 Distribution of means objectives for the internal stakeholder group

### 5.2.2 External stakeholder group

Increasing effective and efficient use of land was extremely important for the external stakeholder group (Fig. 4). The limited land in the port area coupled with the increasing number of port activities, such as tourism, recreational services, fish farming, aquaculture and transportation, as the main ones, have increased the concerns of the external stakeholder group regarding effective and efficient use of land. Furthermore, this group placed emphasis on increasing competitiveness, as this means objective may bring higher

quality of service with cost advantage for port users. Preference for the means objectives of increasing safety and security, better environmental implications and increasing hinterland connectivity was observed in this group. In fact, the group relies subjectively on these means objectives, for instance, fish processing factories requiring better environmental implications, and tourist agencies asking for improved safety and security. Moreover, port–hinterland interaction plays a crucial role in shaping supply-chain solutions of transport companies and logistics service providers.

This group showed a preference for creating flexibility and increasing safety and security. These means objectives are required to supply the changing demand of port users and the seasonality of port activities[4]. The preference of this group for increasing positive economic and social impact and increasing financial performance was limited, as these means objectives might not imply a significant effect on their activities and commerce.

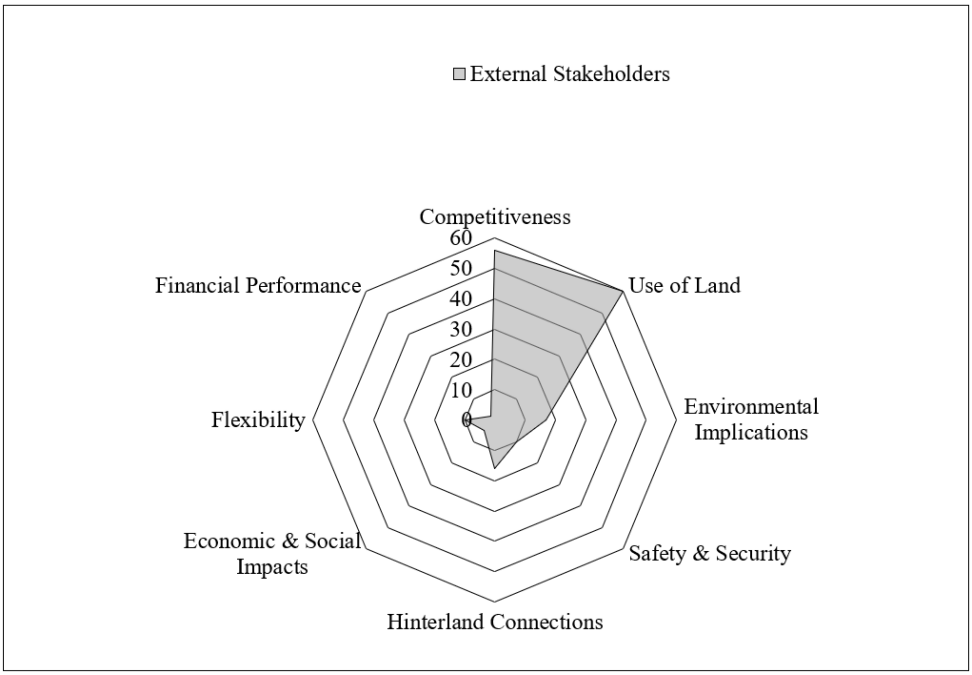


Fig. 4 Distribution of means objectives for the external stakeholder group

### 5.2.3 Legislation and public policy stakeholder group

As shown in Fig. 5, the legislation and public policy stakeholder group showed significant association with increasing competitiveness in the port planning process. Increasing international and national trade through the port influences the regional economy and

[4] High in the summer season because of the high number of cruise calls and low in the winter season because of the frequently harsh weather.

national supply chain. As the performance of the supply chain in terms of price, service quality and reliability might be influenced by increasing competitiveness, this group, including authorities and organisations, stressed the increase of competitiveness. The second priority in this group was to increase effective and efficient use of land. Long-term lease and land-use policies in Iceland, sustainable development and scarcity of land around the port area might be the main reasons why this group emphasised this means objective.

Final decision-making for approval of port planning rests with the central Icelandic government rather than local levels. Thus, this group mostly takes into account whether the plan fulfils national and international regulations and laws, including improving safety and security. Such preference might curb the means objectives of increasing positive economic and social impacts and financial performance in this group. The legislation and public policy stakeholder group did not show a strong preference for creating flexibility. One of the reasons might be the increase in the marginal initial cost of port development by this means objective.

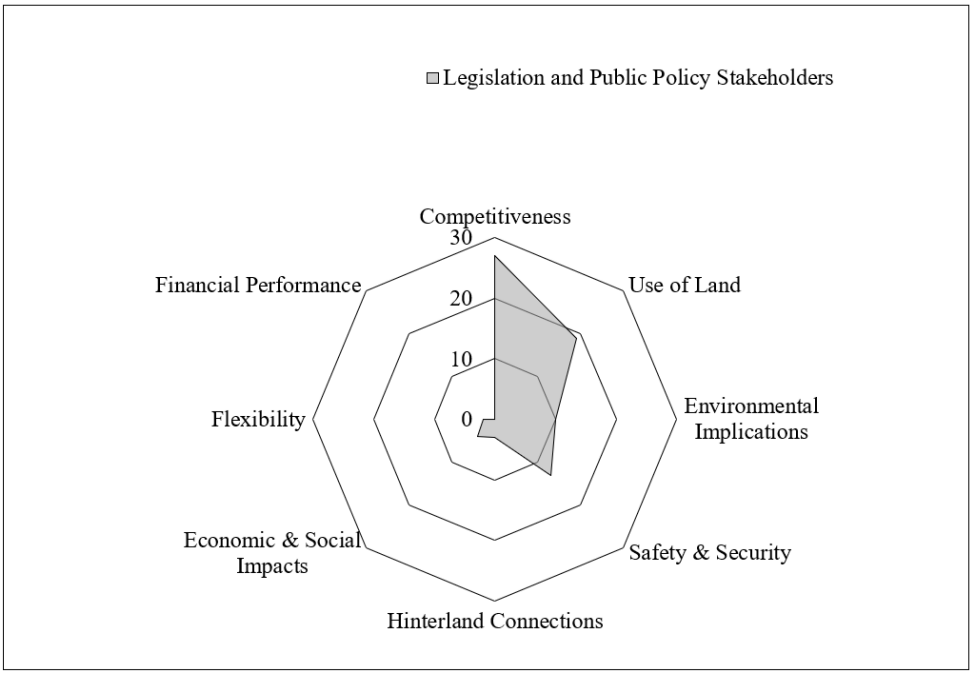


Fig. 5 Distribution of means objectives for the legislation and public policy stakeholder group

### 5.2.4 Academic stakeholder group

The academic stakeholder group had a considerable preference for increasing competitiveness and increasing effective and efficient use of land. Port related research,

such as ascertaining the competitive position of a port vis-a-vis its primary and secondary hinterland (Morgan 1951) and land use in port planning, has been abundant. Increasing port activities raises environmental concerns about air, noise, water and soil pollution in the port and surrounding areas. The academic stakeholder group offered possible solutions to these challenges in the port planning process.

Emphasis on increasing positive economic and social impacts was stressed by this group, as this means objective plays an important role in port (city) planning in remote areas with a small surrounding community. The academic stakeholder group showed preference for increasing flexibility, as can be seen in Fig. 6. Adaptive port planning (APP) results in a flexible port (Taneja 2013).

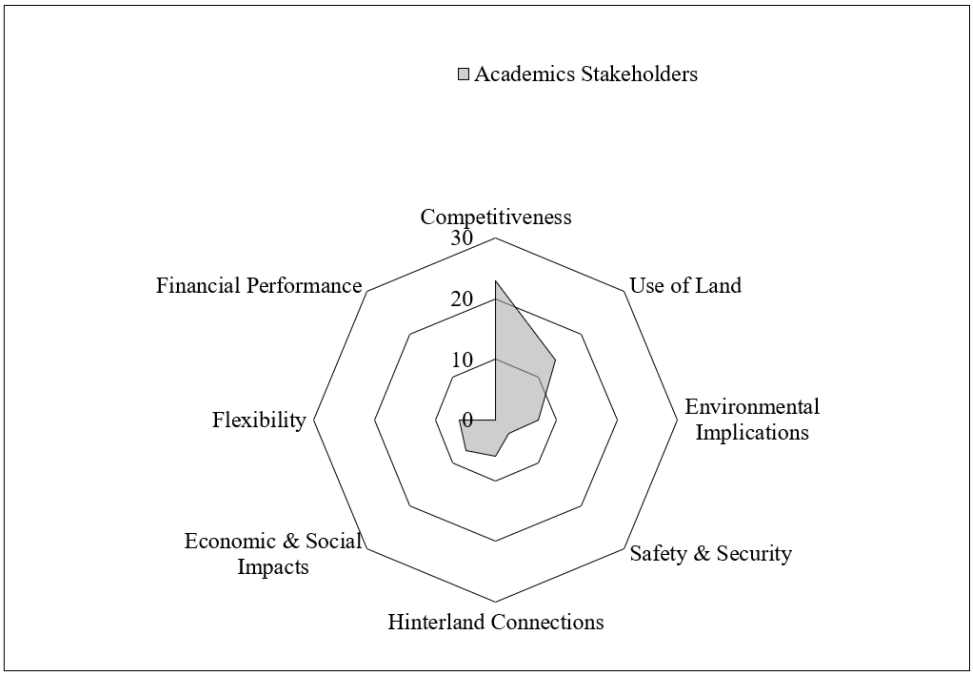


Fig. 6 Distribution of means objectives for the academic stakeholder group

### 5.2.5 Community stakeholder group

In port cities, port activities directly and indirectly affect the surrounding communities in many ways; For instance, increasing cargo handling and transportation or a growing number of cruise calls, and consequently, cruise passengers, increasing environmental concerns such as local pollution and congestion. In addition to increasing port activities, growing populations heighten the demand on the land around the port. Thus, the main preference of the community stakeholder group was an increase in effective and efficient use of land.

The emphasis of this group on increasing competitiveness might be the positive influence of a competitive port in terms of economic and social impacts on the surrounding community. However, improving environmental implications and increasing safety and security were stressed, as increasing port activities might have negative environmental impacts. This group also placed lesser emphasis on creating flexibility, as future generations will be able to modify and upgrade ports so as to better meet port demand. The preference of this group for increasing hinterland connectivity and financial performance was limited as depicted in Fig. 7. The reason might be limited awareness of community stakeholders on these means objectives.

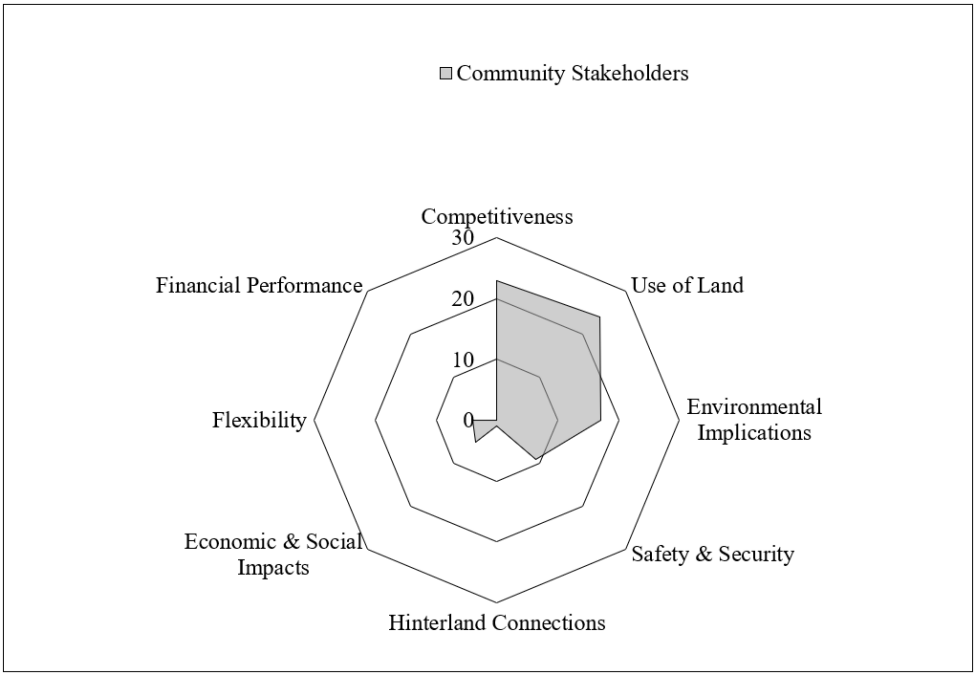


Fig. 7 Distribution of means objectives for the community stakeholder group

## 5.3 Transferability of findings based on the preferences of stakeholder groups on the means objectives

A high degree of commonality was evident among the groups, especially in terms of increasing competitiveness and effective and efficient use of land. This type of emphasis on these means objectives by the stakeholders leads to extra attention in deciding on the fundamental objective by decision-makers. This finding is in line with prior research where port competitiveness is discussed (Cabral and Ramos 2014; Yuen et al. 2012).

The means objectives are also echoed by Arecco et al. (2016), who recognised a comprehensive list of 17 criteria for port success, based on a literature review and using

a European Foundation for Quality Management (EFQM) model. Arecco et al. (2016) concluded that (1) safety, (2) competitiveness and (3) hinterland connections played an important role in assessing port success. However, in the present study, increasing competitiveness, increasing effective and efficient use of land and better environmental implications were the major concerns of port stakeholder groups. The main reasons for the discrepancy were: (1) Arecco et al. (2016) mainly considered internal stakeholder group in their work whereas, in the present work, all groups have been involved to deliver a comprehensive outcome; (2) different method: in the present study, complex decision-making was facilitated by integration of the VFT, the stakeholder analysis and the fuzzy multi-attribute group decision-making method; however, Arecco et al. (2016) carried out literature review and desk research; and (3) discrepancy in size, capacity and activities of the ports under study.

### 5.4 Towards a fundamental objective and formulating a definition of success

In three separate meetings, the representative of each key stakeholder group was asked to indicate their group's preference on the eight means objectives in port planning. Formulating the fundamental objective from the outcome of these three separate meetings instead of one meeting with all three representatives together provided an effective, efficient and comprehensive result. The separate meetings not only increased engagement of the representatives individually but also eliminated (1) domination of one representative's power and interest over the others, (2) time consuming debate about the means objectives by representatives because of their different perspectives about the objectives in port planning, (3) political influences, (4) deviation of the discussion from the goal of the meeting, (5) potential conflict and (6) interference from any potential biasing tendency.

The total preference ordering of the three representatives, $P_i(i \in N_3)$, on a set, $X$, of means objective was as follows:

$X$ = (means objective 1, …, means objective 8).

Internal stakeholders:

$P_1$ = (increasing financial performance, increasing competitiveness, increasing effective and efficient use of land, increasing safety and security, increasing hinterland connectivity, increasing positive economic and social impacts, creating flexibility, better environmental implications)

Legislation and public policy stakeholders:

$P_l$ = (increasing safety and security, increasing hinterland connectivity, better environmental implications, increasing financial performance, increasing competitiveness, creating flexibility, increasing effective and efficient use of land, increasing positive economic and social impact)

External stakeholders:

$P_e$ = (increasing effective and efficient use of land, increasing competitiveness, increasing hinterland connectivity, creating flexibility, better environmental implications, increasing safety and security, increasing positive economic and social impacts, increasing financial performance)

The outcomes of the meetings were three different preference orderings of the means objectives. Table 2 summarizes the relative popularities of the means objectives based on the ordering preferences; For instance, the relative popularities of increasing competitiveness to increase hinterland connectivity was calculated as follows:

$$\mu_s \text{ (increasing competitiveness, increasing hinterland connectivity)} = 2 \div 3 = 0.67$$

Table 2 Summary of fuzzy preference relations

| | CO | UL | EI | SS | HC | ES | FL | FP |
|---|---|---|---|---|---|---|---|---|
| CO | * | 0.67 | 0.67 | 0.67 | 0.67 | 1 | 1 | 0.33 |
| UL | 0.33 | * | 0.67 | 0.67 | 0.67 | 1 | 0.67 | 0.33 |
| EI | 0.33 | 0.33 | * | 0.33 | 0 | 0.67 | 0.33 | 0.67 |
| SS | 0.33 | 0.33 | 0.67 | * | 0.67 | 1 | 0.67 | 0.67 |
| HC | 0.33 | 0.33 | 1 | 0.33 | * | 1 | 1 | 0.67 |
| ES | 0 | 0 | 0.33 | 0 | 0 | * | 0.33 | 0.33 |
| FL | 0 | 0.33 | 0.67 | 0.33 | 0 | 0.67 | * | 0.33 |
| FP | 0.67 | 0.67 | 0.33 | 0.33 | 0.33 | 0.67 | 0.67 | * |

The abbreviations in Table 2 are CO: competitiveness, UL: use of land, EI: environmental implications, SS: safety and security, HC: hinterland connection, ES: economic and social impact, FL: flexibility, FP: financial performance.

Based on the average relative popularity of a means objective, two clusters of high and low importance were defined to avoid unnecessary mathematical complexity of discovering all possible orders (40,320 orders for eight means objectives). The average relative popularity of every means objective indicated different preferences of the representative on a means objective, in comparison with others. Thus, the contribution of the means objective in achieving the fundamental objective could be estimated.

The means objectives of increasing competitiveness (0.63), increasing hinterland connectivity (0.58), increasing effective and efficient use of land (0.54) and increasing safety and security (0.54) played prominent roles in port planning, as they had high average relative popularities. These means objectives were followed by increasing financial performance (0.46), better environmental implications (0.33), creating flexibility (0.29) and increasing positive economic and social impacts (0.12). To achieve the possible final level of agreement on the means objectives, the high and low importance clusters were defined as:

$Cluster_H$: (increasing competitiveness, increasing hinterland connectivity, increasing effective and efficient use of land and increasing safety and security)

$Cluster_L$: (increasing financial performance, better environmental implications, creating flexibility and increasing positive economic and social impacts)

Based on equation 3, the $\alpha$-cuts for fuzzy relations were:

$Cluster_H$ ($S_{0.67}$) = (increasing competitiveness, increasing effective and efficient use of land), (increasing competitiveness, increasing safety and security), (increasing competitiveness, increasing hinterland connectivity), (increasing effective and efficient use of land, increasing safety and security), (increasing effective and efficient use of land, increasing hinterland connectivity), (increasing safety and security, increasing hinterland connectivity)

$Cluster_H$ ($S_{0.33}$) = (increasing effective and efficient use of land, increasing competitiveness), (increasing safety and security, increasing competitiveness), (increasing safety and security, increasing effective and efficient use of land), (increasing hinterland connectivity, increasing competitiveness), (increasing hinterland connectivity, increasing effective and efficient use of land), (increasing hinterland connectivity, increasing safety and security)

$Cluster_L$ ($S_{0.67}$) = (better environmental implications, increasing positive economic and social impacts), (creating flexibility, better environmental implications), (creating flexibility, increasing positive economic and social impacts), (increasing financial performance, increasing positive economic and social impacts), (increasing financial performance, creating flexibility)

$Cluster_L$ ($S_{0.33}$) = (better environmental implications, creating flexibility), (increasing positive economic and social impacts, better environmental implications), (increasing

positive economic and social impacts, creating flexibility), (increasing financial performance, better environmental implications)

The unique crisp of ordered means objectives, $O_\alpha$ in the fuzzy relation $S_\alpha$ were seen to be:

$Cluster_H$ ($O_{0.67}$) = (increasing competitiveness, increasing effective and efficient use of land, increasing safety and security, increasing hinterland connectivity)

$Cluster_H$ ($O_{0.33}$) = (increasing hinterland connectivity, increasing safety and security, increasing effective and efficient use of land, increasing competitiveness)

$Cluster_L$ ($O_{0.67}$) = (increasing financial performance, creating flexibility, better environmental implications, increasing positive economic and social impacts)

$Cluster_L$ ($O_{0.33}$) = [(increasing financial performance, increasing positive economic and social impacts, better environmental implications, creating flexibility), (increasing positive economic and social impacts, increasing financial performance, better environmental implications, creating flexibility)]

As can be seen in both clusters, for the value 0.67, only one order was obtained. Thus, finding the orders of value 0.33 was not required since they should be of a compatible order with the orders of the higher value (0.67).

$$Cluster_H (O_{0.67}) \cap Cluster_H (O_{0.33}) = Cluster_H (O_{0.67})$$

$$Cluster_L (O_{0.67}) \cap Cluster_L (O_{0.33}) = Cluster_L (O_{0.67})$$

Hence, the value 0.67 represents the group level of agreement on the means objectives. The combination of $Cluster_H$ (O0.67) and $Cluster_L$ (O0.67) denotes the total orderings of: (increasing competitiveness, increasing effective and efficient of use of land, increasing safety and security, increasing hinterland connectivity, increasing financial performance, creating flexibility, better environmental implications, increasing positive economic and social impacts).

This ordering of the means objectives has the highest level of agreement among the representatives of key stakeholder groups and can be considered as the fundamental objective. The final level of agreement and the orders were discussed with the representatives of key stakeholders, separately. They were asked if the defined fundamental objective fulfilled their desired objective in the planning process. Considering

the highest level of agreement (value 0.67), the order was confirmed by the representatives of the internal, external and legislation and public policy stakeholder groups to be considered as the definition of success in APP.

## 6 Conclusions

The complexity of a port system and the concomitant uncertainties call for a new port development approach. Adaptive port planning deals with such uncertainties and meets the desired objectives of port stakeholders during the projected lifetime of the port, because it starts with a definition of success. Reaching a consensus on the definition of success is not an easy task when multiple stakeholders, with different interests and power, highlight a wide range of objectives.

An integrated qualitative and quantitative approach was conducted to effectively capture stakeholders' objectives, account for conflicting interests and, at the same time, ensure consistency in the whole process. The approach comprised stakeholder analysis, the value-focussed thinking method, existing literature in the area of port planning and fuzzy logic. The results show that VFT is a capable problem structuring method in port planning, mainly because it facilitates the identification of values of a large group of often 'diverging' stakeholders. VFT enhanced the decision-making process to articulate the means objectives. The fuzzy multi-attribute group decision-making method was applied to identify the highest level of agreement on the objectives and, eventually, formulate the definition of success in the APP.

Conflict of interest among stakeholders in a group, over the sub-objectives, was revealed, extensively. Eight means objectives of port planning were identified by harmonising and clustering the sub-objectives obtained from the interviews with all relevant stakeholders. The means objectives were increasing competitiveness, increasing effective and efficient use of land, increasing safety and security, increasing hinterland connectivity, increasing financial performance, creating flexibility, better environmental implications and increasing positive economic and social impacts.

Although the means objectives of increasing competitiveness and increasing effective and efficient use of land were pivotal among stakeholders, financial performance seemed to be a formidable challenge, as a conflicting interest. The results indicated that increasing financial performance was prioritised by the internal stakeholder group, the one having the greatest salience. Thus, consideration should be given to this means objective in formulating the definition of success by a port planner. A consensus was reached among

the key stakeholders on the definition of success, by prioritising increasing competitiveness among identified means objectives in the APP.

The present framework supports decision-making in port planning, including the APP, to answer the research question. It offers the highest level of agreement on the definition of success among the various stakeholders. The proposed framework provides an easy process for turning the highest level of agreement into a consensus in the follow-up meetings and negotiation with the (key) stakeholders. The scope of the framework is rather flexible and can be applied to large ports with numerous stakeholders, or smaller ones, such as in the present case study. The transparency of the approach allows the active engagement of key stakeholders to monitor each step of the analysis, review the findings and provide feedback.

## Appendix

The colour-scaled level of agreement within the interviewees and the list of subobjectives and means objectives of port planning are presented in Tables 3 and 4.

Table 3 Colour-scaled level of agreement within the interviewees of each stakeholder group

| | | |
|---|---|---|
| | No level of agreement among interviewees | (0) |
| | Low level of agreement among interviewees | (1-33 %) |
| | Medium level of agreement among interviewees | (34-75 %) |
| | High level of agreement among interviewees | (76-100 %) |

Table 4 List of sub-objectives and means objectives

| | | Stakeholder groups | | | | |
|---|---|---|---|---|---|---|
| | Sub-objectives | IS | ES | LS | AS | CS |
| A | Increasing competitiveness | | | | | |
| 1 | Reduce the logistical costs and improve logistical performance | 0 | 0 | 11 | 33 | 0 |
| 2 | Increase efficiency and (responsive) operability of the system | 67 | 24 | 33 | 33 | 17 |
| 3 | Improve the quality of services and port performance | 33 | 14 | 22 | 67 | 0 |
| 4 | Increase current port capacity with constant and integrated port development to meet future demand | 67 | 62 | 44 | 67 | 42 |
| 5 | Reduce down time at the port | 17 | 29 | 22 | 67 | 0 |
| 6 | Increase optimal service and provide available area for different vessels (sailing, fishing, cruise, container) for (un)loading, maintenance, mooring, etc. | 50 | 48 | 56 | 100 | 42 |
| 7 | Increase port facilities, infrastructure, technology and IT | 50 | 24 | 56 | 67 | 8 |
| 8 | Quicker response to market changes and market signals | 0 | 0 | 0 | 67 | 0 |
| 9 | Improve connections and synergy between the port and the domestic airport | 0 | 0 | 0 | 33 | 0 |
| 10 | Increase and update port services such as providing enough (green) energy to vessels and port activities | 17 | 33 | 22 | 67 | 25 |
| 11 | Improve ability to supply different fuels to vessels | 0 | 0 | 0 | 33 | 0 |
| 12 | Increase possibility of sharing port facilities between activities | 0 | 10 | 0 | 0 | 8 |
| 13 | Reduce service and operational costs | 0 | 5 | 11 | 0 | 0 |
| 14 | Increase reputation of the port | 17 | 0 | 0 | 33 | 8 |
| 15 | Quicker emergency response and evacuation plan | 0 | 0 | 22 | 33 | 8 |
| 16 | Keep (multi)functionality of the port and create a balance between functions | 67 | 19 | 0 | 33 | 33 |
| B | Improve financial performance | | | | | |
| 1 | Increase financial benefits for customers and good business prospects | 17 | 10 | 0 | 0 | 0 |
| 2 | Improve independency of the port from governmental support | 17 | 0 | 0 | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | Increase income of the port and investments in the port area | 17 | 0 | 0 | 0 | 0 |
| C | Increasing effective and efficient use of land | | | | | |
| 1 | Increase efficiency of port land use for tourist passengers, processing and storing products, servicing, cargo handling, and customs, as well as other businesses | 83 | 43 | 56 | 100 | 17 |
| 2 | Minimise the cost of a development plan in the port area | 0 | 5 | 11 | 0 | 0 |
| 3 | Improve clustering of activities in the port area | 50 | 43 | 22 | 33 | 17 |
| 4 | Increase access to the activities in the port area | 0 | 38 | 11 | 67 | 58 |
| 5 | Increase the availability of a multiuser and shared land in the port area in high seasonal activities for port users, in particular, in the summer season when the port bustles with cruise and excursion activities. | 17 | 19 | 11 | 0 | 0 |
| 6 | Reduce conflict between activities | 33 | 48 | 22 | 33 | 25 |
| 7 | Improve the buffer zone between the port area and the city; port city planning should be addressed | 50 | 5 | 11 | 33 | 0 |
| 8 | Increase access to taxi or bus stations in the port area for excursion services and visiting the town | 0 | 0 | 0 | 33 | 0 |
| 9 | Increase opportunity for providing a warehouse or area for cargo that can be used as a distribution centre at the regional and national levels | 0 | 0 | 0 | 0 | 8 |
| 10 | Improve planning and better use of land to provide parking areas for port users, staff and tourists | 17 | 10 | 0 | 33 | 0 |
| 11 | Reduce traffic in the port area | 0 | 0 | 0 | 33 | 0 |
| 12 | Increase access of activities (fish factories, transport companies, etc.) to the quayside for (un)loading | 17 | 24 | 11 | 0 | 0 |
| 13 | Increase effectiveness and cooperation between port stakeholders | 17 | 19 | 11 | 33 | 8 |
| 14 | Fulfil the regional and national strategies, policies and guidelines in terms of planning | 17 | 10 | 22 | 0 | 0 |
| 15 | Increase opportunities to distribute port activities and collaborating with other ports in the municipality or neighbouring ports to relieve pressure on the area | 17 | 14 | 22 | 67 | 25 |
| 16 | Keeps the history (culture and heritage) of the port along with new industrial activities in the port area | 0 | 0 | 0 | 0 | 8 |
| 17 | Increase tourism, leisure, recreational and urban activities in the port area | 17 | 10 | 0 | 0 | 33 |
| D | Increasing hinterland connectivity | | | | | |
| 1 | Expanding hinterland (area over which the port has market share) | 0 | 14 | 0 | 33 | 0 |
| 2 | Expanding competition margins (area where two or more ports are in competition) | 0 | 0 | 0 | 33 | 0 |
| 3 | Expanding foreland | 0 | 5 | 0 | 0 | 0 |
| 4 | Improve integration with and connections to the hinterland | 33 | 29 | 11 | 67 | 0 |
| 5 | Increase regional, national and international sea trade and sea trade connections | 33 | 29 | 22 | 67 | 8 |
| E | Increasing positive economic and social impacts | | | | | |
| 1 | Improve positive societal impact and assure quality of life of the society | 17 | 10 | 11 | 0 | 17 |
| 2 | Improve information services and provide a data bank or open data exchange for different purposes such as scientific research and operational work | 0 | 0 | 0 | 33 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | Improve knowledge and provide research and scientific grounds for scientific communities | 0 | 0 | 0 | 100 | 0 |
| 4 | Increase private-public investment in the port and the region (added value) | 0 | 5 | 0 | 0 | 0 |
| 5 | Promote economic growth and contribution to economic development to support regional, national and international trade | 17 | 10 | 22 | 0 | 25 |
| 6 | Improve sustainable development of the port | 17 | 0 | 11 | 100 | 0 |
| F | Better environmental implications | | | | | |
| 1 | Comply and support environmental standards with respect to European directives as well as national policy programs and regulations | 17 | 19 | 33 | 33 | 0 |
| 2 | Maximise scenic/aesthetics and attractiveness of the port area | 33 | 24 | 0 | 0 | 42 |
| 3 | Minimise nuisance in the port and surrounding areas | 33 | 14 | 0 | 33 | 42 |
| 4 | Increase sustainable and environmentally friendly port operations | 50 | 10 | 33 | 67 | 25 |
| 5 | Improve ballast water management and waste treatment from the ships | 0 | 0 | 11 | 33 | 0 |
| 6 | Improve consistently and precisely port activities in line with the public's environmental concerns regarding wildlife ecosystems, fauna and flora and global impacts | 17 | 14 | 33 | 67 | 33 |
| G | Increasing safety and security | | | | | |
| 1 | Comply and support international law, European directives and national policy programs and regulation in terms of safety standards of maritime navigation, port operation and installations | 33 | 10 | 78 | 33 | 8 |
| 2 | Minimise detrimental health and safety impacts to the locals and port users in terms of mortality and morbidity (by distinct sidewalk, signs, marks, passages, etc.) | 67 | 38 | 33 | 67 | 67 |
| 3 | Increase security and safeguarding in the ports and fulfil regulatory framework in terms of port security ISPS from IMO and European union regulation work | 0 | 0 | 22 | 0 | 0 |
| 4 | Increase monitoring, controlling and security system | 33 | 0 | 11 | 0 | 0 |
| H | Creating flexibility | | | | | |
| 1 | Increasing flexibility of the port to deal with future uncertainties specially for existing port activities | 17 | 29 | 11 | 67 | 25 |
| 2 | Increase awareness of port stakeholders for effective implementation of adaptive port master planning (translation from theory to real case) | 0 | 0 | 0 | 33 | 0 |
| 3 | Increasing flexibility of the port to adapt to any possible interchange of port function | 0 | 0 | 0 | 33 | 0 |
| 4 | Increasing flexibility of the port to adapt to external changes such as technological, environmental, social, legislative, etc. | 0 | 19 | 11 | 67 | 8 |

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