

Service Quality Aspects in Ferry Passenger Transport - Examples from Norway¹

Terje Andreas Mathisen² and Gisle Solvoll³

Bodø Graduate School of Business

Changes in the level of service for scheduled passenger transport influence both operating costs and passengers' generalised travel costs. This article focuses on the service level and service quality of ferry crossings using empirical data from a survey carried out in Norway in 2008. Using gap analysis we document how both enterprise and household ferry users rate the importance of and their current satisfaction with a number of service aspects concerning Norwegian ferries. Fares, discount schemes and sufficient capacity in the summer are rated as highly important but providing a low level of satisfaction by both user enterprise and household respondents. These elements should, therefore, be paid special attention to when adjusting the service level. The results from the survey are of special interest for the Norwegian transport authorities with respect to revisions of the national ferry service standard, and the survey method can provide a useful tool when evaluating transport initiatives.

Keywords: Customer satisfaction; ferry transport; service elements; service policy; service quality

1. Introduction

From an economic point of view the service level in scheduled passenger transport is important for two reasons. Firstly, the service level, e.g. the number of departures per hour, strongly influences the direct and external costs of operating the service. Secondly, the service level influences the passengers' generalised travel costs and thereby the users' benefits. Together these two impacts affect the social surplus of the service in question. Changes in the service level for transport services could, therefore, result in considerable welfare economic impacts (Leck et al., 2008). For example, Begg et al. (1996) studied a ferry crossing in Scotland and concluded that increased accessibility for tourists and reduced costs for local businesses following improvements in the service level provided large positive economic impacts. Setting the right service level for public transport services is, consequently, an important task for the transport authorities.

Ferry services play an important role in the national transport system in many European countries, especially those with long coastlines and many inhabited islands. This is for instance the case in Norway where about 130 ferry crossings connect settlements without direct road

¹ This article is a revised version of a paper presented at the Fifth Symposium on Strait Crossings in Trondheim, Norway in June 2009.

² NO-8049 Bodø, Norway, T: +4775517637, F: +4775517268, E: tam@hibo.no

³ NO-8049 Bodø, Norway, T: +4775517632, F: +4775517268, E: gso@hibo.no

access to the highway system on the mainland. Without these ferry crossings, many settlements and enterprises along the Norwegian coastline could not be upheld. Analysis also shows that about 75% of the Norwegian ferry crossings are profitable from a social welfare point of view (Jørgensen et al., 2008). The ferries are highly regulated by the state with respect to most quality service elements. A current national administration reform implies, amongst other things, that the administrative responsibility for 78 of 95 highway crossings will be transferred from the central authorities to the Norwegian county councils as of 1st January 2010. Because the counties will not necessarily follow the current national ferry standard, the transfer of responsibility paves the way for differentiation between crossings with respect to service level.

Due to the considerable subsidy grant of approximately 1.8 billion NOK per year (Report no. 16 to the Storting, 2008-2009) and the ferries' national importance, the transport authorities seek systematic information about the users' appreciation of various service aspects on the ferry crossings. Today, the government receives feedback from ferry users through informal channels such as direct inquiries, media publicity and politicians. This feedback gives some indications of the passengers' valuation, but it is of an occasional and incomplete nature and cannot, therefore, be deemed representative. Consequently, in 2008 the Ministry of Transport and Communications decided to carry out a research project for which one of the main objectives was to reveal how ferry users assess several service elements on the ferries and changes in the service level with regard to these same elements. Bodø Graduate School of Business was given the task of clarifying these issues.

The aim of this article is to document, using survey data, how ferry users appraise the importance of and satisfaction with a number of service elements on Norwegian ferries so that the transport authorities are better informed with respect to improvements in service quality when revising the national ferry standard. The methodology used and some of the findings do also have relevance for other countries where the transport authorities want to obtain empirical based knowledge about the inhabitants' valuation of transport services in general, and ferry services in particular.

The article is organised as follows. Section 2 briefly presents the Norwegian nationwide ferry standard and discusses the central service elements in passenger transport in general and ferry transport specifically. In Section 3 the framework for assessing the importance of and satisfaction with service elements is presented. Section 4 accounts for the data collection and the analyses of the survey are presented in Section 5. Finally, Section 6 provides conclusions and possible implications for policy makers.

2. Service Elements in Passenger Transport

The influence of fares and quality on demand for public surface passenger transport in general is thoroughly examined by Balcombe et al. (2004). In customer satisfaction analysis, the quality of service elements is operationalized according to universally recognised performance elements and industry specific elements (Dutka, 1994). Even though most service elements are relevant for all transport modes, there are some differences between the criteria applied in earlier studies.

Aiming to establish a framework for monitoring quality in Greek railway transport, Nathanail (2008) applied 22 indicators, both quantitative and qualitative, to represent six criteria. In addition to safety, cleanness, comfort and passenger information, Nathanail (2008) included service elements such as speed, frequency and personnel behaviour in an extensive servicing criterion. In a study of leisure passengers' travel to a selection of Greek islands, the most important factor influencing the choice between air and boat transport was travel time (Rigas, 2009). Other factors were for example safety, fare level, and comfort. For air transport, the quality of in-flight services including the quality of food and drink is important for the satisfaction of the

passengers (An and Noh, 2009). Calculating a service quality index for bus transport, Hensher et al. (2003) demonstrated that, at the current service level, travel time and fare are related to most negative satisfaction, whereas frequency and availability of seats are related to most positive satisfaction. This brief review of customer satisfaction studies of transport services indicates that many of the service qualities can be considered as general for public transport modes. Examples of these universal service elements are price, frequency, safety, regularity and travel time.

2.1 The Norwegian Ferries

In Norway, the National Transport Plan (NTP) 2010-2019 (Report no. 16 to the Storting, 2008-2009) defines the government's transport policy regarding all public transport infrastructure - whether it is by road, rail, air or sea. Ferries are regarded as an important part of the transport infrastructure in the coastal and often rural areas of Norway. In 2008, there were 127 ferry crossings in Norway of which 99, 26 and 2 were regulated at state, county and municipality level, respectively. The crossings are operated by 15 shipping companies and carried nearly 20 million vehicles and over 21 million passengers (The Norwegian Public Roads Administration, 2009)⁴. The service standard with regard to frequency and opening hours is, according to the NTP, determined by the amount of traffic and the classification of the crossing. An extract from the ferry crossing standard is shown in Table 1. This service standard is valid for the state regulated crossings only with separate regulation for the 10 main state road crossings (European standard roads) and the 89 other state roads.

Table 1. Extract from the national ferry standard for the Norwegian ferries

Classification	Traffic ^a	No. of crossings ^b	Frequency per day	Opening hours (weekdays)
Main state roads	> 2500 PCE AADT	1	38	24 h
	< 2500 PCE AADT	9	36	24 h
Other state roads	> 2500 PCE AADT	1	36	24 h
	1000 - 2500 PCE AADT	10	30	18 h
	500 - 1000 PCE AADT	9	22	18 h
	100 - 500 PCE AADT	54	21	16 h

^a PCE: Passenger Car Equivalents. AADT: Average Annual Daily Traffic.

^b A total of 15 state regulated crossings have AADT less than 100 and is not considered by the service standard.

It is demonstrated in Table 1 that the required frequency is reduced with respect to traffic. Greater traffic implies, according to the service standard in Table 1, an increased number of departures per day (frequency) and extended opening hours. For example, all main state roads along with other state roads with average annual daily traffic (AADT) exceeding 2500 passenger car equivalents (PCE)⁵ are to offer round-the-clock operation. For all state road ferry crossings, a service level of 98% (the proportion of vehicles able to board on their desired departure) is the stated goal. This 'boarding-ratio' is set by the Norwegian Directorate of Public Roads. However, traffic data from 2008 indicates that 15% of the crossings have a service level lower than the standard (The Norwegian Public Roads Administration, 2009). This is principally crossings with high AADT.

Fares and discount rules are, in the same way as frequency and opening hours, standardised by nationwide regulations. The aim is to ensure that fares are equal throughout the country (see e.g.

⁴ For further descriptions of the Norwegian ferry industry see e.g. Jørgensen and Mathisen (2009).

⁵ The PCE concept is introduced to handle the multiproduct problems related to transporting different types of vehicles. For example, a passenger car (< 6m) count 1.025 PCE while a heavy goods vehicle (> 19 m) count 10.682 PCE. The PCE concept is explained e.g. by Mathisen (2008).

Jørgensen et al., 2004). However, the actual price paid by the users depends on the discount system. In 2008 the maximum obtainable discount rate was raised from 45% to 50%. The influence of price on demand is explained by the elasticity concept. However, studies of passengers' fare elasticity for ferry transport can seldom be found. In Norway, the influence of fares on the demand for ferry crossings has been estimated at about -0.2 to -0.3 (Hervik et al., 1989). Jørgensen et al. (2008) estimated average price elasticities ranging from -0.23 on short crossings to -0.51 on long crossings. This shows that demand for ferry services is price inelastic, which is reasonable since the passengers usually have few other alternative transport modes and are, to a greater extent than other transport modes, forced to use the ferries at any cost.

2.2 Central Service Elements in Ferry Transport

Surveys of customer satisfaction for ferry passengers have used a few additional service elements to evaluate the quality of transport and possible improvements. For example, the "Marine Transport Survey" among ferry riders in Massachusetts used 12 service elements (Cape Cod Commission, 1999). These crossings were characterised by a high proportion of commuters travelling to and from work and depending on correspondence with other public transport modes. Also studying commuters at ferries, Soumoy and Sweeny (2000) found that speed was one of the most important service elements. In Norway, Jørgensen et al. (2008) applied 16 service elements when studying user benefits of car ferries in coastal regions. The service elements used by Jørgensen et al. (2008) are presented in Table 2 and include all universal elements for passenger transport except safety.

Table 2. Service elements for ferry transport (Source: Jørgensen et al. (2008))

Service element (abbreviation)	Question formulation in the survey
Frequency	Number of departures per day.
Opening hours	Time between first and last departure.
Time table	Planned departure times.
Regularity	That planned departures are being carried out.
Punctuality	That planned departures are not behind schedule.
Fare	Full price fares for the vehicle you are using.
Discount	Discount rules for the vehicle you are using.
Capacity summer	The probability to board desired departure in summer.
Capacity winter	The probability to board desired departure outside summer season.
Ferry size	The size of the main ferry in 2008.
Comfort	Comfort on board the main ferry.
Speed	Crossing time.
Information	Information about schedules and fares at quay.
Service	Service attitude to the crew.
Cleaning	Cleanness of the interior of the ferry.
Catering	Catering on board ferry

The 16 service elements in Table 2 are presented both by an abbreviated title and the wording given in the questionnaire (translated from Norwegian). The questionnaire was designed with open questions enabling respondents to elaborate on conditions related to importance of and satisfaction with service elements.

The study by Jørgensen et al. (2008) provides the data set for the following analyses using the service elements in Table 2. Changes in the service elements presented in Table 2 influence the demand for transport through the generalised travel costs notion comprising pecuniary costs and time costs (e.g. Button, 1993). The impact of the service elements on generalised travel costs for the ferry users is thoroughly discussed by Jørgensen et al. (2007).

3. Framework for Assessing Importance and Satisfaction

In order to enable transport authorities to change service quality in the best possible way, it is vital to have knowledge about which criteria are important, as well as an assessment of the passengers' current satisfaction. Information about which service elements ferry users value as most important and how satisfied they are with the service level, is obtained by inviting a selection of ferry users to express their opinions by answering a questionnaire. This method corresponds broadly speaking with the study conducted by Rigas (2009) in which passengers indicated the importance of each service element on boat and air transport on a five graded scale from 1 (low) to 5 (high). Such analyses are usually referred to as gap analyses (Dutka, 1994). Using a similar scale, a study conducted by Lodden et al. (2002) revealed the importance of and the satisfaction with service quality in the bus industry. Grigoroudis and Siskos (2004) also presented and applied similar methods in their review of satisfaction barometers in the transportation and communications industry.

Consequently, the respondents were asked to categorise the service elements in Table 2 on a five-graded scale along the two dimensions importance and satisfaction. Both importance and satisfaction were quantified from 1 (very low importance/satisfaction) to 5 (very high importance/satisfaction). The numbers were accompanied by an explanation stating the meaning of each number with the value 3 representing neither important/satisfied nor unimportant/dissatisfied. Such an ordinal scale does have its limitations with respect to econometric analysis, in that it produces non-metric data (e.g. Hair et al., 1998). It is, however, clear that grade 3 is better than grade 2. In the following analyses it is assumed that the differences between the grades are perceived by the respondents as equal, so that average values can be calculated.⁶

A combination of the two dimensions' importance and satisfaction generates four zones denoted A to D (illustrated in Figure 1 and Figure 2) of which each service element can be put into one zone. As suggested by Dutka (1994), these values are visualised in a two-by-two matrix with satisfaction and importance along the horizontal and vertical axes, respectively. The value 3 is used as the vertical and horizontal lines in the scatter graph according to the definition as a representation of the neutral alternative. Hence, values above and below 3 are named high and low respectively. This is demonstrated in Figure 1 and Figure 2. Such a framework is referred to as quadrant analysis and frequently used to analyse stated measures (Stradling et al., 2007; Transportation Research Board, 1999).

Plotting of the users' assessment of different service elements at the respective coordinates in the matrix reveals which factors need to be subjected to closer examination in order to improve the service level from a user perspective. The matrix forms a framework for assessing whether the quality level of the service elements should be increased or, possibly, lowered if the goal is to increase users' utility under given budget restrictions. Hence, a reallocation of the resources can increase the passengers' utility. Brief interpretations of the different categories are:

- Zone A (high importance - low satisfaction): The service level of elements in this zone should be increased. These are important service elements with low user satisfaction.
- Zone B (low importance - low satisfaction): The service level of elements in this zone should be increased or kept unchanged. Users are not completely content, but rate the importance of the service elements as quite low.
- Zone C (high importance - high satisfaction): The service level of elements in this zone should be maintained as they are important service elements with high user satisfaction.

⁶ It is accepted practice to conceive ordinal scales as delivering interval data in such analyses. See e.g. the discussion of quantitative analysis of stated importance measures by Transportation Research Board (1999).

- Zone D (low importance – high satisfaction): The service level of elements in this zone can be maintained or reduced. These are less important service elements with high user satisfaction. It should be considered whether resources used at these service elements can be reallocated to more important service elements (e.g. zone A).

However, how to handle the service level of elements in the four zones cannot purely be determined according to the importance of and user satisfaction with the present service level. Before measures are taken to downgrade or upgrade the service level, one should have in-depth knowledge of both the marginal costs and the ferry users' pecuniary valuation related to changing the present service level for a given element.

4. Empirical Data

The survey consists of two data sets (samples) gathered by a stratified selection of respondents and aiming to represent ferry users. First, about 8500 enterprises located in Norway's coastal counties were approached using a web-based questionnaire. This respondent sample consists of managers answering on behalf of an enterprise and primarily represents business trips related to freight of goods. Second, a postal questionnaire was sent in October 2008 to a random selection of 2700 household representatives in 17 islands and coastal municipalities located in areas with ferry crossings. The household representatives answered on behalf of their own travel activity and not for the complete household. The response rate was 12.6% and 24.4% for enterprises and households, respectively, providing a total of 1734 answers (1074 from enterprises and 660 from households).⁷ However, as illustrated in Table 3, the number of answers for each question varies, as not all respondents answered all questions. All valid responses were used in the analyses.

Table 3. Descriptive statistics for the two data sets

Sample	Variable	Responses	Maximum	Minimum	Average	Std. deviation
Enterprises	Turnover (NOK)	961	218 000 000	0	26 092 620	38 789 829
	No. of employees	1 018	120	0	17	22
	No. of trips per week	917	150	0	13	24
Households	Age	637	71	13	47.5	12.7
	Yearly income (NOK)	598	2 000 000	0	344 986	194 235
	No. of trips per week	638	20	0	2.4	3.2

The data examination revealed a number of obvious typing errors which were corrected. A selection of descriptive statistics of the two data sets is presented in Table 3. An average enterprise in the data set had annual sales of 26.1 million NOK⁸, 17 employees and 13 weekly ferry trips (one way). The spread in these variables is considerable. It should be noted that an enterprise can be active even if sales or the number of employees are zero⁹. The official statistics of Norway show that an average enterprise located in the counties with ferry crossings has 4

⁷ The total number of enterprises in the coastal counties with ferry crossings are about 160000 (Statistics Norway, 2010b) and the population in the 17 municipalities selected for the household questionnaire is 92 900 (Statistics Norway, 2010d). Consequently, the respondents in the data sets represent 0.67% and 0.71% of the population for enterprises and household respondents, respectively.

⁸ 1 € ≈ 8 NOK (February 2010).

⁹ These enterprises are categorized as "No one employed" in official statistics (Statistics Norway, 2010c).

employees and turnover amounting to 12.2 million NOK (Statistics Norway, 2010a). Many of these enterprises are, however, inactive. Hence, our data set contains enterprises with higher activity than average. The data set contains enterprises related to a total of 12 industries of which the largest are transport, manufacturing and service.

Household passengers had, on average, an annual income of about 345000 NOK, an age of 47.5 years, and made 2.4 weekly ferry trips. A slight overweight of the respondents were females (50.2%). The household respondents represented in-work business trips, commuter trips to/from work and school, leisure trips and other travel purposes (e.g. medical and other). Leisure respondents are overrepresented in the sample compared to the distribution of travel purpose for ferry users indicated by Hervik and Bråthen (1992). The household respondents have a slightly higher gross income than the national average of 322500 NOK in 2007. The spread of respondents ensures that a variety of respondent characteristics are represented for both enterprises and households in the coastal areas of Norway.

After the opening questions focusing on personal characteristics (households) and business activity (enterprises) together with travel habits, the respondents were asked to assess the importance of and satisfaction with all 16 service elements of the ferry operations presented in Table 2. Respondents are treated equally and independently of the number of trips. At the end of the questionnaire the respondents could comment freely on the ferry operations.

5. Analysis

A scatter graph of the average values for the respondents stating the importance of and satisfaction with the service elements in question is given for the enterprises in Figure 1 and the households in Figure 2. The plots illustrate that all service elements are considered important - with grades above 3; whereas satisfaction is generally lower - with grades between 2 and 4.

In accordance with the interpretation of the scatter graph, focus should be directed towards the top left part (zone A) of Figure 1 and Figure 2. Consequently, from the users' point of view reduced fares, better discount schemes and higher summer capacity are the most important measures to be taken when improving the quality of Norwegian ferry crossings. For the households only fares are located in zone A.

The data set enables analysis of the differences between groups of ferry users with respect to branch of industry for enterprises and trip purpose for households.¹⁰ The deviations are calculated for each sample meaning that industry only considers the enterprise respondents and trip purpose only the household respondents. Our data contains twelve groups of industries and five groups of trip purposes of which the three most commonly used groups are studied in particular for each sample. Deviations from mean values of importance and satisfaction are studied for each group of ferry users in pursuit of significant differences. The results are presented in Table 4 and Table 5 for importance and satisfaction, respectively. The level of significance is identified by asterisks and only deviations of 10 % significance or better are reported. Significant deviations from the mean for the selected group compared to that of the complete data set of the respective sample are calculated using a two way t-test¹¹. There are,

¹⁰ Also the characteristics of the passengers presented in Table 3 could explain variations in valuation of importance and satisfaction. Using an ordinal regression model we find that the household respondents' assessment of importance with the service elements is, in general, positively related to the number of trips at 1% level but not significantly influenced by age or income. Satisfaction is, in general, positively related to age at 10% level, negatively related to the number of trips at 1% level but not significantly related to income. However, the model only explains 2% -5% of the variance (measured by R²) in valuation of importance and satisfaction for the service elements.

¹¹ SPSS version 15 was applied for the statistical analyses.

therefore, no a-priori assumptions of the direction of the deviation. The t-test assumes that the data set is normally distributed. However, the large number of observations enables us to use t-tests even if the data are not normally distributed. The Levene's test is applied to assess whether the similarity in variation is acceptable between the selected group and the total sample.

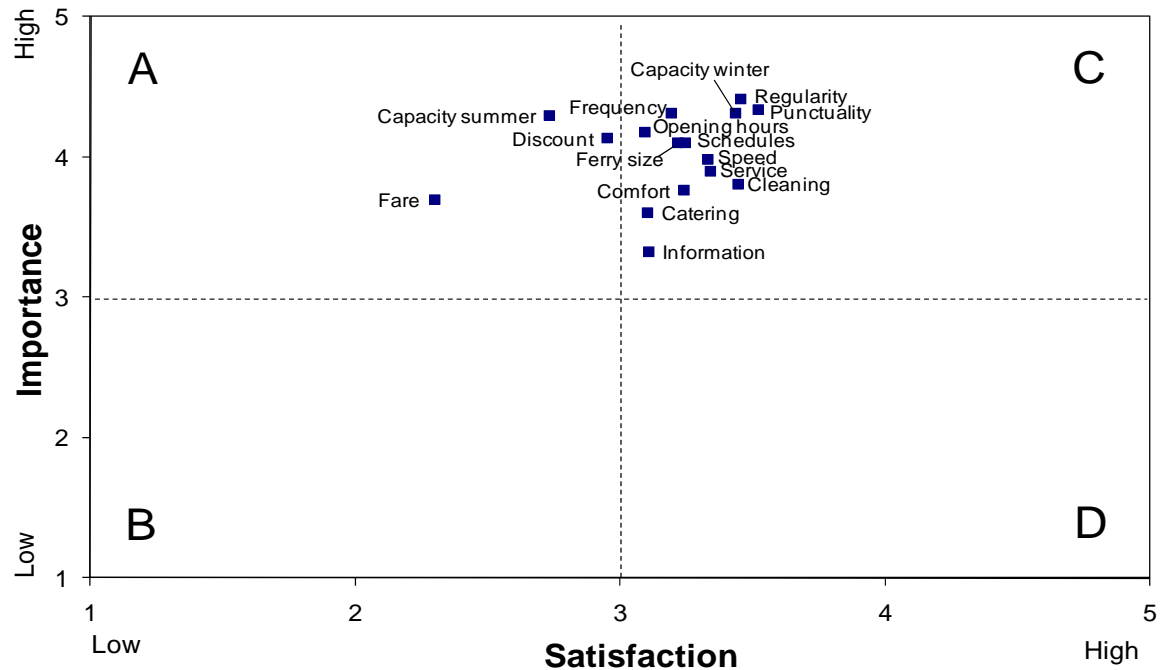


Figure 1. Enterprises assessment of importance and satisfaction with service elements in Norwegian ferry operations.

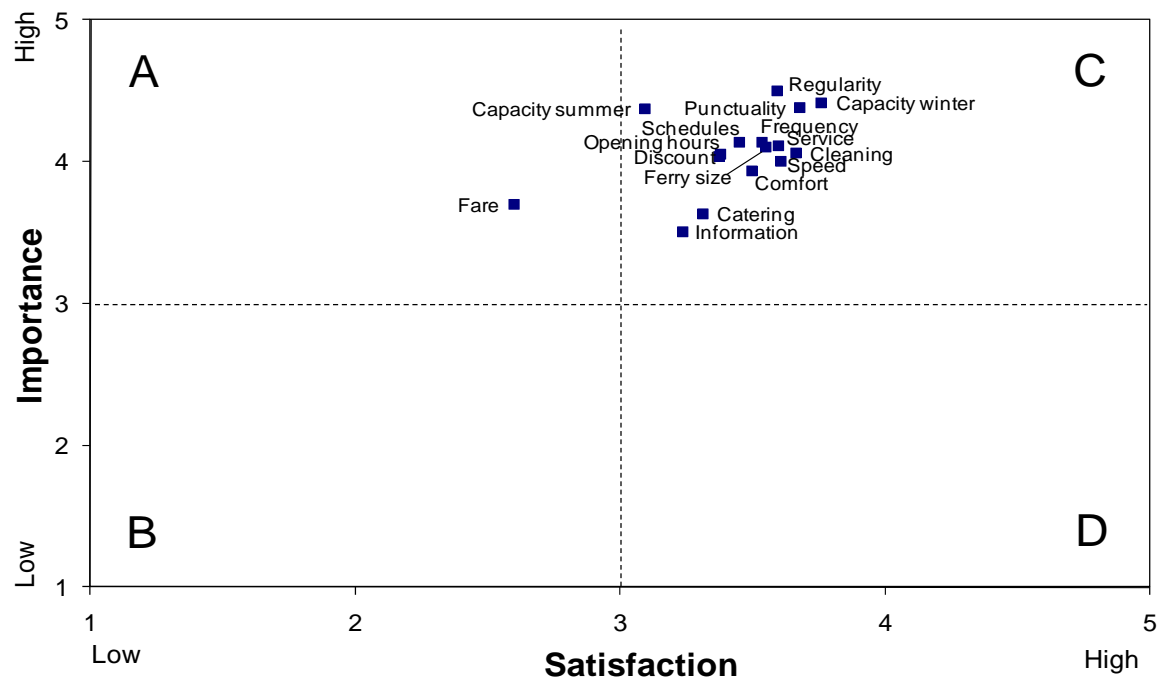


Figure 2. Households assessment of importance and satisfaction with service elements in the Norwegian ferry operations.

Many of the significant deviations confirm commonly accepted differences between groups. It should be noted, however, that even though significant deviations are identified, the absolute values are relatively moderate. The deviations from the mean are represented in Table 4 and Table 5 using “+” and “-” for positive and negative values, respectively. The magnitudes are represented by one, two or three positive or negative signs indentifying intervals of 0.1. Deviations from the mean of more than 0.2 are represented by three positive or negative signs. These deviations are absolute values and should be related to the mean value. For example, a significant deviation of 0.1 represents a relatively less change if the mean value is 4 compared to a situation where the mean value is 3.

5.1 Assessments of Importance

Regularity, punctuality, summer capacity and winter capacity are given high average importance values for both samples with scores well above 4. It is demonstrated in Figure 1 and Figure 2 that households mainly agree with the enterprises regarding the importance of the different service elements. Enterprises find, however, frequency and opening hours more important than the household respondents, which could be due to the fact that the household sample includes a considerable proportion of leisure trips that are more flexible with respect to time of departure. Oppositely, cleaning and service are considered more important for households as compared to enterprises. This could be due to the fact that the household respondents travel by the ferries themselves, while the enterprise respondents are representatives of the administration that prioritise other service elements. Fares, information and catering are considered less important by both samples.

Table 4. Significant deviations in the assessment of importance for different groups of passengers.

Service elements ^a	Mean value	Industry (Enterprises)						Mean value	Trip purpose (Households)					
		Transport		Manufacturing		Service			Commuter		Leisure		Business	
		N = 84		N = 434		N = 188			N = 79		N = 422		N = 103	
Frequency	4.3	++	***					4.1	++	**	-	***	+++	***
Opening hours	4.2	+++	***					4.1			-	*		
Schedule	4.1	+++	***					4.1	++	**	-	***	++	*
Fare	3.7	--	***	++	***	-	**	3.7						
Discount	4.1	+++	***	+	***	--	**	3.9	+++	***	-	***		
Regularity	4.4							4.5	+++	***	-	***	++	*
Punctuality	4.3	++	*					4.4	++	**	-	***	++	***
Capacity summer	4.3	+++	**					4.4			-	***	++	***
Capacity winter	4.3	++	*					4.4	++	*	-	***	++	***
Ferry size	4.1	+++	***					4.1	+++	**	-	***	++	**
Comfort	3.8	+++	***					3.9						
Speed	4.0	++	*					4.0	++	**				
Information	3.3							3.5	--	*	+	**	--	*
Service	3.9	+++	***					4.1						
Cleaning	3.8	+++	***	-	*			4.1	---	**				
Catering	3.6	++	*					3.6	---	*				

^a *** = significant at 1 % level, ** = significant at 5 % level, * = significant at 10 % level.

The significant deviations in assessment of importance are presented in Table 4 for branches of industries for enterprise respondents and trip purposes for household respondents. Amongst the enterprise respondents the firms related to the transport industry assess all service elements except fares, regularity and information as being more important than other industries. This makes sense as transport firms are themselves the most frequent users of ferries (receive quantity discounts) and have the most extensive experience of daily ferry use. Enterprises in the service group report less focus on fares and discounts than average, while enterprises in the manufacturing group report these elements higher than average.

Some differences can be expected between the groups of household passengers because commuting passengers travel frequently, business passengers do not pay the tickets themselves, and leisure passengers have low time costs and high flexibility. It is demonstrated in Table 4 that commuter and business passengers consider most elements more important than average, while leisure passengers consider most elements less important than average. More specifically, commuters find frequency, schedule, discounts, regularity, punctuality, ferry size and speed more important than the average respondent, while they find information at the quay regarding schedules and cleaning and catering on board less important than average users. Business passengers find information less important than average and many of the same elements as the commuters more important than average. The exceptions are fares and speed and the additional service element capacity that is considered more important than average. Leisure passengers consider the importance of frequency, opening hours, schedule, discount, regularity, punctuality, capacity in summer and winter, and ferry size lower than average with a generally high level of significance.

5.2 Assessments of Satisfaction

The enterprises are, according to the average satisfaction score, least satisfied with fare levels and summer capacity. Also, the discount schemes, providing lower average fares to those who travel frequently, are rated with a relatively low satisfaction of 3.0. This is, according to user comments, mainly due to the lack of compatibility of discount programs between ferry operators. Today, an enterprise carrying out activities along the coast of Norway is required to tie up considerable amounts in pre-paid tickets for numerous ferry crossings in order to achieve maximum discounts. Additionally, it would be preferable if the discount programs could be made valid at the increasing number of road toll stations throughout the country. Regularity, punctuality, winter capacity and cleaning are the service elements with the highest scores of satisfaction with values of 3.4 and higher. The satisfaction of the other service elements was rated between 3.1 and 3.3 by the enterprise respondents.

Winter capacity stands out with a high satisfaction score of 3.8 for the households followed by punctuality, cleaning, regularity, speed and service. Fare is given 2.5, which is the lowest satisfaction score, followed by capacity in summer and information. The satisfaction of the other service elements was rated at between 3.3 and 3.5 by the household respondents.

Holding an unweighted average satisfaction score of 3.2 for all service elements, enterprises generally stand out as being less satisfied than households with a corresponding value of 3.4. The differences especially stand out with regard to summer capacity, where household passengers are considerably more satisfied than the enterprises.

The significant deviations in assessment of satisfaction are presented in Table 5 for branches of industries for enterprise respondents and trip purposes for household respondents. Transport firms do not differ considerably from the other groups with respect to satisfaction. The exception is ferry size service element, with which they are less satisfied than average. Enterprises in the service group are significantly less satisfied with regularity, capacity in summer, comfort,

information, cleaning and catering which all are service elements that most likely are highly valued by their customers.

Commuters are generally less satisfied with the service elements than average passengers and both the magnitude and the significance are high. The service elements in question are frequency, opening hours, punctuality, summer capacity, winter capacity, ferry size, comfort and speed. It is to be expected that these frequent users are highly focused on the quality of the transport service. Leisure and business passengers show only minor deviations from mean with respect to satisfaction. Compared to the average respondent, leisure passengers are more satisfied with capacity in summer and ferry size, while business passengers are more satisfied with fares, punctuality, winter capacity and catering.

Table 5. Significant deviations in the assessment of satisfaction for different groups of passengers.

Service elements ^a	Mean value	Industry (Enterprises)						Trip purpose (Households)						
		Transport		Manufacturing		Service		Commuter		Leisure		Business		
		N = 88		N = 433		N = 183		N = 72		N = 413		N = 104		
Frequency	3.2							3.5	---	**				
Opening hours	3.1							3.4	---	***				
Schedule	3.2							3.4						
Fare	2.3			-	*			2.5					+++	**
Discount	3.0							3.3						
Regularity	3.5			+	*	--	*	3.6						
Punctuality	3.5			+	*			3.7	---	***			++	*
Capacity summer	2.7					--	*	3.1	---	**	+	***		
Capacity winter	3.4							3.8	---	***			++	*
Ferry size	3.2	--	*	+	**			3.5	---	***	+	**		
Comfort	3.2			++	***	--	**	3.5	---	***				
Speed	3.3							3.6	---	*				
Information	3.1					--	**	3.2						
Service	3.3			+	*			3.6						
Cleaning	3.4			+	***	--	**	3.7						
Catering	3.1			++	***	--	***	3.3					++	**

^a *** = significant at 1 % level, ** = significant at 5 % level, * = significant at 10 % level.

5.3 Changing the Service Level

The aggregated values presented in Figure 1 and Figure 2 show relatively little variation between service elements, especially with respect to importance. However, the variation is larger when studying each ferry crossing. The administrative reform referred to in Section 1 paves the way for adjustments of the nationwide ferry standard so that counties can prioritise the service elements they find most expedient for each crossing and loosen up the strict fare system. Such decentralised decision making should result in increased benefits for society.

For the transport authorities, the assessment of whether to change the service level or not should be based on welfare maximizing principles. This means that improved/reduced utility for passengers must be related to increased/reduced direct and external costs. Utility or benefits of changes in service level can be revealed by willingness-to-pay (WTP) studies often using stated preference methods (e.g. Eboli and Mazzulla, 2008). The procedure for revealing passengers'

preferences from user choices is discussed e.g. by Louviere et al. (2000). WTP estimates can be used to calculate the economic profitability of a planned service improvement (or service reduction) when the costs of the service improvement are known. Improvements should be carried out, if increased utility exceeds the corresponding marginal costs. Marginal costs can be derived from cost functions as presented for the Norwegian ferry industry by Jørgensen et al. (2004) and Mathisen (2008).

An example of increased frequency can be used to illustrate the welfare maximizing principle. The costs measured in NOK for an extra round trip, C , for a crossing of L km is, according to Jørgensen et al. (2007), $C = 1500 + 225 * L$. The average distance of two-port state regulated Norwegian ferry crossings is approximately 7 km (Mathisen, 2008). Hence, an additional daily round-trip on an average ferry crossing will increase the costs by about 3 100 NOK (1.1 million NOK per year). Consequently, such a service improvement would be profitable from a welfare perspective if the ferry users' yearly WTP for the frequency increase on the actual crossing exceeds 1.1 million NOK per year.

The analysis of significant deviations in Table 4 and Table 5 indicates which groups of travellers will benefit most from changes in service quality. Generally, the importance of service quality for household respondents is more highly valued by passengers travelling in-work and to/from work. The fact that passengers travelling to/from work are significantly less satisfied with a number of service elements makes them a group that will benefit the most from service quality improvements.

Transport firms are the group among enterprises that generally value quality elements of the ferry industry most highly. Even though the service industry does not find the service elements significantly more important than other industries, they are the most dissatisfied group. While the traffic related to the transport industry remains fairly constant during the year, the service group is particularly active on the ferries in the summer due to tourism. Fares are, however, not particularly important for any of these groups. Consequently, service quality improvements on crossings with a high proportion of passengers related to the commuter and/or service industry groups will, *ceteris paribus*, give the highest benefits. The full fare service element is, however, an exception from this conclusion.

6. Conclusions and Implications

Studies of service quality show that frequency, the probability to be able to board the desired departure, punctuality, regularity and fares are important service elements for scheduled passenger transport services, from a user point of view. The results from our survey of the users' assessment of the importance with 16 service elements on ferry services in Norway support this conclusion.

To implement changes in service level based on welfare maximizing principles in scheduled passenger transport, e.g. on a ferry crossing, it is of crucial importance that decision-makers possess reliable knowledge about the customers' travel preferences together with information about how customers assess the quality of the present service level and their utility of improved service level.

A gap analysis framework is applied to visualise how transport users assess the importance of and satisfaction with different service elements in the Norwegian ferry industry. Most service elements associated with ferry operations do not differ considerably from other scheduled transport modes. However, opening hours and capacity are more 'critical' for car ferry services than e.g. for bus services. The reason for this is that ferry services generally have substantially lower frequency than bus services and often have their last departure far earlier than many bus routes. In addition the consequences of missing the last departure give ferry users larger

problems than bus users. One cannot just order a taxi. The analysis of the survey results from the Norwegian ferry industry derives the following main conclusions:

- The service elements considered by ferry users as most important are regularity, punctuality and the capacity during both summer and winter seasons.
- Enterprises are most satisfied with the ferries' punctuality and regularity and least satisfied with fares and the capacity during the summer season.
- Household respondents are most satisfied with the ferries' punctuality and capacity during the winter season and least satisfied with the full price fares for private cars and ferry capacity during the summer season.
- Both enterprise and household respondents are highly satisfied with the cleanliness.

Based on these points we can broadly say that most Norwegian ferry users will be satisfied with the service when the probability to miss a planned departure (due to queue) is unlikely and if full fares are somewhat reduced.

The empirical data shows that enterprise and household passengers' assessments of importance and satisfaction with different service elements vary between groups of passengers. Among the enterprise respondents, the transport firms value the importance of the most service elements significantly more highly and satisfaction with service elements significantly less than the average of enterprises. The conclusion is similar for commuters amongst the household respondents. This indicates that the service elements to prioritise depend on the composition of traffic and that implementation of changes should be adapted to the specific crossing.

If the transport authorities' goal is to improve the service quality for a given market segment, for example commuters, they have to find out how this group assesses the importance and satisfaction with the current quality of the service and make adjustments based on this information.

When the county councils take on the administrative responsibility for the majority of ferry crossings along the Norwegian coast, they will be free to choose fare levels, discount rates, frequencies, opening hours etc. If the quality of transport services is determined according to cost benefit analysis, where passenger surveys form the basis for benefit calculations, the transport services can gradually move from rigid national regulations to a more welfare optimal direction. Since the operation of most ferry crossings has recently been put out on tendered contracts, changes in service level cannot be implemented before the next round of competition takes place in 6-8 years' time. Based on experience from Norwegian bus operations, where the county councils received the administrative responsibility for the quality of the transport services as early as in 1986, it is reasonable to expect that ferry services will gradually move away from today's rigid national standard towards more local variation in service quality.

A survey such as the one carried out among Norwegian ferry users is a useful tool to evaluate transport initiatives. The use of such surveys on a regular basis will give the authorities direct feedback on changes in the road users' preferences regarding service in the ferry sector. If the government expects increased user welfare, e.g. by introducing new environmental friendly buses, more comfortable fast craft vessels or larger ferries, analyses of surveys focusing on satisfaction will provide systematic feedback as to whether the measure has the desired effect or not. If surveys are carried out regularly with the same procedures using standardised questionnaires and identical procedure for selection of respondents, the results will represent a 'satisfaction barometer'. Such measurements will produce useful management information to the transport authorities as well as the transport operators.

Our research project of course set up some problems related to further research regarding challenges for better estimates of economic profitability of a certain change in service level on a

particular transport service (in our case a ferry service). To be able to obtain valid and reliable data on specific crossings, our methodological approach must be improved and expanded in terms of:

- The method used to draw a representative selection of respondents from a population of users of a transport service (such as ferries) to ensure that the sample is sufficiently large and random in order to carry out statistically significant results on service (crossing) level.
- Reveal the respondents' willingness to pay for relevant changes in the service level (e.g. increased frequency, expanded opening hours, larger ferries etc.).
- Calculate the costs for different service improvements.
- Clarify distributional consequences of changes in service quality. Who will receive the largest benefits? Will some groups of passengers experience disadvantages?

An expansion of the survey to include willingness of pay studies and marginal costs analyses can enable the calculation of costs norms that can be used to improve the models the authorities are using when carrying out cost benefit analysis (CBA). In Norway the 'tool' for carrying out CBA is published as a handbook (The Norwegian Public Roads Administration, 2006). Recommendations for estimation of users' benefit of service improvements in the ferry industry are not fully incorporated in the handbook, despite the important role ferries have in the national transport infrastructure. We believe that such shortcomings are also the case in many other countries.

Acknowledgements

We would like to thank the Editor and anonymous referees of this journal for their valuable comments and The Norwegian Ministry of Transport and Communication for funding this study. Also, we appreciate the comments from Finn Jørgensen on earlier versions of this paper.

References

- An, M. and Noh, Y. (2009). Airline customer satisfaction and loyalty: impact of in-flight service quality. *Service Business*, vol. 3, no. 3, pp. 293-307.
- Balcombe, R., Mackett, R., Paulley, N., Preston, J., Shires, J., Titheridge, H., Wardmann, M. and White, P. (2004). *The demand for public transport: a practical guide*. TRL report 593, Transport Research Laboratory, UK.
- Begg, H. M., Henderson, B., Tyler, P. and Warnock, C. (1996). The impact of improved ferry services on an island economy: the case of Mull. *World Transport Policy & Practice*, vol. 2, no. 4, pp. 8-12.
- Button, K. (1993). *Transport economics* (2 ed.). Edward Elgar, Aldershot.
- Cape Cod Commission. (1999). *Marine Transportation Survey*. Barnstable, Massachusetts.
- Dutka, A. F. (1994). *AMA handbook for customer satisfaction*. NTC Business Books, Chicago, Illinois.
- Eboli, L. and Mazzulla, G. (2008). Willingness-to-pay of public transport users for improvements in service quality. *European Transport*, no. 38, pp. 107-118.
- Grigoroudis, E. and Siskos, Y. (2004). A survey of customer satisfaction barometers: Some results from the transportation-communications sector. *European Journal of Operational Research*, vol. 152, no. 2, pp. 334-353.
- Hair, J. F., Anderson, R. E., Tatham, R. L. and Black, W. C. (1998). *Multivariate data analysis* (5th ed.). Prentice Hall, Upper Saddle River, NJ.

Hensher, D. A., Stopher, P. and Bullock, P. (2003). Service quality - developing a service quality index in the provision of commercial bus contracts. *Transportation Research Part A: Policy and Practice*, vol. 37, no. 6, pp. 499-517.

Hervik, A. and Bråthen, S. (1992). *Kryssing av fjorder. Samfunnsøkonomiske lønnsomhetsberegninger ved ny infrastruktur* (Crossing fjords. Welfare economic assessments of new infrastructure). Report 9205, Møre Research, Molde, Norway. (In Norwegian).

Hervik, A., Bråthen, S. and Odeck, J. (1989). Offentlig prispolitikk - Oppfylles målsettinger? (Public pricing policy - Are the goals achieved?). *Sosialøkonomen*, pp. 8-14. (In Norwegian).

Jørgensen, F. and Mathisen, T. A. (2009). Using Standardized Revenue and Cost Norm Analyses to Reveal Subsidy Fraud in Contracted Public Transport Services. *Forthcoming in Transport Reviews*, DOI: 10.1080/01441640902986866.

Jørgensen, F., Mathisen, T. A. and Solvoll, G. (2007). *Kapasitet i fergesektoren* (Capacity in the ferry industry). SIB report 1/2007, Bodø Graduate School of Business. (In Norwegian).

Jørgensen, F., Mathisen, T. A. and Solvoll, G. (2008). *Verdsetting av riksvegfergetilbudet i Norge* (Economic valuation of the highway ferry services in Norway). SIB report 4/2008, Bodø Graduate School of Business. (In Norwegian).

Jørgensen, F., Pedersen, H. and Solvoll, G. (2004). Ramsey pricing in practice: the case of the Norwegian ferries. *Transport Policy*, vol. 11, no. 3, pp. 205-214.

Leck, E., Gat, D. and Bekhor, S. (2008). Welfare economic impacts of transportation improvements in a peripheral region. *European Transport*, no. 40, pp. 88-105.

Lodden, U. B., Kjørstad, K. N., Ruud, A. and Vibe, N. (2002). *Reisekvalitetsundersøkelse i Nordland* (Passenger satisfaction survey in Nordland County). TØI report 602/2002, Institute of Transport Economics, Oslo. (In Norwegian).

Louviere, J. J., Hensher, D. A. and Swait, J. D. (2000). *Stated choice methods: analysis and applications*. Cambridge University Press, Cambridge, UK.

Mathisen, T. A. (2008). Marginal Costs and Capacity Utilization: Calculating Short-Run, Medium-Term, and Long-Run Marginal Costs in the Ferry Industry. *International Journal of Transport Economics*, vol. XXXV, no. 3, pp. 373-389.

Nathanail, E. (2008). Measuring the quality of service for passengers on the Hellenic railways. *Transportation Research Part A: Policy and Practice*, vol. 42, no. 1, pp. 48-66.

Report no. 16 to the Storting (2008-2009). *Nasjonal transportplan 2010-2019* (National transport plan 2010-2019). (In Norwegian).

Rigas, K. (2009). Boat or airplane? Passengers' perceptions of transport services to islands. The example of the Greek domestic leisure market. *Journal of Transport Geography*, vol. 17, no. 5, pp. 396-401.

Soumoy, P. and Sweeny, T. (2000). Effects of enhanced ferry service on Golden Gate corridor transportation from dromedary to camel: How MV Del Norte inverted the ferry ridership curve. *Transportation Research Record*, no. 1704, pp. 100-104.

Statistics Norway (2010a) Subject 10 industrial activities. Table 03219: Enterprises, turn-over and employment except public administration. Retrieved 25th January 2010, from <http://statbank.ssb.no/statistikkbanken/>

Statistics Norway (2010b) Subject 10 industrial activities. Table 06705: Enterprises. Retrieved 28th January 2010, from <http://statbank.ssb.no/statistikkbanken/>

Statistics Norway (2010c) Subject 10 industrial activities. Table 07091: Establishments, by activity codes and number of employed. Retrieved 25th January 2010, from <http://statbank.ssb.no/statistikkbanken/>

Statistics Norway (2010d) Subject: 02: Population Table: 05231: Estimated population per December 31st and estimated population growth during the year Retrieved 27th January 2010, from <http://statbank.ssb.no/statistikbanken/>

Stradling, S. G., Anable, J. and Carreno, M. (2007). Performance, importance and user disgruntlement: A six-step method for measuring satisfaction with travel modes. *Transportation Research Part A: Policy and Practice*, vol. 41, no. 1, pp. 98-106.

The Norwegian Public Roads Administration. (2006). *Konsekvensanalyse. Håndbok 140 - Veiledning* (Handbook in consequence analysis). (In Norwegian).

The Norwegian Public Roads Administration (2009). *Håndbok 157 Ferjestatistikk 2008* (Ferry statistics 2008). (In Norwegian).

Transportation Research Board. (1999). *A Handbook for Measuring Customer Satisfaction and Service Quality*. TCRP Report 47, National Academy Press, Washington D.C.