Applying PQM to a Regional Portal

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Abstract —Portals have evolved from being simple providers of Web page access and corporate databases into being sites that support intelligent management, integration of applications and collaborative processing. Portals can be considered as an evolution of datawarehouses by extending its application to Intranets and giving access to all information resources and knowledge of a firm. All these facts make it essential that developed portals are of good quality.

Our aim is to define a portal quality model and, to achieve it, we have used the GQM method. As our model is in the definition phase now, only its two first phases have been used. That is the reason why our model must be considered as a first approach and not as a close and definitive model. Our model, called PQM, is composed of six dimensions: tangibles, reliability, responsiveness, assurance, empathy and data quality. These dimensions have been obtained by means of the SERVQUAL method. Moreover, we have done a survey of the workers of the portal of Castilla-La Mancha (castillalamancha.es) to obtain their opinion and assesment about different aspects of this portal in relation to PQM.

Index Terms — Quality assurance, quality concepts, model development.

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1 INTRODUCTION

Portals prov ide a way to access to a local or remote network, to a company in the case of a corporate portal or to general-interest topics and services in the case of a public portal.

In general, portals provide [11] us with:

- A custom framework for presenting pages and components within each page and organizing information for specific communities.

- Personalization capabilities for individual users.

- A set of "portlets" (components that integrate data, applications, content, and resources and present information to the portal user)

- A single sign -on to the set of applications accessed via the portal.

- Other features, such as search and collaboration.

Therefore, portals have evolved from being simple providers of Web page access and corporate databases into being sites that support intelligent management, integration of applications and collaborative processing. Portals can be considered as an evolution of datawarehouses by extending its application to Intranets and giving access to all information resources and knowledge of a firm [4]. One of the advantages of portals is its ability to integrate and personalize several technologies (groupware, databases, datawarehouses, e-mail, meta-data, intelligent management systems, etc.) in a unique business management tool. Moreover, por-

tals integrate all kinds of information, applications and services into a unique environment, according to the personal experience of each user. With a portal, a firm can give appropriate information to the correct subject. Hence, portals can be considered as the entry door to the firm [8].

According to [11], portals can be divided into generations:

- First generation: Access Portal: They were used to provide a set of links to other information and resources.

- Second generation: Aggregation Portals: They bring information back to the portal so that the user does not have to go anywhere else.

- Other generations: Workspace Portals (where the portal becomes the users' work environment, including all the appropriate information, tools, and resources) and Adaptive Portals (where the portal experience, itself, dynamically depending on the user's context and the ongoing process).

However, the research on portals is still beginning. Some key points for its evolution are [17] listed below:

- The percentage of organizations that treat portals as core systems will increase from less than 10 percent in 2003 to 15 percent in 2004 to 35 percent by 2007.

- The portal market is only 40 percent introduced now; by the end of 2004, 85 percent of the Global 2000 will have implemented an enterprise portal framework. This fact will lead to a 161 percent growth in revenue in 2004.

- The portal market has contracted 26 percent since 2002; by the end of 2004, another 20 percent of portal players will exit the market.

The fact of achieving that a portal is of good quality is fundamental because it is the only mechanism that makes users return [13]. In fact, quality has been a research subject in several fields:

In [1], a quality model for the selection of ERP systems is proposed. They choose the ISO/IEC 9126-1 quality Standard as a framework and suggest a methodology to adapt it to specific domains. In [10], authors show us a systematic way to specify the relevant quality attributes involved in the ar-

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chitectural design process. In [7], authors show us a model to value and select the e-commerce websites in a B2C environment (Business-to-consumer). In [15], a way to develop web design guidelines through a quality function is shown. In [19], a conceptual model and an instrument to measure website quality are developed and the websites quality factors that are important to consumers are defined. In [2], authors suggest a Web quality model for the classification of metrics and web methodologies.

In [14], the SERVQUAL model is described. This model consists of five dimensions and 22 items used to measure the different elements of service quality across a broad spectrum of services. In [9], authors develop a framework to measure service quality based on web using the SERVQUAL model as a starting point.

However, there is not a specific framework to control the quality of portals, probably due to the recent developing of portals.

In order to put an end to this lack, we present a first proposal of a portal quality model. This proposal has been made using, as a basis, the GQM method [18] and the model proposed by [14] to obtain the goals. We have selected the SERVQUAL model because it has been successfully adapted to the quality achievement of different topics (as tourism, information systems, automobile industry, etc) and the GQM method because facilitates the definition of the portal quality model with a given goal.

Also, we have done a survey of the workers of the Castilla-La Mancha portal (castillalamancha.es) to obtain their assessment about different aspects of the portal with the objective of evaluating the quality of the above mentioned portal in relation to each dimension of quality that we have defined.

Moreover, the model proposed by us is valid not only for corporate portals but also for public ones considering that nowadays public portals include public and private components, as corporate portals. The main difference between corporate and public portals is that in public portals the business is the portal by itself, while in corporate portals, the business is to be open to the public to present their products, services, image or beliefs. In spite of this difference, all portals are becoming multipurpose. Besides, nowadays, public portals include both public and private components like corporate portals.

At last, we can emphasize that we have only used the Goal and Question phases of the GQM method to achieve our aim (to define a portal quality model). So, we have put off the definition of metrics until later on (when the model will have been validated).

This paper is structured as follows: In section two, the GQM method is shown; in section three, the quality model that we have developed is explained and the phases that we have achieved are specified. In section four, the castillalamancha.es portal is described and in section five, it is explained the survey that has been done of the workers of the castillalamancha.es portal and the obtained results are analysed. Finally, in the last section, conclusions and future work are shown.

2 GQM METHOD

The GQM method [18] is a systematic approach for tailoring and integrating goals to models of the software processes, products and quality perspectives of interest, based upon the specific needs of the project and the organisation.

This method starts top-down with the definition of an explicit measurement goal. The goal is refined into several questions that break down the issue into its major components. Then, each question is refined into metrics that should provide information to answer those questions.

The GQM method is composed of four phases [18]:

1.- Planning phase. A GQM team is established, the improvement area and the application project are selected, a project team is established and finally, as a result, we obtain a project plan.

2.- Definition phase. The measurement plan is defined and documented (goal, questions, hypotheses and metrics are defined).

3.- Data collection phase. In this phase, the data collection takes place, resulting in the collected data.

4.- Interpretation phase. During this phase, the collected data are processed with respect to the defined metrics into measurement results, that provide answers to the defined questions. With these answers, it will be possible to evaluate whether the goal has been achieved or not.

As we have said before, we have followed the GQM method to define a portal quality model, but we have only used its two first phases. The other two phases will be used when the model has been validated. In the next section, we will show how our PQM model has been obtained.

3 QUALITY MODEL

The PQM model (Portal Quality Model) has been developed using the two first phases defined in the GQM method.

Taking into account the fact that the quality of a portal is difficult both to define and to measure, the model that we present below must be considered as a first proposal of framework. This model can be used to measure the quality of a portal, considering that the quality of the portal can be defined as the degree which the portal facilitates services and relevant information to the customer with.

The activities carried out in the achieved phases are detailed below.

3.1 First phase: planning

The first activity that we carried out in the planning phase was to establish a GQM team independent of the project team. Then, the area that we wanted to improve was selected. In our case, it was the quality of portals. The project team was formed by all the developers of castillalamancha.es portal.

3.2 Second phase: definition

The second phase, called definition, is the most important one.

In the first activity of this phase, the goal was defined. In our case, the goal was: "To improve the quality of portals". The next activity was to refine the goal into several questions. We used the SERVQUAL model [14], to carry out this

definition. The SERVQUAL model is composed of five dimensions: tangibles, reliability, responsiveness, assurance and empathy. These dimensions were adapted to portals. Moreover, we added another one that is related to data quality.

However, we thought that the breakdown only to that level was not enough because it was too much generic, so we divided some of these dimensions into subdimensions.

Then, we show the six dimensions (questions) that make up our model (of quality of portals) together with their subdimensions (subquestions).

- Tangible: This dimension indicates if "the portal contains all the software and hardware infrastructures needed according to its functionality".

- Reliability: It is the "ability of the portal to perform its functionality accurately". In addition, this dimension will be affected by:

- Availability: The portal must be always operative.

- Search Quality: The results that the portal provides when making a search must be appropriate to the request made by the user.

- Responsiveness: It is the "willingness of the portal to help and to provide its functionality in an immediate form to the users ". In this dimension, we distinguish the following subdimensions:

- Scalability: It refers to the ability of the portal to smoothly adapt to increasing workloads as a result of additional users, an increase in traffic volume or the execution of more complex transactions [6].

- Speed: It relates to the response times experienced by portal users [6].

- Assurance: It is "the ability of the portal to convey trust and confidence". This dimension will be affected by:

- Confidentiality: Ability to keep the privacy of the users.

- Empathy: We define this dimension as the "ability of the portal to provide caring and individual attention ". In this dimension, we distinguish the following subdimensions:

- Navigation: The portal must provide a simple and intuitive navigation when using it.

- Presentation: The portal must have a clear and uniform interface.

- Integration: All the components of the portal must be integrated into a coherent form.

- Personalization: The portal must be capable of adapting to the user's priorities.

Furthermore, due to the big amount of data that are handled in a portal and taking into account that it is fundamental that these data are of good quality, we thought it is necessary to add a new dimension:

- Data quality (DQ): This dimension is defined as "quality of the data contained in the portal". According to [3], we can distinguish four subdimensions:

- Intrinsic DQ: What degree of care was taken in the creation and preparation of information?

- Representation DQ: What degree of care was taken in the presentation and organization of information for users?

- Accessibility DQ: What degree of freedom do users have to use data, define and/or refine the manner in which information is inputted, processed or presented to them?

- Contextual DQ: To what degree does the information provided meet the needs of the users?

Once the portal quality model (PQM) was defined, we decided to do a survey of the workers of the portal of Castilla-La Mancha (castillalamancha.es) to obtain their opinion about different dimensions of the portal

4.- THE PORTAL OF CASTILLA-LA MANCHA (CASTILLALAMANCHA.ES).

In this section, we will explain the aim and structure of the portal of Castilla-La Mancha, since we have done a survey of its workers to know which dimensions of the model should be improved and which dimensions are correct. Also, we have proved the reliability of the survey.

The Castilla-La Mancha portal (www.castillalamancha.es) is a corporate portal that is in operation since April, 2002. Its main goal is to generate Internet projects in the region of Castilla-La Mancha and help to achieve their success.

Regarding the portal workers, they can be divided into two profiles according to the tasks they develop:

? Contents Responsible. They manage the contents that are published in the different channels of the castillalamancha.es portal.

? Technical Support. These workers can be divided into two groups:

- Programmers: they must maintain the technological aspects of the portal.

- Designers: they are in charge of the image of the portal.

This portal is aimed at providing, above all, information about Castilla-La Mancha.

We can distinguish several channels within this portal (each of them contains information related to a specific topic):

- Technology channel: it provides information about scientific, technological, energy or astronomical issues among others.

- Sixth province channel: it establishes contact with castellano-manchegos (people from Castilla La Mancha) that, at present, are living outside.

- Enterprise channel: You can find events related to enterprises among other things.

- Employment channel: People can find a new job.

- Agro channel: It contains information related to agriculture.

- Environment channel: it deals with human resources, pollution, waste, animals, vegetation, water, etc.

- Women and elderly channel: It contains interesting issues for these groups of people.

- Children channel: Basic knowledge about the region will be acquired by children.

These channels are focused on Castilla-La Mancha region. Moreover, there are e-commerce, links to others websites, e-learning, and others interesting things.

5.- SURVEY

Questionnaires are, probably, the most commonly used research method according to [16]. By using a questionnaire, we try to obtain the opinion of people about different aspects in order to evaluate each dimension of quality.

The questionnaire consists of forty two questions (see Appendix). The items that compose each dimension (which is equivalent to indicate the dimension which each of the questions asked in the questionnaire corresponds to) are:

- In the Tangible dimension, we classify questions Q26, Q39.

- In the Reliability dimension, we have questions Q11, Q15, Q29, Q41.

- In the Responsiveness dimension, we have questions Q1, Q3, Q4, Q12, Q13, Q14, Q38.

- In the Assurance dimension, we classify questions Q21, Q22, Q23.

- In the Empathy dimension, we have questions Q2, Q5, Q6, Q10, Q16, Q17, Q18, Q19, Q20, Q24, Q25, Q27, Q28, Q32, Q33, Q34, Q35, Q36, Q37, Q40, Q42.

- In the Data Quality dimension, we classify questions Q7, Q8, Q9, Q30, Q31.

Before the workers of the portal answered the questionnaire, it was evaluated by a small group of users in order to verify its understandability. According to the results, some aesthetic modifications were made so as to obtain a better understanding.

5.1 Survey Reliability

It is necessary to prove the reliability of the survey to state that the results obtained by it are useful.

A survey is reliable if it is made several times by the same subjects and the result obtained is always the same.

Several methods to calculate the reliability of a survey have been proposed. These methods try to calculate the reliability coefficient (defined as the correlation among the marks obtained by the subjects in two parallel forms of a test). [12]. We can use different methods to calculate the empirical value of the reliability coefficient. One of these methods is the Split Halves Method which is the method that we have used because it only needs to make the test once.

We tried to guarantee that the two halves that the test is divided into would be parallel. So, we considered that a half of the test was made up of even questions and the other half was made up of odd questions. This is better than considering that the first part of the test is a half and the second part is the other half because subjects are more tired when answering the second part of the test.

The reliability of the survey does not only depend on the characteristics of the survey but subjects that have answered the questionnaire are important as well

We calculate the reliability with the formula proposed by Guttman-Flanagan, the equation is [5]:

$$r_{XX'} = 2 * \left(1 - \frac{s_p^2 + s_i^2}{s_x^2} \right) \quad (1)$$

where:

s_p^2 shows the variance of the marks obtained by the subjects in the even items.

s_i^2 shows the variance of the marks obtained by the subjects in the odd items.

s_x^2 shows the variance of the global marks.

We have applied the above exposed formula to the results obtained by the survey done of the workers of castillalamancha.es and we have obtained that the reliability of the survey is 0.9. Therefore, we can state that our survey is reliable because the reliability coefficient can vary from 0 to 1, where 0 means that there is no reliability and 1 means there is a maximum of reliability.

5.2 Results

Our following step was to analyse the results obtained by the survey.

Due to the different profiles of workers, not all the subjects answered all the questions that were raised. Therefore, the results of each question (table 1) have been obtained depending on the subjects that answered it.

In the next table, the average value for each of dimension is shown.

DIMENSION	AVERAGE VALUE
Tangible	3.5
Reliability	3.03
Responsiveness	3.97
Assurance	2.71
Empathy	3.44
Data Quality	4.11

Table 1. Average value for each dimension.

The dimension with the lowest value is assurance and therefore, it is necessary to improve it by carrying out different tasks that have been proposed to achieve this goal. In general, almost all the dimensions values are around the average. Hence, we have defined several tasks to improve the dimensions that have the lowest values. We can carry out all the tasks and later, make the test again to verify if the quality of the portal has been improved. The dimension that obtains a higher value on average is data quality. As a result, we can conclude that the information provided by the portal turns out to be correct so the portal fulfils its main goal, which is to offer classified information through different channels.

6.- CONCLUSIONS AND FUTURE WORKS

We know that portals have lately risen. Therefore, it is very important to assure its quality. Customers will choose portals that are more appropriate to their needs and objectives

and this fact implies that if a portal is not of a good enough quality, it will disappear.

Our aim has been to define a portal quality model and to do so, we have used GQM method. As our model is in the definition phase, we have only used the two first phases. Moreover, this means that the model presented here must be considered as a first proposal but not as a close and definitive model.

Our model, called PQM, is composed of six dimensions: tangibles, reliability, responsiveness, assurance, empathy and data quality.

We must carry out several future works due to the initial state of our quality model. The validation of the model is our first and main objective and to achieve it, we are going to carry out several empirical validations from surveys of customers, experts, etc. to controlled experiment and study cases. We will make all these works with different kinds of portals in order to have the model completely validated. Once our model has been validated, we will study and classify, on the one hand, existing metrics and on the other, metrics of other environments but applicable to portals. If it is necessary, we will define new metrics, that must be formally and empirically validated, and will be used for the last phases of the GQM method. We are working in the preparation of a questionnaire for users of the portal.

APPENDIX

[1] Strongly disagree	[2] Slightly disagree	[3] Neutral	[4] Slightly agree	[5] Strongly agree

1.- The portal Web address is included in all existing documentation, publicity and advertising channels.
2.- On the portal, callback (that reports about the result of certain service) exists.
3.- The portal uses suitable names and multiple websites with an increasing speed and bandwidth service to maximize its rate.
4.- There exist other portals with links to the portal.
5.- Graphics, sound and video to make the website visually appealing exist on the portal.
6.- The portal offers language or geographic options.
7.- Information contained on the portal is current and timely.
8.- Information contained on the portal is accurate and relevant.
9.- Information contained on the portal is detailed.
10.- Navigation on the portal is intuitive.
11.- Portal is available all the time.
12.- The result of a requested service is returned quickly to the customer independently of the kind of answer: e-mail, specific pages, etc.
13.- The response e-mails are relevant and accurate, and the portal content is appropriate to customer requirements.
14.- Callback or e-mail system tell customer the time of re-

sponse necessary to perform a service.
15.- The achievable service level is stated on the portal.
16.- The tone of messages is polite.
17.- Relevant FAQs (Frequently Asked Questions) help customers to solve problems by themselves.
18.- Various FAQs help different customers.
19.- Online ordering process is simple.
20.- The portal offers options about mode of payment.
21.- Security and privacy are stated on the portal.
22.- E-commerce operations guarantee security.
23.- Techniques are used to guarantee security of transactions.
24.- Web pages and answer to the e-mail are offered individually (It is offered the possibility of personalizing the portal)
25.- Feedback is continuously changing in response to customers.
26.- E-mail system is both inbound and outbound to deal with customer complaints.
27.- Customers might be reminded electronically to repurchase and be invited to special offers (the registered customers are sent information related to issues that are interesting for them).
28.- E-mails and questionnaires are used to perform surveys to find out the degree of satisfaction of the customers with the portal.
29.- Several channels are available all the time.
30.- The amount of data that are offered on the portal is appropriate.
31.- Portal is objective and current.
32.- The portal design is solid and uniform.
33.- The portal framework is easily understandable.
34.- The visual appearance of the portal is carefully worked.
35.- The portal offers the possibility of personalizing the interface.
36.- The portal offers an appropriate accessibility.
37.- All clicks of the portal are necessary.
38.- The designs allow that the unload time will be minimum and relaxing.
39.- Elements do not need equipment of high hardware capacity.
40.- The portal maintains the same structure to the customer
41.- Different ways lead to the same site.
42.- The design of the portal offers minimum distractions.

ACKNOWLEDGEMENT

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