energy efficiency by using daily customers' quality observations to improve public transport

Supported by INTELLIGENT ENERGY EUROPE

www.enerqi-online.eu

ENERQI methodology

The ENERQI Methodology: an innovative methodology for measuring the quality of service in public transport

Coordinator:	Authors:
DTV Consultants, Mr. Willem Buijs, PO Box 3559, 4800 DN, Breda, The Netherlands, +31 76 513 6631 ENERQI@dtvconsultants.nl	TIS, Mr. João Bernardino, Phone: +351 213504400 ; Email: joao.bernardino@tis.pt TISSEO, Ms. Marie Fourcade Phone: +33 567 049 508 ; Email: marie.fourcade@tisseo.fr

Start date of the action: 29th May 2010 End date of the action: 28th May 2013 Duration: 36 months	Project website: http://www.ENERQI-online.eu

Grant agreement no. IEE/09/718/SI2.558241 – ENERQI, Energy efficiency by using daily customers' quality observations to improve public transport

ENERQI is co-funded by the European Union under the IEE 2009 STEER programme.

TABLE OF CONTENTS

1 The ENERQI Methodology: an innovative methodology for PT quality monitoring 6
1.1 An ambitious Methodology: a common European framework 6
1.2 Why applying the ENERQI Methodology? 7
1.3 Comparison of the ENERQI Methodology and other types of quality monitoring 8
1.3.1 Comparison of the approaches according to the data collected 8
1.3.2 Comparison of the approaches according to the needed resources 9
2 The public transport network: characteristics, objectives and targeting services 11
2.1 Structure and organisation of the public transport networks 11
2.2 Objectives 11
2.3 Targeting services 12
2.3.1 Criteria for targeting services 12
2.3.2 Targeting services in practise 13
2.4 Comparability and common approaches 13
2.4.1 Glossary of terms 14
2.4.2 Measurement scales 14
2.4.3 Data collection tools 15
3 The observers: their profile and assignment. 18
3.1 Definition of “observers” 18
3.1.1 Sampling 18
3.1.2 Recruitment 26
3.1.3 Observers registration 27
3.1.4 Instructions / Training 29
3.2 Work performed by an observer 29
3.2.1 Assignments 29
3.2.2 Questionnaire 30
3.2.3 Observers relation management 31
3.2.4 Summarizing: the client’s path of the observer 33
4 The data: indicators, workflow and analysis 34
4.1 Indicators 34
4.2 The workflow 38
4.2.1 Making of the system 38
4.2.2 Daily operations 40
4.2.3 Maintenance and system improvement 40

4.3 Reporting and analysis 41
4.3.1 Analysing results of observations 41
4.3.2 Adjustment of expectations 43
4.3.3 External events 43
4.3.4 Confidentiality 44
5 Actions: Improving quality 45
5.1 Quality improvement actions 45
5.2 Communication 48
6 Application of the methodology in ENERQI 50
ANNEX 51
A. Glossary 51
B. General conditions of participation by observers (ENERQI project) 53

TABLE OF FIGURES

Figure 1 – The ENERQI Quality Loop 6

Figure 3 – Classification of groups of indicators proposed by EN 13816:2002 according to their importance towards specific trip performance and costumer perceived quality 35

Figure 5 – Scheme of ENERQI database and management system structure 38

Figure 4 – Translation of actual into perceived quality and evaluation of need for communication campaigns to make the link 48

TABLE OF TABLES

Table 1 – SWOT analysis on costumer observations based quality monitoring 8

Table 2 – Comparison of approaches according to the data collected 9

Table 3 – Comparison of approaches according to needed resources 10

Table 4 – Rate of internet use in sites 16

Table 5 – Rate of subscribers to mobile telephony in sites 16

Table 6 – Sample sizes and confidence intervals 21

Table 7 – Sampling example: Grouping of lines/services according to their “theoretical quality of service level” 24

Table 8 – Sampling example: Measurements in lines/services grouped according to their “theoretical quality of service level” 24

Table 8 – Sampling example: Results per line/service 25

Table 8 – Sampling example: Classification of dispersion 25

Table 8 – Sampling example: sampling sizes optimised 25

Table 8 – Relation between ENERQI common questions and quality criteria of EN 13816 ... 36

Table 9 – Quality perception improvement actions (EN13816:2002 items) 46

Table 10 – Quality improvement actions (ENERQI items) 47

1 THE ENERQI METHODOLOGY: AN INNOVATIVE METHODOLOGY FOR PT QUALITY MONITORING

1.1 An ambitious Methodology: a common European framework

The ENERQI approach consists of measuring public transport service quality by involving present and potential customers in the observation and reporting of pre-defined quality aspects on a regular basis. It intends to provide a continuous monitoring of public transport quality and to timely identify appropriate measures to improve quality. Additionally, it allows to closely evaluating impacts on perceived quality of new measures, as well as of communication campaigns.

This process emerges as a “quality loop”, giving direct inputs to the management of the public transport operator and authority. A closer customer relation management is made possible. In the end, the “real time” availability and use of quality monitoring information will lead to an increased use of public transport and lower consumption of energy, environmental emissions, and congestion through less private car use.

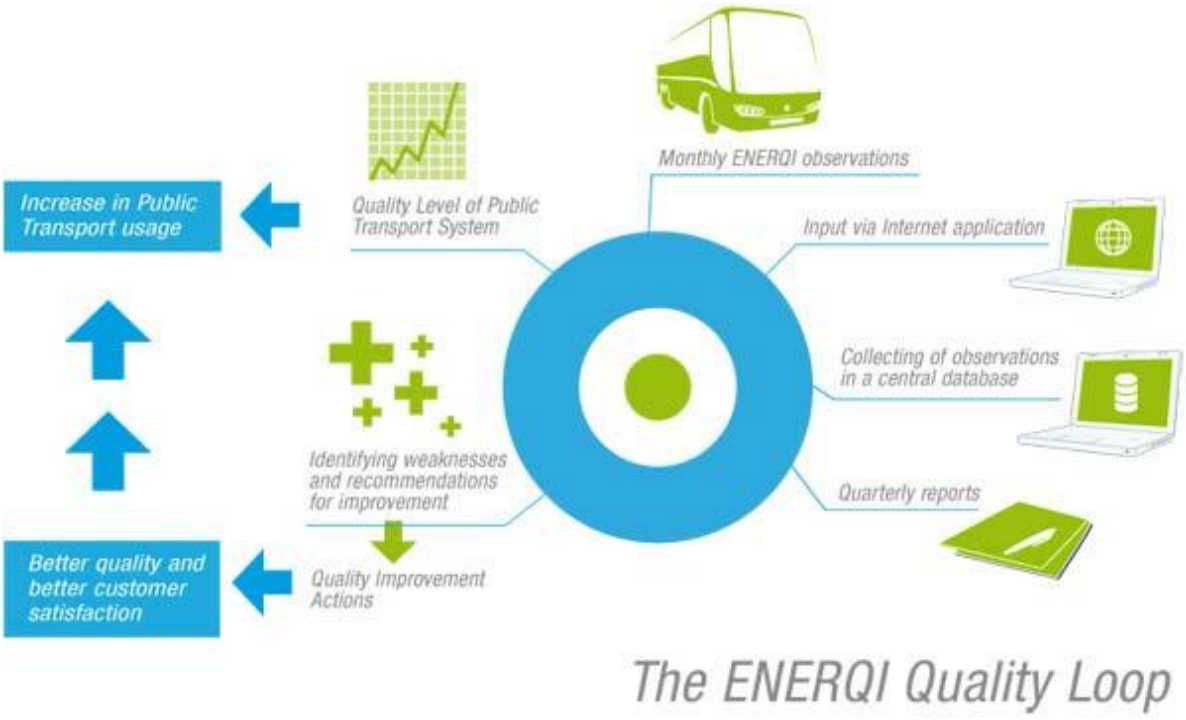


Figure 1 – The ENERQI Quality Loop

This ambitious approach consists of comparing the quality perceived by the users against specificities of each public transport network. The definition of a common European approach allows comparing results across sites and in that way obtaining additional learning both on implementation issues and on analyses of results. Any definition of a common methodology must take into account the diversity of the internal and external components in

each network. Establishing the points of convergence and divergence and appropriate criteria has based the development of this methodology.

The structure and the organisation of the public transport networks are key elements in the development and deployment of the methodology. In addition, European standards have also defined measurement indicators for public transport quality of service, which were a reference in the development of the methodology.

Lastly, the definition of this common methodology requires the creation of a common frame of references, from the definition of the terms to the scales of measurement that are used.

To conclude, the ENERQI methodology may be summarised as follows:

- the measurement of the perceived quality of service of public transport by the costumers themselves,
- with quantitative and qualitative indicators,
- able to be used locally, for the needs of each network, and more widely for benchmarking purposes.

1.2 Why applying the ENERQI Methodology?

The costumer based continuous quality monitoring methodology provides the ability for the transport operator or other entity to receive detailed up-to-date feedback on the perceived quality of public transport services.

According to the European Standard EN 13816:2002[1], there are four sub categories of "quality of service": a) The desired quality of service; b) The delivered quality of service; c) The perceived quality of service; d) The expected quality of service (see also Chapter **Fout! Verwijzingsbron niet gevonden.**).

It is the perceived quality of service that is related to costumer satisfaction and therefore with the willingness to use public transport. The ENERQI methodology concentrates more closely than any other methodology on measuring the quality of service perceived by the users.

The ENERQI approach integrates the customer view with the aim of providing public transport services which match their needs and expectations as closely as possible. The approach is built on the synergies created between the users and the operators. As such, it is expected to be a key tool to improve the quality of public transport, and perform better than other quality monitoring approaches.

In order to highlight the advantages and disadvantages of this methodology, **the following SWOT analysis highlights the strengths, weaknesses, opportunities and threats of this approach**.

[1] EN 13816 – Transportation – logistics and services – Public passenger transport – Service quality definition, targeting and measurement

Table 1 – SWOT analysis on costumer observations based quality monitoring

	Positive	Negative
Internal origin (Organisational)	***Strengths*** • The feeling of belonging amongst the users involved in the project. • Collection of data close to the travel experience of the user. • Benchmark of quantitative and qualitative performance criteria.	***Weaknesses*** • Difficulty to maintain panellists within the approach (loyalty). • Level of "professionalism" of the volunteers.
External origin (Extra-organizational)	***Opportunities*** • Willingness of costumers to cooperate • Increase of equipment and usage rate of Internet/ new technologies • Good publicity by the media • Availability of usable databases of potential volunteers	***Threats*** • Lack of willingness to cooperate by costumers • Lack of ability of users to use the reporting tools • Bad publicity by the media

1.3 Comparison of the ENERQI Methodology and other types of quality monitoring

The state of the art of methodologies used by the European public transport networks has highlighted the diversity of the different approaches. The ENERQI methodology is an approach which has resemblances and differences to a **customer satisfaction survey** and the **"mystery shopper"** concept. In this section, the three methodologies will be compared in order to highlight their particular features.

1.3.1 Comparison of the approaches according to the data collected

The ENERQI approach is half-way between the customer satisfaction survey and the "Mystery shopper" concept.

Rather than using paid staff to make observations, as with the mystery shoppers, **the information collection is carried out directly by the users themselves during their normal daily journeys** on the public transport network. Although the measured indicators are similar, their subjectivity must be taken into consideration during the data analysis phase.

The principal difference between the customer satisfaction survey and the ENERQI panel lies in the recruitment of the person surveyed. Someone responding to a customer satisfaction survey has no prior knowledge of the items he or she will be asked about. But **an ENERQI panellist knows that he or she will be interviewed about certain criteria.** So he or she will be more attentive to the environment and to the journey experience.

Lastly, **the definition of common performance indicators for all the ENERQI partners means that benchmarking can be carried out on the topics studied**. In this way a transport operator can compare itself to the other project partners and share its experience. This approach is not possible for customer satisfaction surveys or mystery shopper commentaries which have been conducted outside the scope of multi-local approaches.

Table 2 – Comparison of approaches according to the data collected

	ENERQI methodology	Customer satisfaction survey	Mystery shopper
Type of approach	Perceived quality in relation to delivered quality	Perceived quality	Delivered quality
Type of indicator	Quantitative and qualitative + Benchmarking	Quantitative and qualitative	Quantitative
Type of administration	In situ or a posteriori	A posteriori	In situ
Observations made by...	Users and, potentially, non-users of the public transport network	Users of the public transport network	Service provider
Typical frequency of analysis reports	Quarterly (Monthly and daily is possible)	Quarterly and/or Annual	(Variable frequency)

1.3.2 Comparison of the approaches according to the needed resources

The degree of internalisation of the service affects the level of resources to be allocated to the project. Five missions have to be considered to determine the organisation that should be dedicated to this approach:

- the methodology definition;
- the realisation of the questionnaires;
- the management of the relation with the observers;
- the data processing;
- the data analysis.

Those missions can be totally or partially internalised or totally externalised. The management of the relation with the answerer is one of the specificities of the ENERQI panel that, as for every panel, needs a real follow-up and to gain the loyalty of participants.

From the recruitment of the panellists to the editing of the analysis reports, providing the complete service internally to a public transport operator, would mean the employment of one full-time assistant plus a half time project supervisor.

If the service was to be completely externalised, the minimum cost would be proportional to the level of detail expected, and hence to the size of the sample of panellists and number of observations desired.

Table 3 – Comparison of approaches according to needed resources

	ENERQI methodology	Customer satisfaction survey	Mystery shopper
Project management	Internalised, externalised or mixed	Internalised, externalised or mixed	Usually externalised
Cost	+ to +++	+ to ++	++ to +++
Organizational man-hours	Internalised: +++ Mixed: ++ Externalised: +	Internalised: ++ Externalised: ++	Externalised: +
Analysis report recipients	Public Transport Authority, Transport operator, and General public	Public Transport Authority, Transport operator, and General public	Transport operator

+: Low *++: Medium* *+++ : High*

2 THE PUBLIC TRANSPORT NETWORK: CHARACTERISTICS, OBJECTIVES AND TARGETING SERVICES

2.1 Structure and organisation of the public transport networks

The functional and organisational characteristics of the public transport networks are crucial for the development of correct approaches.

One of the first questions to ask is, 'over what scope do we want to develop this methodology?' In other words, over which part of the public transport network do we want to evaluate the perceived quality of service?

During Work Package 2, the data collected has highlighted the diversity of the networks in terms of constitution (transport modes operated), management (number of operators, relationship with authorities, the importance of users' point of view into the local services development policy, etc.), size of the network, environment of operation (urban, suburban, interurban), etc. Taking into account those different situations, how can we agree on a common ground for our study?

The first consensus agreed upon for the ENERQI project is **the common evaluation of the bus network of each partner, whilst forecasting a methodology sufficiently flexible to be able to include the other transport modes operated.**

2.2 Objectives

The specific objectives in place when doing quality monitoring may vary from place to place, and may have implications regarding the definition of a correct approach concerning the selection of targeted services, the sampling of observers, the selection of indicators to evaluate, the choice of quality improvement measures to apply and the choice of the quality monitoring approach itself.

Clear objectives are therefore essential for a sound design of the quality monitoring scheme and the various options that will have to be taken in its design.

In the first place it must be noted that the application of the ENERQI approach is directed at certain operational objectives, in particular that the monitoring is:

- Continuous – i.e. providing almost "real-time" information;
- Specific – providing detailed information on specific services or schedules – and;
- Focused on perceived quality.

If at least one of these aims of quality monitoring is not intended, then it would probably justify using other types of quality monitoring and not the ENERQI approach.

Some particular objectives have influence on the appropriate design of the local scheme. At the strategic level there may be different objectives at stake that should have direct

implications on the design of the scheme. For example, if the strategic objective is to improve perceived quality as such in order to improve social well-being, then it makes sense to cover all segments of demand and services.

On the contrary, if the objective is to increase public transport (PT) use, it might make sense to specifically focus on the measurement of perceived quality by segments of demand that are more sensitive to quality in their travel choices (e.g. it doesn't make sense to focus on captive users, who have no alternative choice and might have different preferences, in comparison with non-captive users). As stated in the examples, the definitions of strategic objectives unfold into specific operational objectives to which the specific design of the monitoring scheme should correspond.

Another dimension relevant for definition of objectives is the prior knowledge on customer preferences and on the strengths and weaknesses of the public transport services. At an initial stage with low level of knowledge on these aspects, the monitoring may be intended at acquiring additional general information. At a more advanced stage of knowledge on supply and demand characteristics, the aim may be directed at the more specific monitoring of particular performance aspects or effects on perceived quality of measures improving delivered quality.

2.3 Targeting services

2.3.1 Criteria for targeting services

Public transport services can be defined by route and schedule. **The choice of services to include in the monitoring scheme depends basically on the objectives, availability of resources and resource efficiency** of the quality monitoring and quality improvement.

As in the example above, if the strategic objective is to increase the use of public transport, it may make sense to focus on services where **demand sensitivity** is greater. This tends to happen in services that compete with the car, particularly at peak-times and in lines covering dense areas where the costs for using the car are greater.

Focusing monitoring on services with high demand instead of services with low demand is an appropriate approach from a **statistical efficiency** perspective, particularly if the available resources are limited. Directing efforts on high demand services allows obtaining statistical significance for a wider population of present and potential customers.

Another possible reason for focusing on specific services may be related to the intention of **measuring particular quality aspects** or their evolution. For example, the operator may want to know more about the opinion of costumers on a hot topic associated with particular lines or to understand the effect of the introduction of a new measure (like training a group of drivers).

The **availability of knowledge on quality or the degrees of freedom (cost efficiency) for delivering quality improvements** are also factors of relevance for the choice of targeted services. For example, if an operator of several modes (including buses and metro) has high

prior knowledge on the perceived quality of its metro services, and the metro services have much less flexibility in terms of available measures for quality improvement (e.g. they are already very punctual, frequent and comfortable), then it makes more sense for the operator to concentrate its efforts in studying the evolution of quality perceptions on its bus services.

2.3.2 Targeting services in practise

The public transport services that will be evaluated during this approach should be clearly identified, and assure that the observers sample of targeted services meets minimal requirements of reliability. Fortunately, the sampling frame can be easily defined as it is the comprehensive list of daily trips proposed by the PT network, or the part of the network that was defined at the previous step.

Any scheduling and operations software can edit such a list – and export it as a datasheet into a block compilation.

Other sources can be usable – even customer timetables – but they might not be as accurate and precise as the original data extracted from the operations software.

In a practical manner, data originated from the operations software can come attached with such useful items as knowledge of the particular bus or driver scheduled for each trip to be operated.

The scope of the sampling frame can be shortened in manners not nefarious to the reliability of the measurements:

- The time frame can be reduced to the operating hours within which most customers use the PT network, for example from 7 AM to 19 PM;
- All working days should be investigated on a minimum basis; Saturdays are interesting as PT attracts other types of customers on week-ends; Sundays and public holidays may be investigated if deemed of interest. The time frame can be adapted for the week-end days according to customer riding habits.

Marginal periods of operations (Early-bird, Night services) can also be included within the sample frame if such periods seem important to quality assessment.

The reliability of the observations will strongly depend on the continuous coverage of the operating hours. The quality level rendered by the PT system can be very dependable on the hours of the day, which can influence many measured items: cleanliness, on-board comfort, traffic congestion and driving easiness, the mood of drivers and riders and even the mood of the observers.

2.4 Comparability and common approaches

In parallel with the evaluation of the quality of service perceived by users on their own networks, the partner networks also want to **share knowledge of good and bad practices and results with one another**. To fulfil this need for comparability of network performance,

the terminology, measurement scales and collection tools used for ENERQI must be common to all of the partner networks.

2.4.1 Glossary of terms

The glossary gives the meaning of the terms used throughout this approach. **It serves as the reference for understanding the scope of each criterion** (see Annex). Indeed, a "run" is defined in a different way from a country to another. For example, in France, two notions are taken into account:

- a "trip" in reference to a run from a point A to a point B without any connection,
- a "journey" in reference to a run from a point A to a point B with connections between the same mode or different transport modes.

In Greece and Bulgaria, on the other hand, there is no distinction.

By integrating language specificities, the shaping of common indicators' questions will be the same whatever the country. In terms of benchmarking, the data analysis is made clearer, which then allows comparing the results obtained using a common basis: "Everyone is talking about the same thing".

2.4.2 Measurement scales

Once the terms to be used have been defined, the measurement of indicators is essential for establishing the connection between the local studies and the analysis of the data. A measurement scale should be understandable by the respondents and should translate into sound quantitative measurements of the indicators in question.

There are four general types of measurement scales:

a) **Nominal:** Dichotomous Scale Yes/No; Favourable/Unfavourable; Socio-demographic categorisation

b) Ordinal/ Rank order: Rank ordering, preference, larger/ smaller

c) **Interval:** Intervals between adjacent ranks are equal. Differences between ranks can be compared (1 to 2 is same as 2 to 3 but 3 is not three times 1)

d) **Ratio:** Meaningful zero point. Can compare absolute magnitudes as well as differences. Aggregate data (passenger kms, average value of time, market share), Magnitude scaling, Willingness to pay.

The most commonly used scales in transport marketing research are:

- Likert scale
- Verbal scale
- SIMALTO scale
- Numerical scale
- Constant sum scale
- Semantic differential scale
- Ungraded scale
- Magnitude scale

A detailed description of these scales is provided in WP2, which provided a comparison between them:

- Likert, Verbal, SIMALTO and Semantic Differential ratings fairly easy to answer
- Likert, Verbal and Semantic Response scale often treated as interval
- Likert, Verbal and Semantic Differential scales are not fine scales – discriminatory power
- Ungraded scales needs to be interpreted
- Numerical rating, constant sum and ungraded scales more discriminating (information) but more difficult
- Magnitude rating is the most difficult

The overview conducted during Work Package 2 in ENERQI has shown that the definition of the measurement scales is dependent on local culture. In the ENERQI project, a numeric ordinal scale of 5 scores was applied. In effect, the measurement scales used for the project are chosen for their "analytical friendliness" capacity in terms of operational performance:

- at a local level, to assist the creation of an action plan,
- at a global level, to facilitate the collection of “neutral” benchmark data between networks.

The glossary of ENERQI terms includes the meaning of the scales used (see Annex).

2.4.3 Data collection tools

Questionnaires can be adapted to the type of project as required. The use of new technology (web interfaces and mobile web interfaces) in this project is a way to take into account the changing society in terms of mobility behaviour.

However, the rate of internet connectivity and mobile phone use evolves differently between countries. The two tables hereunder describe respectively the rate of Internet users and the rate of mobile subscribers during the last decade within the partners’ country involved in the ENERQI approach.

Table 4 – Rate of internet use in sites

	Rate of Internet use (for 100 inhabitants)										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Austria	33,73	39,19	36,56	42,70	54,28	58,00	63,60	69,37	72,87	73,45	72,70
Bulgaria	5,37	7,61	9,08	12,04	18,13	19,97	27,09	33,64	39,67	45,00	46,23
France	14,31	26,33	30,18	36,14	39,15	42,87	46,87	66,09	70,68	71,58	80,10
Greece	9,14	10,94	14,67	17,80	21,42	24,00	32,25	35,88	38,20	42,40	44,40
Netherlands	43,98	49,37	61,29	64,35	68,52	81,00	83,70	85,82	87,42	89,63	90,72
Portugal	16,43	18,09	19,37	29,67	31,78	34,99	38,01	42,09	44,13	48,27	51,10
Romania	3,61	4,54	6,58	8,90	15,00	21,50	24,66	28,30	32,42	36,60	39,93
United Kingdom	26,82	33,48	56,48	64,82	65,61	70,00	68,82	75,09	78,39	83,56	85,00

Source: ITU World Telecommunication / ICT Indicators Database 2011

Table 5 – Rate of subscribers to mobile telephony in sites

	Rate of subscribers to mobile telephony (for 100 inhabitants)										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Austria	76,42	81,37	83,33	89,42	97,64	105,26	112,18	119,28	129,66	136,61	145,84
Bulgaria	9,22	19,50	32,91	44,65	60,72	80,69	107,33	129,54	138,32	140,21	141,23
France	49,20	62,29	64,55	69,29	73,51	78,84	84,17	89,66	93,36	95,35	99,70
Greece	54,00	72,19	84,11	80,43	83,65	91,75	97,87	109,23	122,21	117,38	108,22
Netherlands	67,8	76,47	75,41	81,8	91,22	97,11	105,61	117,28	124,99	121,68	115,45
Portugal	64,48	76,86	83,18	95,58	100,62	108,57	115,59	127,05	132,11	139,38	142,33
Romania	11,26	17,40	23,22	32,11	46,76	61,34	73,67	94,25	113,34	117,94	114,68
United Kingdom	73,80	78,32	82,96	91,03	99,66	108,75	115,76	121,25	125,24	130,17	130,25

Source: ITU World Telecommunication / ICT Indicators Database 2011

The ENERQI approach offers an Internet platform which is common to all the partner networks, with the possibility of varying the methods of administering the questionnaire.

A restricted area (only open to the registered volunteers) contains a data entry section linked to the online database and allows observers to report directly there. This part is the technical "backbone" of the quality-monitoring process. The interface focuses on clearness and user friendliness to help and not to hinder the process of monitoring. It is cross-platform capable, which means that it allows to be filled stationary (the observer performs the quality check on paper and he or maybe someone else fills the data afterwards).

The platform can be accessed through a mobile interface (the quality observer uses a mobile device to collect the data and fill the database). So, all levels of technical capabilities of the

users are covered. ENERQI does not build on dedicated devices, but browser technology with small screen capabilities are used as a technical basis to allow compatibility with most mobile devices available.

However, if the usage rate of Internet among costumers is under a certain threshold (70% seems a good reference number), a second method of questionnaire administration is recommended (face to face, phone, paper, etc…). Therefore, the data collection can be adapted to each participating network, which will ensure the representativeness of the sample participants.

Additional practical inputs about the ENERQI management system are provided in section 4.2.1.

3 THE OBSERVERS: THEIR PROFILE AND ASSIGNMENT.

This chapter is dedicated to the description of the methodology step by step, with a focus in the processes that relate to the volunteer.

At first, to establish an observers' group, we shall put the rules of sampling: the methods of elaboration, the criteria for selection, the number of persons to recruit, etc. We shall continue by describing approaches for the observer recruitment, in particular the commitments to follow by each of the stakeholders of the approach (the volunteers and the operators).

Secondly, the design of the questionnaires, their assignment and the management of the relationship with the observers is described.

Finally a schematisation of the "volunteer's path" is provided, redrawing in a synthetic graph the relevant stages.

3.1 Definition of "observers"

3.1.1 Sampling

Sampling is a cornerstone of the ENERQI methodology, because the quality of sampling will ultimately determine the ability of the ENERQI process to monitor quality and predict changes in customer attitudes or behaviour.

The principle of the ENERQI process is that a panel of PT costumers observes and assesses some of the trips that they would naturally make.

Sampling is an important issue as three samples intermingle:

1. The sample of volunteers who are a subset within the PT users/customers
2. The sample of observations that the sampled customers are going to make on request: these sampled observations are a mere part of all trips spontaneously made by the sampled observers.
3. The sample of trips observed are themselves a smaller sample of the entirety of the trips produced by the PT network

Defining the base population

The objective of efficient sampling is to provide measurements that will finally sincerely represent the values taken by the measured properties within the entire population of reference, called "base population" by the measured characteristics.

In our case, the baseline questions are:

- Will the volunteers' sampling represent the whole users' network or only the defined target?
- Will the quality measurements made by the observers faithfully represent the quality level rendered by the PT network as a whole to every individual customer using it?

- How to prevent possible biases?
- Can the observations be safely extrapolated to the whole population of trips, and furthermore of customers?

The sampling method

The sampling method consists of the ways used to select the observers and trips to observe.

The sampling methods are of two kinds: probability methods and non- probability methods.

Probability-based sampling methods

In the probability sampling methods, every unit in the population has a chance (or probability) of being selected in the sample and this probability can be accurately determined.

For example, a network offers 1450 trips per working day so roughly 35000 trips per month. If we randomly select 600 trips from this monthly population of 35000 trips, then the average probability of one trip being selected amounts to 0.017%

All probability sampling methods require that:

- Every element belonging to the population frame is defined and known before the sampling process begins;
- Every element has a nonzero probability of being sampled;
- Random selection is involved at some point of the process

Probability sampling implies that trips to be observed are selected beforehand and then that volunteers are asked to ride these selected trips and perform an observation of each trip.

A simple randomized sampling of trips can be subject to sampling errors because the randomness of the selection may result in not properly reflecting the makeup of the population of trips, in particular when the sample size is small (e.g. the number of observations performed every month is inferior to one thousand).

Non-probability sampling methods

The sampling process follows a non-probability scheme when:

1. some element of the population has no chance of being sampled and will remain uncovered;
2. the probability of the selection cannot be accurately determined.

This will occur if observers are not given itemized instructions on which specific trip to assess, but only general instructions, and are therefore asked to select themselves the assessed trips.

Hence, because the selection of elements is non-random, non-probability sampling doesn't allow the estimation of sampling errors. These conditions lead to exclusion bias, placing limits on how much information a sample can provide about the population and the measurements.

Depending on which instructions will be given to observers on how and when to perform observations (boarding PT trips and assessing them); one of these three non-probability sampling methods will be used: quota sampling, convenience sampling or event sampling.

In **quota sampling**, the population of trips is segmented into mutually exclusive sub-groups (for example, PT routes by time-bands). Observers will be instructed to gather observations based on certain number of trips to assess within every segment. This second step makes this method one of non-probability sampling because not every trip gets a chance of selection. In practice, some sort of randomization can be reintroduced in order that the sampling bias can be somewhat corrected (using event sampling).

A **convenience sampling** takes place when the sample is selected chiefly because members of the population are conveniently available, at hand where the sampler happens to be. In theory, no extrapolation can be inferred from a convenience sample. This will occur when unspecific instructions are given to the observers on which trips to assess. However, it is also possible to adapt the frame in order to reduce convenience sampling defaults and making the results more representative of the population. Before totally excluding convenience sample, it must be settled whether there is a good reason to think that a particular convenience sample would behave differently from a random sample from the same population.

Event sampling is a recent method where sample elements are collected when a certain event occurs. For example, observers would be asked to perform an observation when randomly notified by a signal (beeping, mail) to do so, or when a certain event occurs (example: an incident during a trip). Participants should be equipped with some sort of diary (paper or electronic) so that they record their measurement as soon as possible. This method has the advantage of minimizing recall bias but may lead to self-selection bias: if not all participants are willing to perform an observation at the moment requested, it creates a non-probability sample. Furthermore, event sampling may change the phenomenon measured owing to the repetitiveness of the measurements, leading the participants to evaluate differently the same situations by dint of time.

Sample size

The topic we are addressing in this section is: how many observations need to be carried out to obtain an acceptable statistical precision or reliability of the quality measurements?

Theoretically, a larger sample size leads to increased precision in estimates of various properties of the population, though the results will become less accurate if there is a systematic error in the experiment.

This implies that the sampling size should be determined in function of:

- The level of the wished accuracy or the confidence interval accepted:
    - The same number of observations brings the same accuracy whatever the public transport network size;
    - Nevertheless, a bigger sample might compensate inevitable mistakes;

- The necessity of collecting a large enough number of observations in a defined temporal space (say a quarter, a semester etc.) to guarantee a better visibility of the corrective actions effects on the users' satisfaction.
    - The repeat and accumulated observations by a same group of volunteers all along the approach improve the accuracy on long-term.

As a consequence, a large PT network may need a larger sample: not on theoretical grounds, but on practical ones; the larger the network, the larger the chance of making sample errors and the need to compensate them with more observations.

The optimal sample size

The precision of a measurement, or confidence interval, is linked to the variance of the measured property within the population. When we aim at estimating a proportion (e.g. the proportion of customers rating the quality as good), the variance of the estimation varies with that very proportion.

As a rule of thumb, the less (or the more) customers rate the service as good (or bad) one would expect that the variance decreases meaning that they tend to reach a consensus over bad (or good) quality. To the opposite, when the sample splits into equal ratings with 50% good ratings and 50% bad ratings, then the variance is maximized, meaning that all the widest variety of opinions exists.

Thus, the confidence interval shrinks when the sample size is larger, or when the estimated proportion tends to 100% (or on the opposite direction: to 0%).

These differences between confidence intervals are what we mean by accuracy; accuracy is thus closely related to sample size.

Table 6 – Sample sizes and confidence intervals

Sample size	Satisfied travellers Estimated proportion	Confidence interval
100	70%	± 9.2%
200	70%	± 6.5%
300	70%	± 5.3%
400	70%	± 4.6%
500	70%	± 4.1%
1000	70%	± 2.9%
2000	70%	± 2.0%

Sample size	Satisfied travellers Estimated proportion	Confidence interval
100	90%	± 6.0%
200	90%	± 4.2%
300	90%	± 3.5%
400	90%	± 3.0%
500	90%	± 2.7%
1000	90%	± 1.9%
2000	90%	± 1.3%

Accuracy gains are not proportional with sample gains: huge samples don't minimize significantly the confidence interval, but small samples can lead to meaningless measurements.

In consumer research, a mistake range of 5% is tolerated. This means a confidence interval moving between ± 2.5%.

The periodicity of measurements

For practical reasons, the realisation of a desirable number of trips can be made on a period longer than standard measurement period. But it is important that this amount of measurements is made within a reasonable period of time so that comparisons thru periods can be made statistically significant.

Statistically speaking, the confidence interval between two estimations determines their comparability. It takes a higher standard and thus a larger sample to decide whether two evaluations are in a tie, or are significantly different.

In order to significantly monitor evolutions over time, a larger sample is therefore necessary, which might not be less than 1500 individual measurements.

Following this rule, if a network monitors its quality by performing 500 measures each month, then it will take three months until evolutions can be significantly reported, thus making only quarterly evolutions statistically significant.

For the common ENERQI methodology, as a target it is suggested that 1500 to 2000 quality observations should be realised over a quarter. This periodicity of analysis will guarantee significant statistical comparisons.

Enhancing comparability

The rules governing statistical significance of evolutions over the time apply the same to differences between PT services.

In order to differentiate evaluations between PT lines, minimal amounts of observations are necessary for each line. Keeping up with such higher requirements as in reporting evolutions over time would involve very huge samples, causing cost and feasibility issues. One would question the wisdom of multiplying large samples for each line of a PT network. The

importance of accuracy is less important when comparing lines with one other and one can be satisfied with an order of magnitude. The sample size issue pertains mainly to the ability to report evolutions over in customer perception of quality.

Differences of quality perception between lines can checked with a wider margin of confidence. Minimal sample sizes for each line should be set for the purpose of ensuring the overall representativeness of the sample.

The goal of representativeness will be much easier to reach by implementing sample stratification which besides tends to improve accuracy.

Sample stratification

Stratification is a method for improving the quality of sampling when the measured property varies according to some known characteristics of the population.

This is exactly what might be expected when measuring quality served by a PT network: that quality differs, sometimes by large proportion, between parts of the network, stemming from operational differences and areas served.

So whenever the population groups have diverse characteristics it is advisable to split the quality measurements between different groups (strata) of PT lines according to the excepted variability of the quality level.

As a rule of thumb, before the beginning of the measurements the variance is inversely proportional to the level of quality. So the higher the quality ratings, the less the measurements will vary; the lesser the ratings, the more variable the ratings will tend to be.

Consequently, in order to apportion the overall sampler, we recommend taking into account two sets of considerations:

- Network description: amount of lines, types of lines and modes of exploitation;,
- Excepted quality levels for each line or groups of lines.

The first step is to share out a fixed amount of measurements to each operated PT line or homogeneous type of lines, regardless of trip numbers.

The second step is to make this fixed amount vary according to excepted quality level.

After the first quarter or semester of measuring, the amount of measurements allocated to each line can then be reapportioned according to the actual standard deviations calculated from the actual results.

We can take a PT Network named ALPHA as an example: the quality measurements could be carried out on 75 different routes: 3 metro lines, 3 tramway lines, 22 trolley lines, 38 bus lines and 9 express lines.

Initially, each route is allocated a monthly sample of 10 measurements, amounting to a monthly network sample of 750 measures to be performed.

Building of the initial sampling

In order to obtain a homogenous result qualitatively speaking, important information could be taken into consideration: knowledge on lines, satisfaction surveys, and customers' complaints. This information can improve the initial sampling definition. From those elements, a table can be built in which lines are shared according to their "theoretical quality of service level". The following table gives an example for the ALPHA network:

Table 7 – Sampling example: Grouping of lines/services according to their "theoretical quality of service level"

Theoretical lines spread over	Metro	Tram	Trolley	Bus	Express bus
Largely above average	3	3			
Above average					4
Within average			10	15	5
Below average			6	10	
Largely below average			6	13	
Total = 75 lines	***3***	***3***	***22***	***38***	***9***

After a first month of quality monitoring, the ALPHA network should collect 837 measurements spread over the lines as shown in the table above (over 750 measurements expected).

Table 8 – Sampling example: Measurements in lines/services grouped according to their "theoretical quality of service level"

Measurements spread over	Metro	Tram	Trolley	Bus	Express bus
Largely above average	15	15			
Above average					40
Within average			100	150	40
Below average			72	120	
Largely below average			90	195	
Total = 837 observations	***15***	***15***	***262***	***465***	***80***

Update of the measurements sampling spread over

This optional step allows operators wishing to optimise their measurements sampling in function of the results obtained to do so, on a constant number observation basis. Indeed, the initial allocations can be redesigned according to the variability of the ratings provided by volunteers. This operation can only be carried out after a significant period of collection, which means as a minimum a semester, according to the ENERQI approach.

For an indicator with a measurement scale of 1 to 10, the ALPHA network obtains the following results:

Table 9 – Sampling example: Results per line/service

	Average Ratings	σ(ratings)	Initial Sample
Metro 1	7,8	1,5	5
Tram G1	6,5	1,2	5
Line 1	5,5	3,2	10
Line 20	7,6	1,4	10
Line 25	8,3	0,9	10
Line 21	7,2	1,5	12
Line 101	6,1	2	12
Line 136	5,6	3,5	15
Line 149	4,3	3,5	15
…	…	…	…
Investigated lines	***6,5***	***1,2***	***837***

The following table shows a classification of dispersion for measurement scales from 1 to 5 and from 1 to 10.

Table 10 – Sampling example: Classification of dispersion

Dispersion	Symbols	Formula	
		Scale from 1 to 5	**Scale from 1 to 10**
Very high (heterogeneous)	++	1,0 ≤ σ(line)	2,0 ≤ σ(line)
High	+	0,75 ≤ σ(line) < 1,0	1,5 ≤ σ(line) < 2,0
Mean square	=	0,5 ≤ σ(line) < 0,75	1,0 ≤ σ(line) < 1,5
Weak	-	0,25 ≤ σ(line) < 0,5	0,5 ≤ σ(line) < 1,0
Very weak (homogeneous)	- -	σ (line) ≤ 0,25	σ (line) ≤ 0,5

The table hereunder shows the sampling sizes optimised in function of the standard deviation of the rating in comparison of the real data, on 9 lines of the ALPHA network:

Table 11 – Sampling example: sampling sizes optimised

	Average Ratings	σ(ratings)	Dispersion	Initial Sampling	Optimised Sampling
Metro 1	7,8	1,5	+	5	8
Tram G1	6,5	1,2	=	5	5
Line 1	5,5	3,2	++	10	15
Line 20	7,6	1,4	=	10	10
Line 25	8,3	0,9	-	10	8
Line 21	7,2	1,5	- -	12	8

	Average Ratings	σ(ratings)	Dispersion	Initial Sampling	Optimised Sampling
Line 101	6,1	2	++	12	18
Line 136	5.,6	3,5	++	15	20
Line 149	4,3	2,5	++	15	20
…	…	…	…	…	…
Investigated lines				***837***	***837***

In this example, the sampling of bus line 25 could be reduced to 5 monthly observations (ratings clearly above the average, weak standard deviations) while sampling of bus line 1 should be enhanced to 17 monthly observations (rating clearly under the average, high standard deviation. Afterwards this method should be applied to the overall investigated lines in order to balance the sampling size of observations.

The global sampling remains the same one but each sampling strata is redesigned in order to minimise the variance into each strata and maximise the variance between stratums.

Thus, obtained measurements are more valid. On the long-term, the sampling sizes could be reduced for those lines which are very stable in ratings and standard deviations.

3.1.2 Recruitment

From sampling to recruitment of volunteers/observers

The aim of sampling is to gather measurements made on specific PT lines in set amounts each month.

To do that, you need to recruit a number of observers proportional to the amount of needed measurements divided by the number of observations that you will ask them to perform each month, plus a safety margin.

It does seem reasonable to ask volunteering observers not to perform more than two measurements each month because:

- Too much solicitations could wear them off ;
- The quality of their judgment will blunt over the time by becoming;
    - More accurate than a “classic” traveller. This could lead to a decrease of their satisfaction due to their high level standard demand,
    - More neglected due to a lassitude in proceeding always with the same type of observations.
- If they received a too important gratification, they might be turned into professional observers inducing risk of reducing their spontaneity and they will participate only for the reward.
- The more the same observers perform measurements, the less randomness there will be, because each observer tends to predetermine the time and place of the observations.

The main constraint is to recruit observers that will use the targeted PT lines. So, not every candidate that will pop up will be recruited, if they don't comply with inclusion criteria.

This can entice some disappointment among turned down candidates. Disappointment can be prevented by:

- Carefully designing the recruitment scheme: allocating means to the targeted lines proportionally to the goals; pretesting the responsiveness of the recruitment plan before massive launch;
- Appropriate communication; preparation of some kind of consolation message ;
- Allowing supernumeraries as a precaution against defections or ;
- Waiting list management to replace later defectors.

Recruitment techniques

The observer recruitment process should consider two issues: how to contact potential observers; how to motivate potential observers.

The appropriate choice of **means** of contacting observers depends on which are the targeted user groups and services – different target groups may be reachable through different means – and which means and resources are available locally. Some possible means of contacting observers are:

- street personal contact (in public transport vehicles or infrastructure)
- phone
- advertisements in vehicles and stops
- advertisements in media or web social networks

The choice of recruitment means should follow criteria of cost-effectiveness and sampling coherence (3.1.1) for each target group.

Additionally, the recruitment process should be able to **motivate** people. The key factor is to emotionally link the observer to the aims of the quality monitoring, by making them feel that their participation is useful for the general public and that it will benefit them directly. Three important ways to motivate observers are outlined:

- An effective and costless incentive seems to be simply the promise of giving feedback to observers on the results of the quality monitoring.
- A continuous and close contact with observers is also an important factor of motivation.
- Attributing rewards to participating observers allows increasing the rate of participation but has some disadvantages (see 3.2.3.1).

3.1.3 Observers registration

When costumers accept being observers they will asked to be registered as such. Like for the reporting of observations, the registration process can be fully done online through the

ENERQI web tool. In the case of observers which do not use the web platform from the start, alternative platforms for registration need to be used.

This section outlines important aspects as this process.

3.1.3.1 Segmentation of observers / costumers

The registration of observers should include their contacts and the personal characterization data that allow identifying the type of costumer and establishing the segmentation of the respondents. In ENERQI the following personal characterization data was requested at the point of registration:

- Sex
- Birth date
- Level of qualifications
- Main activity
- Possession of driver's licence
- Possession of personal vehicle
- Lines/services used
- Regularity of use of public transport
- Times of day of regular travelling
- Main motive for travelling in public transport

This type of data allows the monitoring organisation to consider different segments of costumers in their analysis of results and also check if a sufficient number of observers in each segment is available for the monitoring process to start.

3.1.3.2 ENERQI charter

Furthermore, at the point of registration it is useful to guarantee that the observer is sufficiently committed and understands the conditions for participation, and what is requested from him/her. A standard document of terms of participation is provided in Annex. Main elements to cover are:

- Eligibility of the observer according to the sampling criteria of the analysis and legal provisions (like minimum age);
- Ability of the observer to work with the communication tools used;
- Acknowledgement to cooperate and carry out the essential tasks involved;
- Agreement on data provision and use specifications.

3.1.3.3 Respect of privacy

The association of observers implies the sharing of some personal data, including contact details or data on personal life including trips realized. It is necessary to protect these data against abuses. National legislations have specific rules for privacy protection. In ENERQI, the commitment to privacy protection is established in the Terms of Participation of the observers.

3.1.4 Instructions / Training

One of the major differences of the observer based monitoring in relation to other monitoring methodologies is that observers are made aware beforehand on the configuration of their assignments. In principle the observers should know in advance in detail what aspects of quality will be assessed in the trips assigned. Moreover, the observers must be acquainted with the system of observation assignment and reporting whereby the monitoring entity provides assignments to the observers and observers provide their reports back. This implies some kind of prior **instructions or training given to observers**. Observer awareness can take various forms, namely through either personal or remote, and individual or collective contact.

The essential aspects to be instructed to the observers are:

- Process of assignment and reporting
- Clarification of contents of questionnaire
- Communication flow between observers and organisation responsible for monitoring (clarification requests or initiatives, feedback on results, rewards, etc)

The phase of training is also an opportunity to determine which interaction system (internet, phone, etc) best suits each observer, in case there is more than one possibility available.

3.2 Work performed by an observer

3.2.1 Assignments

The observers will receive regular assignments to report observations though questionnaires.

The choice of assignments to deliver should be based on the initial plan of continuous monitoring but can and should be complemented by new needs of data that emerge either from the building of knowledge on customer preferences and quality of service given by data analysis of previous assignments or from the introduction of new measures or appearance of relevant 'hot topics' to study on an *ad hoc* basis (e.g. snow in the street).

As described theoretically in section 3.1.1, the timing of the assignments sent to observers may follow different approaches. Timing concerns both the **frequency** and the **level of specification** of the assignment object (the trip).

The more frequent are assignments given, the closer to "real time" information is possible to achieve and more information there is to process. On the other hand, higher frequency of assignment delivery involves more resource consumption and, most importantly, a possible fatigue of the observers through repetitiveness of the survey content and own time consumption (see also section 3.1.2). The annual measure is appropriate for reporting purposes, but smaller periods may be more useful for flexible quality responses to everyday challenges. The issue is directly related to cost. The advantages and disadvantages of the frequency level must be balanced for an appropriate decision. If the recording procedure is automated and internet based the measurement could be a constant and daily procedure. If

the analysis procedure is also automated, then the reporting could also be quite frequent. For the needs of middle management quarterly reporting is sufficient while for the needs of top management yearly reporting is recommended to set priorities. In the ENERQI project, the general option was to conduct common assignments with a frequency of one month, although some partners realize additional assignments to address specific local issues.

The level of specification of the assignment refers to the obligation of the observers to conduct the reporting of a particular trip or, alternatively, to be free to choose the reported trip. There are three possible dimensions of specification of the trip(s) to evaluate: service/line, period of time (e.g. a week or a day) and schedule of the trip (e.g. a particular circulation departing at 8:30 am). These three trip dimensions have different implications and may be related to the following objectives:

- Bounded target services/lines: the specification of a service or line (or group of services or lines) depends on the desire of the quality monitoring entity to evaluate some services in particular related to reasons described above
- Linkage of quality perception results to specific events, measures undertaken or trip features
- Representativeness of the sample: If the observers are free to choose the trips to report, results will be biased according to the reasons of the observers to choose certain trips to report in favour of others. On the other hand, even with this bias it can be expected that the results will be consistent in showing the issues that concern users in terms of quality perceptions.

3.2.2 Questionnaire

The observers report their opinion about the quality of trips assigned through questionnaires that are delivered to them.

The **contents** of the survey must allow measuring the perceived quality by the observer through indicators. Surveys can change from assignment to assignment, but they should include a common body of questions/indicators so that they can be aggregately analysed in order to assess the evolution of perceived quality through time.

Like in other questionnaires, some concerns should guide their design:

- The aims of the questionnaire/assignment should be clear to the observers
- Questions should be clear, not subject to different interpretations
- Questions should objectively represent the indicators they are supposed to measure
- The questionnaire should be structured in a way easy to follow (e.g. organized in topics)
- The questionnaire should not be too time-consuming

Given that the indicators concerned are mostly dealing with a subjective judgement by people, it is necessary to use an appropriate measurement scale, which should be understandable by the respondents and should translate into sound quantitative

measurements of the indicators in question (section 2.4.2). In the ENERQI project, an ordinal scale of 5 scores was applied.

The ENERQI project developed a standard questionnaire which was organized in the following topics of questions:

- Value for money
- Tickets and tariffs
- Level of crowding
- Safety and security
- Stops and shelters
- Vehicle condition
- Journey speed
- Staff service
- Information
- Disruption / Incidents
- Customer support

These were suggested as a basis for questionnaire development in the project ENERQI, although different sites were free to organize these topics in a different manner. What was common to all sites was a group of basic questions on the most important indicators which had to be applied in every site, in order to allow comparing results across sites.

One additional issue is the need to guarantee that there will not be fraud in observers reporting. There may be an incentive to do so particularly if there are rewards for participation. One way to avoid this possible problem is to include questions on aspects of the trip that the observer will only be able to respond if he or she actually does the trip, like providing the registered number of the vehicle (which can usually be found inside buses).

Several types of survey **formats** may be used, depending on the type of observers: Paper survey, phone interviews, email, internet site, etc. The least costly means is the reporting through the internet, since it does not involve resources to copy responses into a database, a process that is done automatically in this case. However, some user groups may not have access to internet or may be more motivated through other means. In this case, paper or telephone reporting may be necessary.

3.2.3 Observers relation management

Before the start of the attribution of assignments to observers, the ENERQI methodology requires some prior knowledge by them on the monitoring process and the associated assessment material, i.e. the questionnaires. For that aim, it is essential to provide some form of previous training to observers. See section 4.2.1 for more details.

Throughout the implementation of the ENERQI quality monitoring approach there is the need for a continuous communication line between the operator and the observers, for the sending of assignments, respective reports from observers, requests or initiatives on clarification of

assignment and reporting issues, feedback to observers on results of the monitoring or information and attribution of rewards.

The relevant factors for a correct choice of a communication platform(s) should be: survey and feedback of results formats, characteristics of the observers (e.g. age, education, and technological knowledge), timing of survey application defined.

As for the survey format and feedback reporting of results, internet communications are the least resource consuming ones, but they may be inappropriate for certain user groups. On the other hand, a more personal contact may be recommendable from the point of view of identification and commitment to the project by the observers, e.g. by organising regular discussion events for the observers.

3.2.3.1 Rewarding how, when, why

The ability to motivate potential observers to cooperate may be very distinct from place to place. In some places people are not used to the concept of directly cooperating with public authorities, while in others they are happy to do so. Different social and age groups may have different willingness to cooperate as well. However, the experience shows that in many cases it is important to provide some kind of rewards for cooperation.

If rewarding observers for their delivery of observations is desirable from the point of view of achieving a higher number of observations, it may be too costly to implement. In this case, smart incentives could be considered that are effective and not too costly. From this point of view the appropriate types of incentives may again be different depending on culture and availability of resources and should be suited locally. For example, in the Netherlands a small monetary reward is given for each report delivered, while in Lisbon the plans are to carry out a lottery for the most cooperating observers.

The decision and choice of timing for introduction of incentives may be made dependent on the rate of participation from observers achieved during the initial process of monitoring. The previous experience in the Netherlands shows that some observers will lose motivation with time. If and when that happens it may be revived through the attribution of additional rewards.

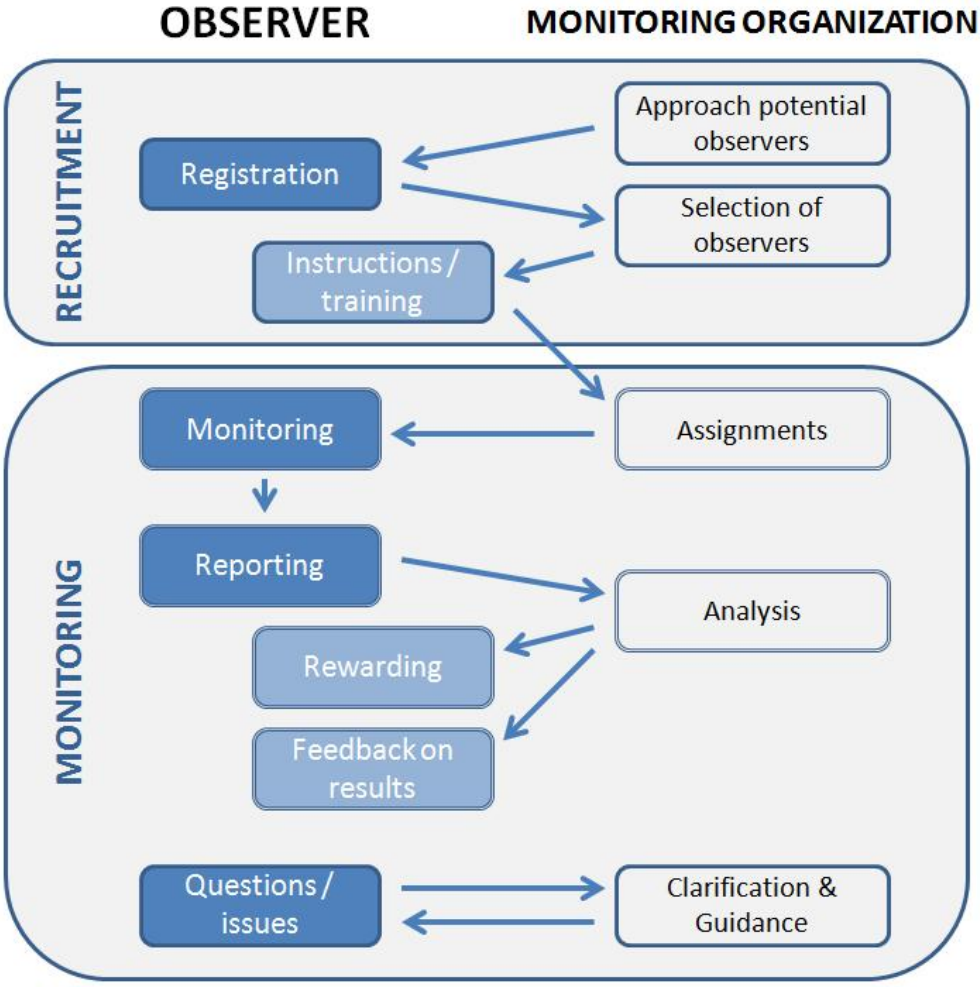
For non-users of public transport, a minimum requirement in terms of motivation will be to offer the tickets corresponding to the trips reported.

Besides the cost issue, as pointed out above rewards may entail other problems:

- Observers might be turned into professional observers inducing risk of reducing their spontaneity and they will participate only for the reward;
- Incentives may induce fraud in observers reporting, which may be avoided through proper reporting mechanisms (see 3.2.2).

3.2.4 Summarizing: the client's path of the observer

The following figure summarizes the sequence of steps and actions from the perspective of the observer.



The process starts with the search by the monitoring organization of potential observers (section 3.1.2). The costumers that accept the challenge of being observers have to register as such (3.1.3). On the basis of the potential observers' data and the sampling strategy of the monitoring organization, it selects the observers to be engaged (3.1.2) and then provides them instructions or specific training (3.1.4). After a sufficient number of observers have been recruited and instructed, the monitoring process may start. The monitoring organization provides assignments (3.2.1), which observers should carry out and report (3.2.2). After processing of the results, the observers will be rewarded and receive feedback on the results of the monitoring if these are part of the process (3.2.3). Complementarily to the regular communication flows between the observers and the monitoring organization, there should be a permanently open line of enquiry available to observers for questions or any other issues.

4 THE DATA: INDICATORS, WORKFLOW AND ANALYSIS

4.1 Indicators

Once the scope of the study has been defined, it is important to consider the quality of service criteria to be measured and to put in common.

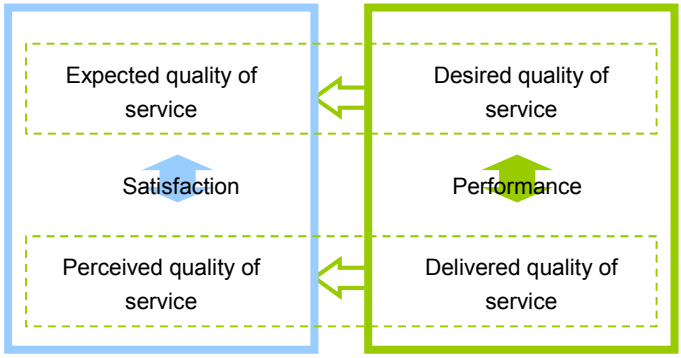


Chart 1: The 4 forms of quality of service.

The **European Standard EN 13816:2002** lists 4 sub categories of « quality of service », according to whether the measurement is conducted from the operator's point of view (a and b) or from the user's point of view (c and d):

a. The desired quality of service (“Service quality targeted”): defined by the public transport authority or by the operator itself. It corresponds to the objectives that the operator must meet in terms of quality of service

b. The delivered quality of service (“Service quality delivered”): corresponds to the actual level of service delivered by the operator.

c. The perceived quality of service (“Service quality perceived”): this is the level of quality of the public transport service offer as perceived by the users themselves. This approach to quality of service takes into account the subjectivity of the users, who, as a result of their personal travel experience, will perceive quality of service in different ways.

d. The expected quality of service (“Service quality sought”): corresponds to the level currently desired by the users, and therefore that which the transport operators should aim for in order to best satisfy users.

The overlapping views from users on quality of service allow us to verify the coherence of the defined objective with the actual perceptions of users. The ENERQI methodology has chosen to concentrate principally on the measurement of the quality of service perceived by the users. Additionally, the ENERQI methodology focuses on specific trips and therefore the indicators should in general be related to characteristics of individual trips rather than general characteristics of the services in question. For example, service *availability* (e.g. frequency, area coverage) might be understood as a general characteristic of the service or network

rather than a specific feature of the trip in observed. Punctuality, on the other hand, is clearly a performance issue related to single trips.

EN 13816:2002 proposed a list of eight standard indicators[2]. It includes eight groups of indicators: Availability; Accessibility; Information; Time; Costumer care; Comfort; Security, and; Environmental impact. The following figure presents a subjective view of their general positioning concerning relevance towards trip specific performance and perceived quality of service. In face of this classification, it can be concluded that groups of indicators 3. to 7. are comparatively more relevant for a continuous observer based quality monitoring approach.

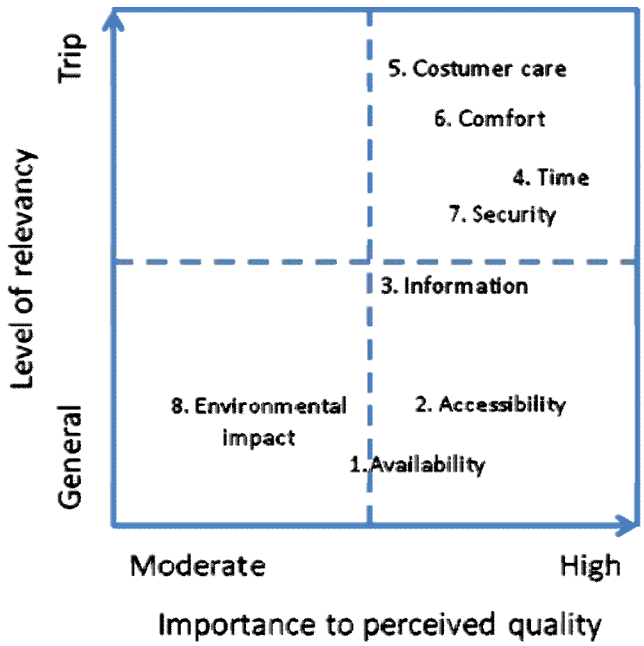


Figure 2 – Classification of groups of indicators proposed by EN 13816:2002 according to their importance towards specific trip performance and costumer perceived quality

The relevancy of each indicator may vary from place to place, according to costumers' expectations and preferences. For example, mobility users in a place may be highly focused on status concerns – projected by comfort – as in a different place costumers may be more economically rational, privileging for example time.

If, for an issue of resource constraints or simplification of the methodology (e.g. simplification of the surveys given to observers), it is important to limit the number of indicators tested, the ones more relevant for the target groups of costumers should be selected.

The ENERQI project departed from the reference list of indicators of EN 13816:2002 and defined a common set of indicators for use and comparison within the project with the following common characteristics:

- Indicators that are used to **measure the perceived quality** per type of user, trip, time of the day, individual bus line and place of arrival and departure. These indicators are

[2] For an overview see ENERQI Deliverable 2.

be both quantitative, like user classifications given to comfort, and qualitative, like specifying the reason of a feeling of insecurity.

- Indicators that allow for a measurement the level of quality **over time**, which are able to show "real time" results of a scheduled quality improvement action or communication campaign.

The Euro Norm indicators were unfolded into more specific indicators that were translated into questions for use in the questionnaires. Along with the evaluation of the quality of service perceived by users on their own networks, the public transport operators may also want to compare their results with other public transport networks (benchmarking), as well as share their knowledge and exchange experiences about their practices to improve the quality of transport service. To fulfil this need for comparability of network performance, the terminology, measurement scales and collection tools applied in ENERQI have followed a common terminology as described above.

The following table shows the common ENERQI questions directly related to quality evaluation and establishes the linkages of each question with the quality criteria of EN 13816:2002. Of the eight criteria, only five are deemed relevant in the scope of service operations: information, time, customer service, comfort and safety/security.

Table 12 – Relation between ENERQI common questions and quality criteria of EN 13816

	Quality criteria according to EN 13816								
Question (compulsory)	**General quality**	**Availability**	**Accessibility**	**Information**	**Time**	**Costumer service**	**Comfort**	**Safety / Security**	**Environment**
Relevant in ENERQI methodology? (compulsory questions)	**x**			**x**	**x**	**x**	**x**	**x**	
Overall customer satisfaction									
7. How satisfied are you in general with the service offered to you?	x								
Value for money, tickets and tariffs									
11. How do you judge the value for money (price/ quality) of this service?	x								
Level of crowding									
12. How satisfied were you with any crowding at your boarding stop(s)?							x		
13. How satisfied were you with any crowding on the vehicle?							x		
Safety and security									
15. How satisfied have you been with your personal safety on the vehicle (s)?								x	
16. How satisfied have you been with your personal safety at the stop(s)?								x	
Stops/shelters									

Question (compulsory)	Quality criteria according to EN 13816							
	General quality	Availability	Accessibility	Information	Time	Costumer service	Comfort	Safety / Security	Environment
18. How do you judge the condition of the (bus) stop environment on departure (s)?							x		
19a. How satisfied have you been with the punctuality of the departure?					x				
OR (in case of an offered frequency)									
19b. How satisfied have you been with the reliability of the service?					x				
20. How do you judge the conditions of the (bus) stop environment on arrival?							x		
Vehicle condition									
22. How do you rate the condition of the vehicle (s)?							x		
23. How satisfied have you been with the comfort in the vehicle(s)?							x		
Journey speed									
25. How satisfied have you been with the duration of your trip?					x				
Staff service									
26. How satisfied have you been with the friendliness and the overall behaviour of the driver (s)?						x			
27. If you asked for information / advice, how satisfied have you been with the information given by the driver (s)?						x			
28. How satisfied have you been with the driving style of the driver (s)?							x		
Information									
30. How satisfied have you been with the information at the stop(s)?				x					
31. How satisfied have you been with the information in the vehicle?				x					
Disruption/ incidents									
34. In case of disruption, how satisfied have you been with information regarding the disruption and possible solutions?				x					

4.2 The workflow

4.2.1 Making of the system

The implementation of the monitoring system is preceded by its setup. The most important practical tasks are outlined.

Management system and database

A database is required to gather all the information provided by the observers and other relevant information. On the other hand, there must be a system of information analysis and interaction with the observers.

Some kind of **management system** is crucial mainly for the following purposes:

- Development of surveys,
- Realizing assignments,
- Data analysis.

In the ENERQI project such type of system is integrated into the ENERQI website[3], which has three main aims. It is a dissemination platform, giving general and in-depth information about the project, it is the working platform for operators and volunteers and it also serves the partners for management purposes.

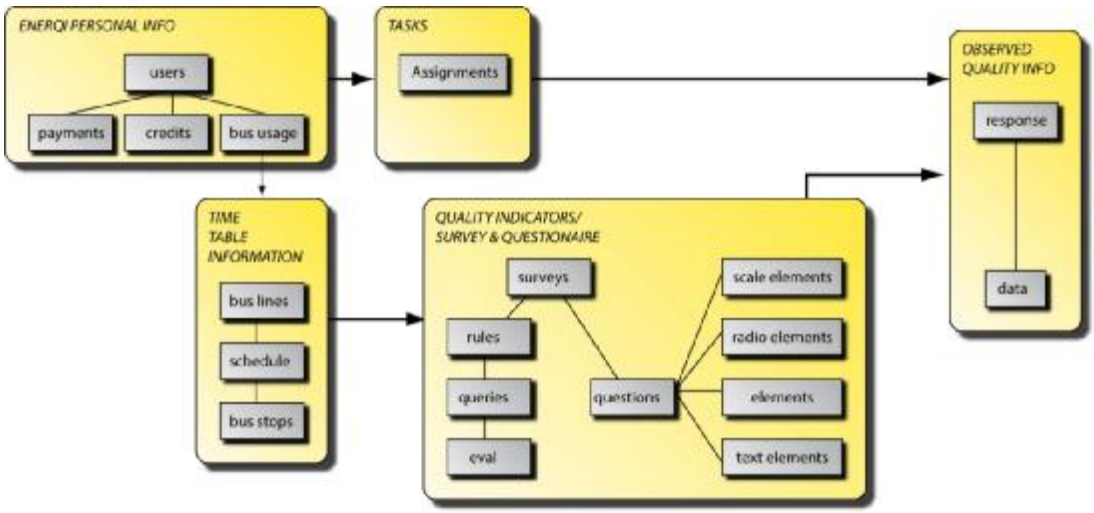


Figure 3 – Scheme of ENERQI database and management system structure

A restricted area only open to the registered volunteers contains a data entry section linked to the on-line database and allows observers to report directly there. This part is the technical "backbone" of the quality-monitoring process. The interface focuses on clearness and user friendliness to help and not to hinder the process of monitoring. It is cross-platform capable, which means that it allows to be filled stationary (the observer performs the quality check on paper and he or maybe someone else fills the data afterwards).

[3] The website of the project ENERQI lies under the URL http://www.ENERQI-online.eu

The platform can be accessed through a mobile interface (the quality observer uses a mobile device to collect the data and fill the database). So, all levels of technical capabilities of the users are covered. ENERQI does not build on dedicated devices, but browser technology with small screen capabilities are used as a technical basis to allow compatibility with most mobile devices available.

The operator/ manager area supports in the preparation of a number of tasks, in coordination with the other sites which are applying the methodology. It contains the following sections:

- Assignment preparation section,
- Questionnaire management section,
- Public transport network, lines, stops and schedule management section,
- Volunteers' filled data control check and analyse section,
- Reporting and results presentation section.

For the ENERQI local applications, a common **database** is developed which may be applied by followers of the project. The database content structure for every site consists out of 5 main tables:

- a personal section in which privacy sensitive information of the ENERQI volunteers/observers,
- a time table of the public transport service,
- a section containing the quality indicators on the basis of which the questionnaires are constructed.
- a section of assignment generation for the involved observers based on randomly chosen trips from the timetable,
- a section containing the actual observations on the basis of which performance analysis can be executed.

Confidentiality issues must be taken care of in the contact with the observers and the development of the management system. This is so in relation to personal data of the observers but also, in case the management system is common to several monitoring entities, in relation to confidentiality of data of each monitoring entity. Confidentiality statements and security devices are used for this purpose.

Human resources

To successfully implement the ENERQI methodology correct human resources should be allocated to the project. The necessary valences of such a team are relatively diverse and specific. The main tasks involved are:

- Contact with observers;
- Database management, assignments, observer management;
- Data analysis;
- Specification and management of local quality improvements;

- Communication campaigns.

These valences, especially the two latter ones, will most probably implicate the participation of different departments within the operator for the first three potentially the involvement of external entities for carrying out part of the tasks.

Recruitment & Training

The next step is the recruitment of observers. Then they need to be instructed on the actions they will be involved in. Details and recommendations on these processes are presented above (respectively sections 3.1.2 and 3.1.4).

4.2.2 Daily operations

There is a continuous work needed from the entity carrying out costumer observer based quality monitoring. The most important regular tasks are the following:

- **Assignment design and delivery**: The process of assignments can to some extent be made an automatic process until the evolution of data needs by the operator arise as a function of previous data analyses or emergence of hot topics to analyse.
- **Data collection and input**: Depending on how automated the data collection process is for the various target groups, it may be needed to rely on human resources to collect and input data in the database.
- **Data analysis**: Data analysis should be done monthly or, in the case of reported incidents by costumers, on a daily basis.
- **Reporting**: An internal regular reporting process should be established that organizes the data and provides conclusions directed at possible actions. The reporting mechanisms should extend to the various departments of the organisation for which the data is of interest for their activities. Another important dimension of reporting is to costumers themselves as a motivation factor.
- **Action – quality improvement**: Specific points in time should be scheduled for definition of improvements for the following period. This quality improvement schedule should be layered into various regularities (daily, monthly, yearly) depending on the type of quality aspects and improvements in question.

4.2.3 Maintenance and system improvement

During the operation of the monitoring process the need will arise for its maintenance and improvement. The most important aspects for updating are assignments, recruitment of new observers and the management system.

Assignment design

The choice of assignments to deliver should be based on the initial plan of continuous monitoring but can and should be complemented by new needs of data that emerge either from the building of knowledge on customer preferences and quality of service given by data

analysis of previous assignments or from the introduction of new measures or appearance of relevant 'hot topics' to study on an *ad hoc* basis. Assignments should be permanently redesigned to meet instant needs.

Rate of participation, incentives and new recruitment

The organisation should monitor on a regular basis the rate of participation throughout the process, and check the need to improve the communication channels with the observers.

It is important to assure that the volunteers are motivated and willing to proceed with the observations along the projected time. Some important points to be taken in consideration might are:

- Accommodating assignments with the observers regular routines;
- Observers have to feel that they are part of the organisation, and that their collaboration is crucial for the success of the process. To improve the commitment between the observers and the ENERQI organisation it might be important to set a training meeting instead of just giving the observers written instructions;
- Keeping the observers informed about the results of the ENERQI process;
- In case the rate of participation is low, further encouraging the fulfilment of questionnaires by observers with additional communication and rewards.

If the rate of participation is decreasing or unsatisfactory, these mechanisms of motivating observers should probably be reinforced or new observers must be recruited.

Management system

With the use the management system it is likely that problems or new needs are identified both from the point of view of the observers and the point of view of the organisation. The manager of the system should be prepared to update its management system during the monitoring process, at least in an initial stage.

4.3 Reporting and analysis

4.3.1 Analysing results of observations

With the information that comes from the observations, different types of analysis have to be taken to best assess the quality of service and evaluate which should be the most cost-effective quality improvement measures.

The analysis of quality perceptions should ultimately attempt to understand which are the quality factors that can be improve for a better cost/effectiveness, in order to prioritize and plan quality improvement actions. Additionally, the data can be particularly useful to instantly identify occasional specific problems in the provision of services, as a complement to the established complaints system.

Analysing quality perceptions should therefore identify the major **weaknesses** of the public transport service, network and individual lines. That is partly revealed by the ratings allocated to the various quality criteria, whereby the comparison of rating between different criteria allows understanding which factors are perceived as worse and best.

For a complete picture it is nevertheless necessary to understand also which of the identified weaknesses are **most relevant for costumers**. It is not necessarily so that the weakest indicators actually refer to quality aspects that are important to costumers. So, identifying the quality items that are more relevant for the perceived quality of the observers will be useful to define and implement the most cost-effective quality improvement measures. This may be identified either or complementarily by directly asking costumers which they consider to be the most important quality aspects for them or by doing regression analyses relating responses on general satisfaction with responses in the remaining indicators in order to check which are the most influencing ones.

Additionally to the comparison of results of different indicators and assessment of which are most important to costumers it is possible to get additional information through benchmarking of results with other sites realizing similar monitoring processes. The **benchmarking** will allow the public transport operator to measure its level in terms of quality of service, and position themselves in relation to other operators to see if the current state of quality service is within what is practiced elsewhere. For an overall assessment of perceived quality evolution based on benchmarking, it must be guaranteed that the results are comparable through time, which may not happen if a common set of questions is not included or if the samples of compared costumers or PT services are not uniform. Followers of ENERQI methodology will be able to compare their results with the test sites used in ENERQI project or other cities whose quality monitoring has data to compare with.

A particular advantage of realizing continuous quality monitoring is the ability to measure effects on perceived quality of any events including deliberate **quality improvement actions**. By comparing reported user perceptions data from before and after the implementation of the quality improvement actions, it should be possible to assess the real effects of these actions on the perceived quality by users and on increasing public transport usage. For example, it will be possible to compare journey times before and after the implementation of punctuality improvement actions, and verifying if the time saved was enough to change the users' perceptions (See also section 5.1).

4.3.2 Adjustment of expectations

A particular aspect to take into account is the adjustment of expectations by the observers through time. It is known that people adjust their satisfaction levels to a dynamic reference which adjusts with past experience[4]. Past public transport monitoring experiences show that absolute perceived satisfaction ratings cannot be expected to account for absolute delivered quality[5]. Cases of monitoring have shown that during the quality monitoring process, users tend to become more demanding on the quality of public transport service[6].

Therefore it is important to distinguish the expected quality (level of quality desired by passengers) from the perceived quality (level of quality perceived by users during their journey). A sound interpretation of results requires that (the adjustment of) expectations must be taken into account in the interpretation of perceived quality results.

4.3.3 External events

Several types of external events impact perceived quality and public transport demand. Economic performance, energy prices, other mobility policy, lifestyle changes, strikes or weather are a few examples.

In the scope of perceived quality monitoring, external events are relevant from various perspectives.

- Continuous perceived quality monitoring allows to measure effects of external events on perceived quality;
- By influencing perceived quality, external events introduce noise in the data which may introduce difficulties in the interpretation of monitoring results;
- By influencing public transport use, external events also put difficulties in the analysis of a relation between quality improvements and public transport use.

Isolating the effects of external effects in order to understand the real effects of quality improvements may in some cases be possible if there is empirical data available that allows parameterizing their share of effects on perceived quality and/or demand is. For example, elasticity of demand to fares is available in the literature[7].

---

[4] Easterlin R A (1974) "Does Economic Growth Improve the Human Lot?" in Paul A. David and Melvin W. Reder, eds., *Nations and Households in Economic Growth: Essays in Honor of Moses Abramovitz*, New York: Academic Press, Inc.

Kahneman D, Tversky A (1979) “Prospect Theory: An Analysis of Decision under Risk”, Econometrica, Vol. 47, No. 2. (Mar., 1979), pp. 263-292.

[5] Friman M, Fellesson M (2009) “Service Supply and Customer Satisfaction in Public Transportation: The Quality Paradox”, Journal of Public Transportation, Vol. 12, No. 4.

[6] It has happened for example in the application of the costumer based quality observations monitoring in Noord-Brabant before the start of the ENERQI project.

[7] Reference values that can be considered for bus fare elasticity are -0.4 in the short run, -0.56 in the medium run and -1.0 in the long run, for metro -0.3 in the short run and -0.6 in the long run, and for

In other cases, if the period of incidence of external effects is limited, it may be possible to estimate their effects assuming all other variables equal. This could be done for example in the case of weather events. The ability of accounting for external effects depends thus on their period of incidence. The smaller it is, the easier is to estimate their individual effects on perceived quality and demand.

An additional aspect is that external events can be an opportunity to allow non-costumers to get to know the present public transport quality. Events like economic downturns, increasing fuel prices, policy events like car-free days, are opportunities to bring potential new costumers to experiment public transport. This may be especially useful in cases of public transport networks which have had important quality improvements that have not yet been fully perceived by non-costumers. The perception of non-users on public transport quality is often lower than the actual quality due to stigmatization or persistence of past image of PT quality. Having non-users experiencing public transport may thus be an opportunity with high potential to change perceptions. For example, after the end of the six month trial period of the Stockholm congestion charge, about half the people who had shifted from car to public transport did not move back to car after the tolling was cancelled[8].

4.3.4 Confidentiality

Some operators may want to treat the data gathered in the quality monitoring process as confidential, most notably when they are private entities. The development of a tool that can be used by different entities which have access to each other's data for benchmarking purposes may not always be compatible with this need. In this case, it is possible to use the tool individually, without any kind of shared data. Another possibility is having different layers of available information, where some are accessible and others are not. For example, it is possible that information on the results of aggregate indicators is public but not the detailed data on the results of observations. Finally, it is possible to establish a confidentiality agreement between the participating entities that impedes disclosure of information by some partners of other partners' data. The later is only feasible if there aren't potential competitors inside the group.

Another important dimension of confidentiality is related to disclosure of personal information on observers. This may be sensible both for legal and private data property reasons. In the second case, it is common that databases with details of costumers (including their contacts) are valuable property of the entities responsible for recruitment who are not interested in sharing this information. Again, the problem could be solved through individual use of the tool or by setting up appropriate data access restriction mechanisms or by a confidentiality agreement.

---

suburban rail -0.6 in the short run (see Paulley N, Balcombe R, Mackett R, Titheridge H, Preston J M, Wardman M R, Shires J D, White P (2006) "The demand for public transport: The effects of fares, quality of service, income and car ownership". Transport Policy, 13(4), pp.295-306.).

[8] See Eliasson J (2008) Lessons from the Stockholm congestion charging trial, Transport Policy, Volume 15, Issue 6, November 2008, Pages 395-404.

5 ACTIONS: IMPROVING QUALITY

5.1 Quality improvement actions

A crucial part of the ENERQI methodology is the selection and implementation of quality improvement actions. The observer based continuous monitoring methodology has the ability to provide continuous and almost real time information, which enables a very quick response to new problems or needs. This step deals with the decision on the choice of quality improvement actions to carry out in response to the feedback provided by the monitoring process or fine-tuning of previous actions.

The characteristics in any public transport that influence the perceived quality can be divided into 4 dimensions of service:

1. Physical aspects (including accessibility, cleanness and design),
2. Nature of the service offered in accordance with the customer travel needs (including reliability and information);
3. Personnel (including competence of the personnel, consideration of the customer and politeness), and
4. Image of public transport, which is partly defined by the first 3 dimensions, yet also by the communication strategy of the public transport operator.

The quality improvement actions should be outlined following a cost-efficiency perspective. The goal should be to improve quality as much as possible with a minimum consumption of additional resources. These quality improvement actions should seek to respond to the public transport service needs and can be used to transform the attitudes of users. The choices have nevertheless to take into account the implementation costs and feasibility of this quality improvement actions.

From the results taken from the observers questionnaires, is possible to sort the major weaknesses in terms of quality of service. This is important because there might be quality items that, although having a good potential for improvement, are not considered by users as relevant as other elements whose improvement would contribute more for improving global satisfaction.

The tables below present lists of quality improvement actions according to their potential to fulfil quality gaps of different categories of quality. The first table refers particularly to impacts on user perceptions according to the groups of indicators set out in the EN 13816:2002. The second table refers to the same potential according categories structured in the standard ENERQI questionnaire. This type of assessment is useful in the choice of appropriate measures to respond to particular weaknesses as identified by the observers. The first table is oriented to the perspective of the customer. The second one is more oriented to the perspective of the operator, as it is organized in terms of activities/objects of the operator.

Table 13 – Quality perception improvement actions (EN13816:2002 items)

Quality improvement action	Effect on perceptions: (according to EN 13816:2002 Items)							
	Availability	Accessibility	Information	Time	Customer Care	Comfort	Security	Environmental Impact
Bus driver training in customer service/hospitality	-	-	-	-	+++	-	-	-
Bus driver training in driving style	-	-	-	-	++	+++	++	+
Investments in new vehicles	++	-	-	-	-	++	+	++
Intensified vehicle cleaning programs	-	-	-	-	-	++	-	-
Smart cards, SMS ticketing	+	++	-	+	+	-	-	+
Better shelters for bus stops	-	++	-	-	-	++	-	-
Punctuality improvement measures	+	-	+	+++	-	-	-	-
Improved passenger information systems	-	-	+++	++	+	-	-	-
Increase of frequency	++	-	-	+++	-	+	-	-
Operation control systems (e.g. through GPS)	++	-	++	++	-	-	-	-
Introduction of additional services (e.g. Wi-Fi in public transport)	-	-	-	-	-	++	-	-
New bus/tram lines	+++	-	-	+	-	-	-	-
Green branding of public transport	-	-	+	-	-	-	-	++
Campaigns on healthy lifestyle and public transport	-	-	+	-	-	-	-	++

Table 14 – Quality improvement actions (ENERQI items)

Quality improvement action	Effect on perceptions: (according to standard ENERQI survey Items)										
	Value for money	Tickets and tariffs	Level of crowding	Safety and security	Stops and shelters	Vehicle condition	Journey speed	Staff service	Information	Disruption / Incidents	Customer support
Bus driver training in customer service/hospitality	+	-	-	-	-	-	-	+++	-	-	++
Bus driver training in driving style	+	-	-	++	-	-	-	++	-	+	-
Investments in new vehicles	++	-	-	+	-	+++	-	-	-	++	-
Intensified vehicle cleaning programs	+	-	-	-	-	+++	-	-	-	-	-
Smart cards, SMS ticketing	++	+++	-	-	+	-	-	-	+++	-	+
Better shelters for bus stops	++	-	++	-	+++	-	-	-	+	-	-
Punctuality improvement measures	+++	-	-	-	-	-	++	-	+	++	-
Improved passenger information systems	+	-	-	-	-	-	-	-	+++	+	++
Increase of frequency	++	-	++	-	-	-	+++	-	-	+	-
Operation control systems (e.g. through GPS)	++		-	-	-	-	++	-	+	++	-
Introduction of additional services (e.g. Wi-Fi inside bus)	++	-	-	-	-	+	-	-	+	-	-
New bus/tram lines	+++	-	-	-	-	-	-	-	-	-	-
Green branding of public transport	++		-	-	-	+	-	-	-	-	-
Campaigns on healthy lifestyle and public transport	++		-	-	-	+	-	-	-	-	-

In the decision of which quality improvement measures the operator should additionally take into account some of the risks that may surge in its implementation, such as:

- Insufficient funding
- Organisation and administrative changes
- Lack of innovativeness
- Lack of political support
- Major changes on infrastructures and built environment

5.2 Communication

The ultimate objectives of ENERQI can only be fully achieved if the quality improvement actions implemented locally are properly translated into perceived quality by regular and non-regular public transport users. To achieve this goal, communication actions may be necessary.

It is relevant in this scope to distinguish between two types of communication:

- Communication to inform about quality improvements
- Communication to change perceptions alone (image campaigns)

The first type of communication is aimed specifically at maximizing the impact on satisfaction of the undertaken improvements. It is not guaranteed that quality improvements delivered will actually translate into improvement of perceived quality, since the users may not notice the changes in question or fully value them. In these cases, it may be useful to endeavour communication campaigns in order to bring delivered quality into perceived quality.

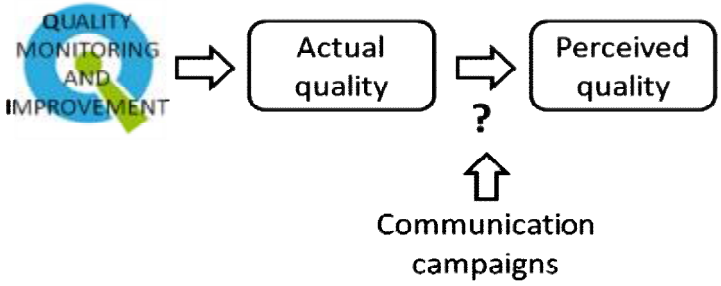


Figure 4 – Translation of actual into perceived quality and evaluation of need for communication campaigns to make the link

To evaluate the potential advantages of doing quality improvement information campaigns, it may be useful to assess the impact of quality measures on satisfaction. For example, data on delivered punctuality can be compared with satisfaction regarding punctuality. If the quality improvement is not perceived or valued by costumers in its full potential, it may be the case for a communication campaign calling the attention of costumers to the improvements made.

The utility of communication campaigns in relation to quality is even more stringent in relation to non-costumers, who do not have the opportunity to feel any quality improvements through experiencing public transport. Apart from spread the word phenomena, the way to change perceptions of non-costumers is restricted to communication campaigns.

The second type of communication could be included in the group of measures to improve perceived quality. Contrary to the other means of perceived quality improvement, image campaigns can potentially improve perceived quality without direct linkage to specific delivered quality improvements. In this sense they can be compared to real time information on arrival times which, without changing punctuality, have the ability to change the perceptions about it. Still, they are a possible means to achieve the proposed objectives.

Finally, as for other measures, it will be useful to use the data on perceived quality to assess the effectiveness of the communication campaigns.

6 APPLICATION OF THE METHODOLOGY IN ENERQI

The ENERQI project is implementing the approach in 8 sites. These demonstrations will validate the attainment of the proposed objectives of the methodology and provide valuable experience that will be used to refine its methodology and which will be crucial in the transfer of knowledge to followers of the ENERQI approach.

The ENERQI Guide (Deliverable 3.2) provided guidelines for the planning, implementation and operation of a public transport quality monitoring scheme based on regular observations by costumers, with the aim of guiding both ENERQI and other organizations in setting up their costumer based quality monitoring.

To date all carried out the first process of recruitment and are gathering observations from the observers. The results, conclusions and quality improvement actions from each site will be documented in the local 3-monthly Feedback Reports (Deliverables 5.1.x) throughout the project.

A Benchmark Analysis will compare the results from the eight demonstrations. Their quality monitoring data will be systematized, compared over time and between sites. The comparison of aggregate indicators per sites allows identifying common patterns and differences across countries. This will provide additional insight on various local characteristics and suggests useful lessons for a better interpretation of quality monitoring results. The benchmark analysis will be realized in two phases (Deliverables 5.2.1 and 5.2.2).

Following the Benchmark Reports, a final Impact Assessment of the ENERQI approach and the demonstrations in particular will be prepared (Deliverable 5.3). This will include an evaluation of user perceptions, demand behaviour, energy savings and emission reductions following the improvements of the quality of public transport and other changes in quality at local level, and considering the added inputs given by the benchmark report.

With an eye on followers, the ENERQI Guide will be revised at the end of the project, considering the lessons learned from the experience gathered in the implementation (Deliverable 5.4).

A. Glossary

Terms	Part of questionnaire	Definition
Primary	Subscription form : "What's your level of education ?"	First stage of compulsory education
Secondary		Last stage of compulsory education
University and higher		
Pupil	Subscription form : "What's your main profession ?"	Someone who studies at school (rather than college/University)
Student		Someone who studies at college or university
Employed		Someone who works, who has an professional activity
Unemployed		Someone who is out of work
Retired		Someone who has finished one's active working life
Week	Subscription form : "How often do you use a public transport service?"	Working days (Monday to Friday)
Week-end		Saturday and Sunday
Every day		Each days of the week or every working day (Monday To Friday)
Day		Working hours of the day (7 am to 7 pm)
Trip	Regular questionnaire	Short travel, to the stop / station where someone gets on a vehicle to the stop / station where someone gets out the vehicle. Only one type of vehicle and one line are used.
Journey	Regular questionnaire	Long travel, to the place of departure to the arrival place. Several vehicles and lines can be used.
Stop	Regular questionnaire	Place where bus stop to pick up or set down passengers.
Station	Regular questionnaire	Place with a ticket office, waiting room, … where metro, tram and buses stop to pick up or set down passengers.
Vehicle	Regular questionnaire	Bus, trolleybus, tram, metro
Service (of public transport)	Regular questionnaire	The total service package offered to the customer from core transporting of the customer, ticket sold, the information provision and ambiance at stops and in vehicles
Value for money	Quality of the services	Perception of quality of the services regarding the price paid
Price	Quality of the services	Cost of the ticket
Level of crowding	Quality of the services	Perception of the number of people gathered together at the stop / station or into a vehicle.
Safety	Quality of the services	Feeling free from fear or anxiety depending of involuntary acts (ex: road accident)
Security	Quality of the services	Feeling free from fear or anxiety depending of voluntary acts (ex: theft, degradation, ...)
Personal Safety	Quality of the services (Questions 15 and 16)	Feeling free from fear or anxiety for someone (independing of the type of the act)
Punctuality	Quality of the services	Be on time, with "X" minutes before or after accepted
Reliability	Quality of the services	Respect of a period of time between two hours of passage of vehicle into a same line.

Frequency	Quality of the services	Type of line. The vehicles of a same line pass every "XX" min at a stop / station. (In opposition with "Line with schedule". The vehicles of a same line pass at the hour indicated (interval aren't equal between two schedule).
Comfort	Quality of the services	State of ease and freedom
Driver behavior	Quality of the services	Respect of the driver to follow the rules
Incident	Quality of the services	Interruption of the services.
Disruption	Quality of the services	Case when the service of public transport doesn't work normally.
Route change	-	Modification of the way.
Shelter	Quality of the services	Place giving protection of bad weather or danger, to wait for the bus, the tram or an other vehicle.
Duration of the trip / of the journey	Quality of the services	Perception of the time of duration.
Trip / journey speed	Quality of the services	Perception of the speed of a trip / a journey.
Customer	-	Someone who uses the public transport,

Table A 1 – Glossary of terms

Part of the questionnaire	Questions	Types of scale	Meanings
Quality of the services	All questions with scale	1 to 5	1/5 = Not satisfied at all 2/5 = Not satisfied 3/5 = Neutral 4/5 = Satisfied 5/5 = Really satisfied
		1 to 10	1/10 = Not satisfied at all … 10/10 = Really satisfied
Regular questionnaire	12. Condition of the traffic	Qualitative	Very busy Busy Clear
Regular questionnaire	13. Duration of the journey	Quantitative or Qualitative	Longer than normal Normal Shorter than normal
Regular questionnaire	14. Items that most influenced opinion	1 to 3	1st 2nd 3rd

Table A 2 – Glossary of scales used in the ENERQI common questionnaire

B. General conditions of participation by observers (ENERQI project)

1) You are travelling on a regular basis on at least one of the lines of the operators (NAME OF THE OPERATOR OF OBSERVED NETWORK(S)) or prepared to do so. You will be asked and agree:

- on request to execute on a regular basis (INDICATE WHICH REGULARITY) a quality observation of your trip and to report back trough the provided questionnaire;
- to do this for a longer periods;
- to be prepared to participate to ad-hoc theme based questionnaires.

2) You are in the possession of a computer or any other replacing device with an internet connections (please note that much experience of working with a computer is not requested)

2A) in case you are asked to return the questionnaire in a paper format the possession of a PC or any other replacing device with internet connection is not necessary. In that case you are asked to properly return the filled paper-based questionnaire as locally indicated.

3) You are aware that not every person that subscribes can automatically participate. In order to get a representative panel of observers a selection will take place.

4) Staff of the public transport operator is excluded from participation

5) Participation is allowed from 16 year (REPLACE BY LOCAL LEGAL AGE)

6) As a result of a change in the research methodology or focus of the research it might be possible that your participation is ended by the local organisation (INSERT NAME OF LOCAL MAIN RESPONSIBLE ORGANISATION)

7) The local organisation (INSERT NAME OF LOCAL MAIN RESPONSIBLE ORGANISATION) can at any moment decide to change the manner of rewarding for your participation. You maintain every right on reward(s) that you gained before this change

8) You will be asked during any period that you are not able to execute a quality observation (for example vacation) to indicate this to the organisation. This can be done by sending an email to (INSERT EMAIL ADRESS)

9) You are able at all times to end your participation by sending an email to (INSERT EMAIL ADRESS)

10) You agree that the organisation sends you news items related to research, including a feedback on the local results

11) You agree that the local organisation (INSERT NAME) processes your personal information in line with the respective national privacy legislation and regulation in place.

12) You agree that the local organisation (INSERT NAME) uses your anonymous made data for analysis on the quality of public transport in the frame of the European ENERQI project www.ENERQI-online.eu

(REPLACE or COMPLETE IF NECCESARY BY ANY OTHER LOCAL SPECIFICATION)