

INFORMATION SYSTEMS QUALITY MEASUREMENT

Luc Rochette

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ABSTRACT

Information System Quality Measurement

Luc Rochette

For many years, a great deal of the research endeavor in the area of information systems (IS) has been devoted to the evaluation of their quality. Because of the difficulty of identifying the components of IS quality, researchers have resorted to surrogate measures that look at specific aspects of IS quality or rely on only one of the stakeholders. Drawing on a socio-technical quality evaluation instrument developed to assess the quality of expert systems, an instrument for the assessment of the quality of more general IS is developed and tested with IS managers, developers, and end-users in Canadian organizations. This study shows that IS quality evaluation can only be performed if both social and technical aspects of IS are considered simultaneously, in a global fashion. This study did not show, however, if IS quality evaluation is best performed when all stakeholders participate in the evaluation process.

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INTRODUCTION

For many years, a great deal of the research endeavor in the area of information systems (IS) has been devoted to the evaluation of their quality (Bailey and Pearson, 1983, Conrath and Sharma, 1992, King and Epstein, 1983, Ravichandran and Rai, 1994, Srinivasan, 1985). Quality, without a valid measurement instrument, remains a word devoid of meaning. Although the absence of quality can be assessed quite easily, the same cannot be said of the assessment of quality, especially in the area of IS. How much quality is present in the product or in the service that has just been purchased is a question for which there is no direct answer. The evaluator must rely on a measurement instrument to assess the degree of quality that is in fact present. Not all measurement instruments, however, are suitable for all circumstances; the measurement of quality must be tailored to the area of interest. The quality criteria used to evaluate the quality of a surgical intervention are surely not the same as those used to evaluate the quality of a chocolate cake.

Because of the difficulty of identifying the components of IS quality, researchers have resorted to surrogate measures such as user satisfaction (Bailey and Pearson, 1983, Doll and Torkzadeh, 1988; Ives et al., 1983, Raymond, 1987), IS effectiveness (Dickson et al., 1986, Hamilton and Chervany, 1981, Hamilton and Chervany, 1981a, Srinivasan, 1985), or IS usage (Baroudi et al., 1986, Srinivasan, 1985). Most of the surrogates used to evaluate IS quality look at specific aspects of IS. This does not account for the

multidimensional nature of IS, which comprise many components, that can be classified as technical components (components which relate to the processes, tasks, and technology needed to transform inputs into outputs) and social components (components which relate to the attributes of people, the relationships between people, reward systems, authority structures, evaluation of the results of the operations of the organization) (Bostrom and Heinen, 1977)

In their two-article series, Bostrom and Heinen (1977, 1977a) analyzed the reasons behind IS failures. They identified seven conditions as the major causes of the inappropriate design and change strategies. In short, these seven conditions point to "two solitudes". On one side, there is the IS development team, with its limited view of the organization and of the possible change strategies. The main focus of the members of the development team is on the technical sub-system and development process and tools. Still on the development side, there are IS managers who are interested in meeting deadlines and achieving performance objectives. On the other side, there are users, who are interested in their involvement in the development of the IS but not in the development process and tools.

The instrument used to measure IS quality should consider that the technical and social components of the IS interventions do not evolve independently but rather tend to influence one another in a dynamic fashion. In reference to this dynamic interdependence of the social and technical sub-systems, Davis et al. (1992) suggested that the technical

and social components of IS be evaluated together, using the same measurement instrument. Also, this instrument should reconcile the views of IS people (programmers, analysts, designers, IS managers) with those of users by taking into account the concerns of all stakeholders (Hamilton and Chervany, 1981, Rowe and Neal, 1993). A recent research has led to the development of a quality measurement instrument based on the socio-technical systems design concept (Conrath and Sharma, 1992, Sharma et al., 1991). This instrument has been primarily developed and validated for the assessment of the quality of expert systems (Conrath and Sharma, 1992).

The purpose of this research will be to explore the quality measurement of IS. We will first look at the components of such an instrument, and secondly, try to identify the groups of people to whom the IS quality measurement instrument should be administered.

IS QUALITY MEASUREMENT

The evaluation of IS quality has been the main focus of many researchers over the years (Bailey and Pearson, 1983; Conrath and Sharma, 1992; King and Epstein, 1983; Ravichandran and Rai, 1994; Srinivasan, 1985). However, most existing models such as user satisfaction (Bailey and Pearson, 1983; Galletta and Lederer, 1989; Gatian, 1994; Ives, Olson and Baroudi, 1983; Ives and Olson, 1984; Melone, 1990; Raymond, 1985; Srinivasan, 1985) or IS effectiveness (Dickson et al., 1986; Hamilton and Chervany, 1981; Hamilton and Chervany, 1981a; Srinivasan, 1985) focus on IS success. Furthermore, these models propose measurements that belong to six categories: System Quality, Information Quality, Use, User Satisfaction, Individual Impact, and Organizational Impact, as pointed out by Delone and McLean (1992).

The successfulness of the development of evaluation instruments has been hampered by two factors: first, the search for a single index to evaluate the quality of IS; and second, the use of performance-oriented measures at the expense of effectiveness-oriented measures.

The objective of many studies so far has been to find a single index that would measure the success, or effectiveness, of an IS. The case of user satisfaction as a surrogate of IS success is typical of this situation (Bailey and Pearson, 1983; Galletta and Lederer, 1989; Gatian, 1994; Ives, Olson and Baroudi, 1983; Ives and Olson, 1984; Melone, 1990; Raymond, 1985; Srinivasan, 1985). However, the idea that the user satisfaction construct may constitute a surrogate measure for IS success has been challenged on the grounds that it lacked both a conceptual and a theoretical framework (Galletta and Lederer, 1989; Klenke, 1992). Also, as pointed out by Hamilton and Chervany (1981a), user perceptions constitute only one dimension among the multiple dimensions of an IS. Much in the

same vein, Delone and McLean (1992) concluded that there is not one single measure of IS success, but that the IS success construct would be better measured using a composite instrument. The use of a single index, such as user satisfaction, for example, puts the burden of system evaluation on only one of the stakeholders, thus ignoring the other stakeholders in an IS. The recognition of an IS success model in lieu of an index of IS success is clearly a step in the right direction, since it allows IS evaluation by all stakeholders (Conrath and Sharma, 1992).

Existing measures of IS success actually measure the relative performance of an IS, as it is perceived by one of the stakeholders (users, or managers, or developers). Since actual measurements of IS success focus on the technical part of the system and of the organization, the technical components of the IS will often be blamed for any failure. In addition, these instruments tend to rely on efficiency-oriented and easily quantified objectives and measures while effectiveness-oriented and qualitative objectives and measures are ignored (Hamilton and Chervany, 1981). Much in the same line of thought other characteristics may contribute to IS failure: quality of user training (Kleinman et al., 1994), quality of the approach taken to introduce organizational changes due to the implementation of the new IS (Bostrom and Heinen, 1977, 1977a, DeSanctis and Courtney, 1983; Lason, 1988; Keen, 1981; Robey, 1987; Zmud and Cox, 1979), evolution of user behavior during the implementation of a new system (Hiltz and Turoff, 1981); implicit or explicit assumptions held by developers (Bostrom and Heinen, 1977; Davis et al., 1992; Hirschheim and Klein, 1989), improper professional standards (Oz, 1994); or political interests at stake in the implementation of the new IS (Markus, 1983) are good examples of such contributing characteristics.

The concept of socio-technical systems design may provide a means to develop a more integrated measure of IS quality that takes into account the multidimensionality of IS and

of the viewpoints over them. This measure would use a blend of efficiency-oriented, performance-based and of effectiveness-oriented objectives and measures. The socio-technical concept establishes the framework for the evaluation of IS as well as providing IS designers and IS managers with guidelines for the design and development of IS.

The concept of socio technical systems design began to take form in post-war Great Britain when researchers from the Tavistock Institute observed that, in response to the introduction of a new technology for coal extraction, teams of workers organized spontaneously in semi-autonomous groups. Until that moment, it was believed that technology was deterministic in the sense that it would lead to the definition of the organizational context. Van Eijnatten (1993) reviews the origins and the evolution of socio-technical systems theory and concepts and provides an extensive bibliography.

According to the socio-technical theory of systems design, organizations are open systems that interact with their environment and that are made up of a social sub-system and of a technical sub-system. These two sub-systems are mutually dependent since they need each other in order to fulfill the production function of the organization (Emery, 1959). The social sub-system is concerned with matters such as attributes of people, relationships between people, reward systems, and authority structures. On the other hand, the technical sub-system is concerned with matters such as processes, tasks, and technology needed to transform the inputs into outputs (Bostrom and Heinen, 1977; 1977a). The main objective of socio-technical theory is the joint optimization of the social and technical sub-systems of the organization (Emery, 1959). In the socio-technical point of view, optimizing the technical sub-system at the expense of the social sub-system will result in sub-optimization of the system as a whole. Similarly, optimizing the social sub-system at the expense of the technical sub-system will also result in sub-optimization (Emery, 1959). Any IS intervention must therefore deal with

both the social and the technical sub-systems in an integrated form (Bostrom and Heinen, 1977a). Or, as Davis et al. put it,

" the technical system is typically an intervention introduced into an already existing social system " (Davis et al., 1992, p 306)

IS designers are expected to achieve the same joint optimization objective as other socio-technical systems designers. Emphasis on a technical design apart from the organizational design may result in a technically sound system that does not correspond to what its users expected. Similarly, when organizational design is considered apart from technical design, the resulting situation may be one in which new jobs, procedures, and policies do not consider the constraints and opportunities of the tools that are necessary to achieve the objectives (Eason, 1988; Mumford, 1987)

Information technology, like any other technology, is not deterministic in nature but rather involves a higher degree of technical and economical uncertainty. Whether an application succeeds or fails depends on the decisions that are made on how it shall be used (Bostrom and Heinen, 1977a). Hence, a change in the technical sub-system of the organization will not automatically lead to a specific, pre-determined, set of organizational changes. Organizations have options open to them in response to the introduction of new technologies; these options are not of equal quality, though some options will prove more appropriate than others in response to technical changes (Eason, 1988).

To consider IS as socio-technical systems imposes the need to consider them in a global fashion: their technical design and their fit with the organization (Lyytinen, 1987) Evaluation of an IS quality should therefore follow the same socio-technical path; the

evaluation not only takes into account the social and technical aspects but their interdependence as well. The reason behind this may be that an IS, once viewed in its entirety, is more than the sum of its parts (Rowe and Neal, 1993). It becomes clear that a definition of IS quality should therefore take into account the view of all stakeholders with respect to quality as well as it should consider all related variables in an integrated, rather than additive, fashion.

The measurement of IS success as a surrogate for the measurement of IS performance, or effectiveness, posits that performance, quality, and success are synonymous. However, it seems that it is not always the case (Eilon, 1993). Because of the current definition of success (or lack thereof), at least in the area of IS, we cannot conclude that quality and performance are synonymous. Although the most appropriate development methods and tools may have been used, the system may still perform poorly once implemented; similarly, a system may exhibit great performance even though it has been developed with less adequate development methods and tools.

Because current measurement models are not integrated, we cannot hope to use them to evaluate IS quality. In this research, we propose a new model that achieves the integration of most of the factors that are believed to measure the IS quality. This model is inspired by the work of Conrath and Sharma (1992) on the evaluation of the quality of expert systems.

A SOCIO-TECHNICAL QUALITY MODEL

As pointed out earlier, IS are socio-technical systems. A model designed to evaluate the quality of the IS would be expected to comply with that fundamental characteristic of IS, it should encompass both the social and the technical aspects, as well as their interdependence, as they are perceived by the different groups of stakerholders.

A Quality Model

The socio-technical quality model proposed by Conrath and Sharma (Conrath and Sharma, 1992; Sharma et al., 1991) is based on the relationships between the various dimensions that will affect the quality of an expert system. In this model, the quality of an expert system is affected by relationships between the nature of the task, the technology that is applied, support from people, and other organizational factors. The authors symbolically represented the model in the following manner (Conrath and Sharma, 1992):

$$\text{Quality}(i) = f(\text{task}^i, \text{technology}^i, \text{people}^i, \text{organization}^i),$$

as perceived by $i = \text{users, managers, developers.}$

What is clear from this model is that quality evaluation is the responsibility of most stakeholders, as shown by the superscript i in the symbolical representation. The two fundamental postulates behind the socio-technical quality model are, first, that quality is determined by features and characteristics that span categories of task, technology, people, and organization; and, second, that assessments of users, developers, and managers differ as a result of their heterogeneous perspectives (Conrath and Sharma, 1992). So, keeping the superscript i fixed, quality, in this model, is then the sum of

perceptions of groups of stakeholders. This argument is supported by Hamilton and Chervany (1981; 1981a) and other researchers (Bostrom and Heinen, 1977; 1977a).

This quality model is multifaceted and is spread over 39 dimensions covering technical aspects (task and technology) as well as social aspects (people and organizational factors) of IS design. The dimensions were identified by Conrath and Sharma (1992), a more complete description of the dimensions can be found in Sharma et al. (1991). The quality model is presented in a diagrammatic fashion in Figure 1. The type of diagram used for the representation of Figure 1 is either called an Ishikawa, or fish-bone, or a cause and effect diagram. The purpose of this TQM tool is to highlight how various causes contribute to a problem and the relationships between causes. In the case of this quality model, the problem usually listed at the end of the horizontal line is replaced by the main objective, that is, the quality of the system. Each of the branches pointing to the main stem represents a possible cause. Branches pointing to causes are contributors to these causes.

Conrath and Sharma (1992) report that the dimensions making up the model were extracted from an extensive literature review. This extraction from the literature yielded 70 dimensions. In a first step, this list of dimensions was distributed to a panel of twenty researchers and practitioners for comments. As a result, the number of dimensions has been reduced to the actual number of 39 through item dropping and item combination.

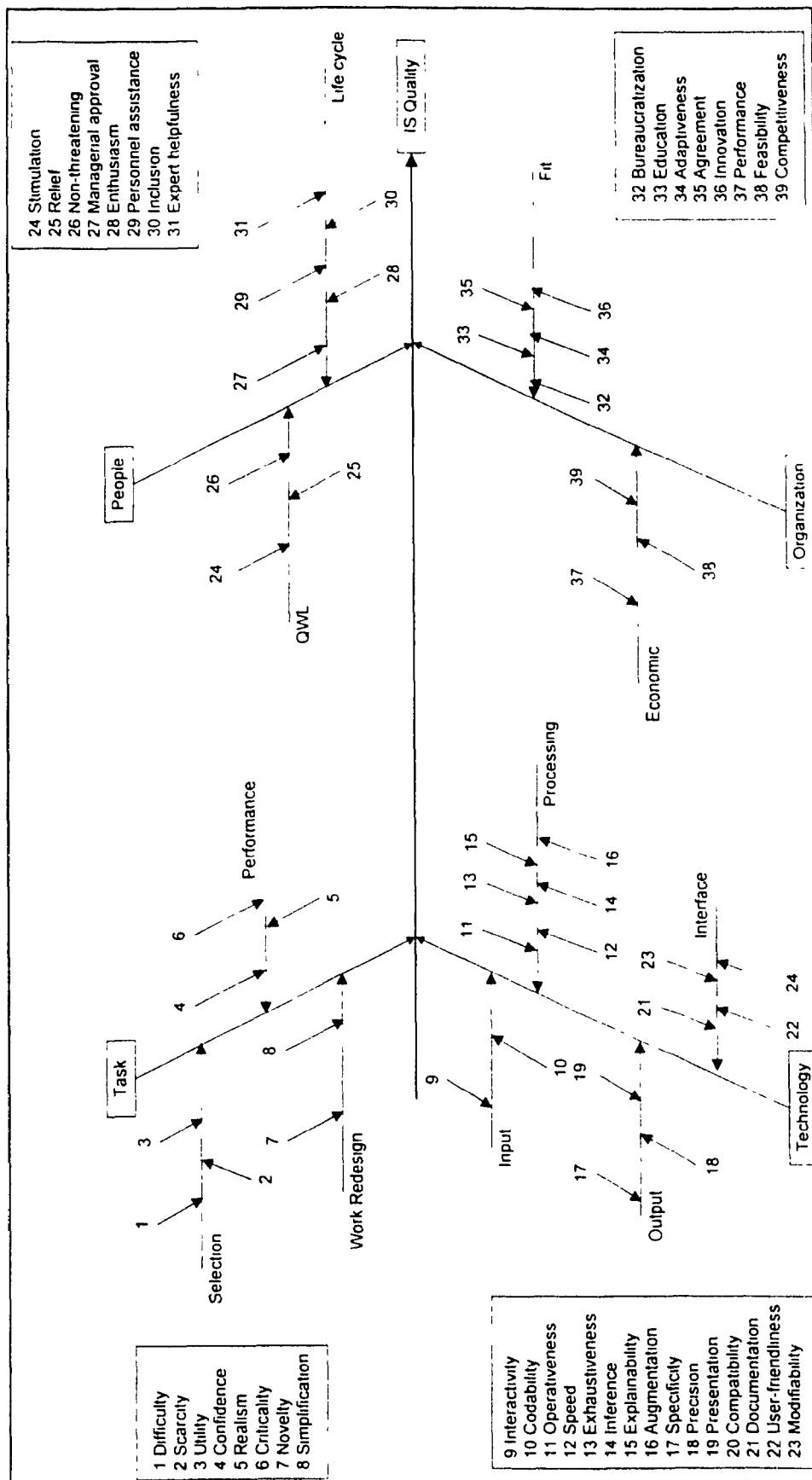


Figure 1 - Socio-technical Quality Model for Expert Systems (Conrath and Sharma, 1992)

GENERALIZATION OF THE QUALITY MODEL PROPOSED BY CONRATH AND SHARMA

The socio-technical quality model proposed by Conrath and Sharma (1992) is intended for the evaluation of the quality of expert systems. In our quest for a method to evaluate IS quality in general, and from a socio-technical perspective, this model is a step in the right direction. However, the quality model proposed by Conrath and Sharma is not aimed at the evaluation of more general IS, which is the modus operandi of this research project. The original model was thus examined for the identification of items that pertained specifically to expert systems, items that could be altered to suit more traditional IS, or items that could be added to help contribute at the generalization of the model. The literature review conducted, which is part of an effort of that type, covered topics such as the measurement of IS success, user satisfaction, IS effectiveness, and software quality measurement.

As was discussed by Conrath and Sharma (1992) for expert systems, quality is the result of the joint optimization of features and characteristics spanning the categories of task, technology, people, and organization, as assessed by all stakeholder groups: users, developers, and managers, each with their own perspective.

According to the socio-technical theory of systems design, the social and the technical sub-systems are interdependent. Any intervention conducted into an organization should thus consider both the social and the technical sub-systems simultaneously (Bostrom and Heinen, 1977, Davis et al., 1992). Similarly, an instrument designed to measure IS

quality would be defined in the same manner. One would then expect to observe the presence of these factors (task, technology, people, and organization) if one were to survey IS managers, IS developers, and end users about the quality of IS

IS professionals (IS managers and developers) and users (primary and secondary users) do not share the same view of IS quality. When users and IS professionals are questioned about their perceptions, it appears that these differ (Hamilton and Chervany, 1981a). While IS managers are interested by the development process and developers are concerned with IS performance, users, on the other hand, tend to pay a greater attention to their involvement in IS development (Hamilton and Chervany, 1981a; Rivard, 1995).

Like Conrath and Sharma (1992), we hypothesize that perceptions of users and IS professionals will differ. We will therefore compare users' perceptions to those of IS professionals in search of any difference.

Research is an evolutionary process: theories are first built and verified, and, like the case of the measurement of IS quality, instruments are built according to the theory. By attempting to confirm the socio-technical IS quality model, our research fits in this evolutionary process as a necessary step toward the development of an instrument for the measurement of IS quality based on the socio-technical theory of systems design.

METHODOLOGY

An extensive literature review was conducted to identify items that could be included in the measurement instrument. Factors identified by Conrath and Sharma (1992) and Sharma et al. (1991) were used for the categorization of the dimensions that were included in the instrument. Only dimensions for which support could be found in the IS literature were retained for inclusion in the instrument. The list of dimensions included up to 83 dimensions grouped under 4 factors¹ before its revision. This grouping was originally defined by Conrath and Sharma (1992). The list was then reviewed, in 4 successive revision sessions, by a senior IS researcher and the author for redundancies and possible omissions. This revision exercise yielded a list of 58 dimensions, which correspond to the 58 items found in the questionnaire. Appendix A gives a definition of the factors that are believed to contribute to the attainment of IS quality, and of the dimensions that constitute those factors along with references for all dimensions included in the model.

Sampling

Two sampling strategies were devised for questionnaire distribution to respondents. The first strategy, which will be briefly described in short while, presented a major flaw and was modified in favor of a sampling strategy that had the potential to improve external validity as well as the response rate. In both sampling strategies, though, respondents are selected among the members of the three stakeholder groups, namely IS users, managers,

¹In this paper, we use the following meaning for the terms "dimensions" and "factors". Dimensions are items included in the questionnaire that was sent to respondents. In this sense, dimensions are the individual variables of the model whereas factors represent a grouping of dimensions of similar nature.

and developers from organizations across Canada. The major difference between the two sampling strategies lies with the selection of IS users and developers for inclusion in the sample.

In the first sampling strategy, a certain number of copies of the questionnaire would have been mailed to IS managers selected from the list of members of the Canadian Information Processing Society (CIPS). For inclusion in the manager sub-group, participants had to be identified as managers (project managers, IS managers, systems development managers, etc...) and be employed by an organization located in Canada. Managers would have been asked to keep one copy of the questionnaire for themselves and to distribute the rest of the questionnaires to IS users and developers in their organizations and ask them to complete the questionnaire. As was pointed out by a senior IS researcher, this strategy presented a serious threat to external validity in that, although we knew about the manager sub-group, it was impossible to know the characteristics of the two other sub-groups. Ignorance about the characteristics of the other two sub-groups tends to forbid generalization of the findings of this study to the population in general. Asking IS managers to execute an action that is in addition to responding to the questionnaire exposed us to a potentially lower rate of response, thus posing another threat to the generalization potential of the results.

A second sampling strategy was designed to address the problems present in the first sampling strategy. The CIPS members list was browsed a second time in order to identify and extract IS developers. For inclusion in the IS developers sub-group, participants had to be identified as such (designers, analysts, systems architects, programmers, etc...) in the list and be employed by an organization located in Canada. The IS managers sub-group was then randomly split in two smaller sub-groups. Members of the first sub-group were called and asked if they would be interested in providing us with users' names, no

questionnaires were sent to members of this group. Members of the second sub-group of IS managers were sent the questionnaire

The selection of IS managers from the list of CIPS members resulted in 979 names. Of this total, 450 were randomly selected for the mailing of the survey. The remaining 529 IS managers were called and asked to provide us with users' names, this resulted in 253 users' names. Other managers either refused to provide us with names or could not be reached. IS developers selection resulted in 720 names of which 450 were randomly chosen for questionnaire expedition. A grand total of 1153 questionnaires were mailed to respondents

Questionnaire distribution

One of the disadvantages of mailed questionnaires is the low response rate, which is generally under 50 percent and diminishes as the number of questions increases (Judd et al., 1991). Because of the length of the questionnaire used in the study (58 questions, plus 6 demographics questions, and 4 general impression questions), we planned for a conservative response rate of 15 percent.

Respondents were told, in the cover letter mailed along with the questionnaire, that completing the questionnaire takes about 30 minutes of their time and were thanked for their participation in the study. As an incentive for their participation in the study, respondents were promised an executive summary of the results of the study if their business card was enclosed with the completed questionnaire. An example of the cover letter is presented in Appendix B

Questionnaire

The questionnaire used for this project was divided into three parts. In the first part, respondents were asked to answer demographic questions designed to categorize respondents according to their position in the organization for which they work, the type of IS used, and the type of the organization; respondents were also asked to identify the IS they use the most in their work. In the second part of the questionnaire respondents were asked to rate the IS identified in the first part of the questionnaire against each of the 58 socio-technical dimensions using a 5 point Likert scale ranging from *Strongly Agree* to *Strongly Disagree*. In the third and last part of the questionnaire, respondents were asked for their overall impressions about the IS. An example of the questionnaire, in its French and English versions, is presented in Appendix C. Questions were later coded for data entry. The coding scheme for the first and last section was as follows: all options were given a value ranging from 1 to 5, 6, or 7 depending on the number of choices available, missing values were identified with the value 9. Questions of the second part of the questionnaire were given values ranging from 1 to 5, thus following the scale, missing values were again identified with the value 9.

RESULTS

Descriptive statistics

	Questionnaires sent	Questionnaires received	Hits	Proportion of sample
IS users	253	34	13%	23%
IS managers	450	63	14%	42%
IS developers	450	52	12%	34%
No group identified	---	2	---	1%
Total	1153	151	13%	100%

Table 1 Response rates

Out of the 1153 questionnaires mailed, a total of 151 questionnaires were returned in time for inclusion in the study, this gives a total response rate of 13%. Table 1 shows the response rate of each sub-group of respondents. IS developers, had the lowest response rate of all sub-groups, with a response rate of 12%. The Canadian Postal Service returned fifteen questionnaires due to incorrect or invalid addresses. Three questionnaires were returned due to personnel movements. A total of 18 questionnaires were thus returned for various reasons. Finally, four questionnaires were excluded from the study; in one of the questionnaires, the respondent persistently gave two responses to each answer, two questionnaires were returned that did not belong to this study, and one questionnaire was returned unanswered.

The total rate of response, which is 13% is below our conservative estimates, which, in retrospect, appear to have been rather optimistic. Two factors may have played against the response rate. First, the length of the questionnaire surely played a major role, a

bigger part than expected at design time. It is well known that questionnaire-based surveys yield response rates that are usually under 50% (Judd et al., 1991) and that this rate of response diminishes as the number of questions increases. With a total of 68 questions, the questionnaire used for this study must have appeared too long for most of the respondents. As it turned out, the deadline may have appeared too short for some respondents. Questionnaires were mailed to respondents on April 6, 1995 and a response was asked for April 22. Some respondents mentioned that they had received the questionnaire after the date set for inclusion in the study. Although we cannot extrapolate and generalize these cases to all those who did not respond, we may nevertheless suspect a negative effect coming from that side. Caution will therefore have to be exercised on conclusions based on these data. Because the questionnaires were not coded, it is not possible for us to identify the respondents who did not respond to the questionnaire. Since 87% of the sample did not respond, it is impossible to draw a profile of the typical non-respondent, nor is it possible to do the same for the typical respondent.

Table 1 also shows the composition of the sample. End users accounted for 23% of the total sample used in the study, IS managers, for 42% of the total sample, and IS developers for 34% of the total sample. Two questionnaires were returned with no indication about the role of the respondent with regard to IS in his or her organization.

Type of Organization	Number of Organizations	Percentage
Government	44	29%
Service	26	17%
Manufacturing	26	17%
Education	8	5%
Other	46	30%
Sub-total	150	99%
Missing values	1	1%
Total	151	100%

Table 2 Types of organizations

Respondents included in the study came from all sorts of organizations, as is shown in Table 2. Government organizations accounted for 29% of the respondents; service organizations, for 17%; manufacturing organizations, for 17% of the respondents while education organizations represented 5% of the respondents. Finally, 46 of the respondents reported working in organizations that did not belong to any of these categories, for a proportion of 30% of the respondents.

Type of IS	Number of IS	Percentage
Transaction processing system	93	40%
Information reporting system	69	30%
Decision support system	36	16%
Executive IS	14	6%
Expert system	7	3%
Other	12	5%
Total	231	100%

Table 3 Types of IS

Respondents had the choice among 5 types of IS, as is shown in Table 3. The questionnaire made it possible for respondents to pick more than one type of IS. This is

why the number of IS included in the study does not add up to the 151 responses reported. Transaction processing systems, represented 40% of the sample; information reporting systems, 30% of the sample; decision support systems, 16% of the sample; expert systems, 3% of the sample, finally, executive IS represented 6% of the sample.

Business Functions	Number of IS	Percentage
Finance and Accounting	63	28%
Sales and Marketing	34	15%
Production	31	14%
Purchasing	19	8%
Human Resources	21	9%
Other	57	25%
Total	225	100%

Table 4 Business functions covered by IS

IS included in the study covered a wide variety of business functions, as shown in Table 4. The categorization of the business functions was borrowed from the field of organizational theory and design and the respondents had the choice among the functions that are best known and easily recognizable by respondents. Finance and accounting systems account for the majority of the sample with 28% of the observations. Other business functions covered by the IS included in the study are sales and marketing IS, with 15% of the sample; production IS, with 14% of the sample; human resources systems, with 9% of the sample; and purchasing systems, with 8% of the systems included in the study. 25% of the systems in the study were indicated as belonging to other business functions in organizations. Here again, the reader will notice that the total number of observations is higher than the total number of questionnaires returned. As

was the case for the different types of IS this difference is due to the fact that IS often are not limited to one business function. Management requirement planning systems (MRP II), for instance, are usually implemented and used in many business functions of an organization: production, procurement, accounting, sales, order processing, etc.

Factor Identification

Factor analysis was chosen as the means to identify the factors that make up the IS quality measurement instrument. Factors were extracted using unweighted least squares (ULS) as the extraction method. ULS tends to provide a better factor solution when the sample is small, which was our case. In a typical factor analysis, items load on all factors with more or less weight on each factor. Factor solutions produced by the factor extraction are not easily interpretable in their original form. Rotation of the factor matrix eases interpretation by giving, for each item, a high loading on a single factor and small to moderate loadings on the others. This factor structure is simpler and, therefore easier to interpret. Non orthogonal rotations have the advantage of maximizing the difference between the highest and the smallest loadings of the variables, which facilitates interpretation of factors. Oblimin, which is a non orthogonal rotation method, was used to rotate the factor matrix. Finally, the reliability of the instrument was assessed using Cronbach's alpha, which is provided using SPSS Reliability program.

As mentioned earlier, the sample size (151 observations) is quite small and prevented performing a single factor analysis to assess the socio-technical nature of the measurement instrument. Two separate factor analyses were thus performed, one analysis for the technical items of the questionnaire to observe the constitution of the technical sub-system part of the measurement instrument; one analysis was also performed for the social items of the questionnaire to observe the constitution of the social sub-system part of the measurement instrument.

The small sample size raises another problem as far as factor analysis is concerned. The ratio of observations (151) to variables (58) is 2.6:1, which is much lower than the recommended 5:1 ratio. Although performing separate factor analyses alleviates the problem in part, the reader should be aware that this study is tentative and that generalization of the results should therefore be made with caution.

Item	Description
7	Realism
18	Completeness
19	Testability
21	Response time
24	Security
25	Predictability
35	Documentation

Table 5 Items eliminated from further analysis

Table 5 lists the items that were eliminated from further analysis. When the variables listed in Table 5 were included in the factor analysis, it was impossible to rotate the factor matrix. SPSS could not find a rotated solution.

Item	Description
02	Scarcity
05	Structure
28	Precision

Table 6 Items eliminated after reliability optimization

Of the several extractions performed for technical items, the seven-factor solution seemed the most appropriate and the one that could be interpreted the most easily. Table 7 shows the rotated factor matrix for the seven-factor solution. Altogether, the seven technical

factors explain a cumulative 50% of the variability. Of the seven factors extracted, however, only four may be considered as real factors. The three remaining factors ("Processor", "Task Performance", and "Work Redesign") may not represent factors, as indicated by their eigenvalues lower than 1. Any interpretation based on these factors must therefore be done with caution. Analysis of the reproduced correlation matrix showed that 13% of the residuals were over .05, which is an indication that the seven-factor solution is a good fit for the data.

The bottom line of Table 7 shows optimized alpha coefficients which are obtained through the reliability program of SPSS. Alpha coefficients are an indication of the reliability of the instrument; they are optimized by dropping the items for which there is an indication that the overall reliability of the factor could be improved if these items were indeed dropped. This operation resulted in three more item eliminations, as shown in Table 6. Optimization of the reliability coefficients is an activity for which a balance has to be reached between reliability of the instrument and the breadth of the construct. Variables were dropped from the analysis if dropping them increased the alpha coefficient by .10.

		Interface	Content	Task Selection	Software Quality
QS36	User friendliness	0.82	0 01	0 04	-0 01
QS38	Ease of use	0.75	-0 10	-0 06	0 01
QS39	Control	0.64	0 06	-0 08	0 14
QS37	Ease of learning	0.63	-0 09	-0 09	-0 06
LQS33	Presentation	0.64	0 18	-0 14	0 28
QS12	Interactivity	0.40	0 08	-0 10	-0 10
LQS29	Currency	-0 08	0.86	0 06	-0 06
LQS27	Accuracy	0 11	0.72	-0 01	0 18
LQS30	Timeliness	-0 14	0.63	-0 05	0 14
LQS32	Understandability	0 35	0.46	-0 08	0 04
LQS26	Specificity	0 02	0.44	0 02	0 21
LQS01	Difficulty	-0 04	-0 15	0.68	0 01
LQS03	Utility	-0 01	0 08	0.65	0 05
LQS04	Interdependence	-0 08	0 04	0.52	-0 04
LQS34	Compatibility	-0 07	0 16	0 04	0.63
QS22	Functionality	0 06	0 02	0 37	0.39
LQS31	Conciseness	0 33	0 27	-0 10	0.39
QS15	Maintainability	0 17	-0 05	0 06	0.26
Eigenvalues		7 38	2 28	1 75	1 08
Pct of var.		25 50	7 90	6 00	3 70
Cumulative pct of var.		25 50	33 40	39 40	43 10
Alpha coefficient		0 86	0 81	0 64	0 58 ²

Table 7 Rotated factor matrix (technical items)³

²The low Alpha coefficient observed for "Software Quality" may be an indication that the construct has a broader definition than the one provided in the instrument.

³When a variable loads on more than one factor, as is the case with the "Confidence" variable, the highest loading is chosen. In the case of "Confidence", "Task Performance" (-.34) was chosen in preference to "Content" (.31) or "Task Selection" (.30).

The first technical factor was interpreted as "Interface" and is measured by the degree to which the system's dialogue with the end user is clear and concise (Interactivity); the extent to which the layout of the output is appropriate (Presentation); the degree to which the IS is not frustrating and is enjoyable to use (User Friendliness); the ease with which users can make use of the IS (Ease of Learning); the extent to which the IS is easy to use and not cumbersome (Ease of Use); and the feeling of control held by users while interacting with the IS (Control). Although the variable known as Efficiency did load on this factor, as shown in Table 7, it was decided to take it out, since it does not belong to the "Interface" construct.

The second technical factor, "Content", is explained by the level of content relevance and completeness of the information produced by the IS (Specificity); the degree of correctness of the output information (Accuracy); the extent to which the information is up to date (Currency); the extent to which the output information is available in a time suitable for its use (Timeliness); and the degree of comprehension that an end user possesses about the purpose of the IS (Understandability).

The third technical factor, "Task Selection", is measured by the extent to which the task is complex and knowledge-intensive (Difficulty); the significance of the task in terms of its consequences and the frequency with which the task is undertaken (Utility); and the level to which the task is intertwined with other tasks in the organization (Interdependence)

The fourth technical factor, "Software Quality", is explained by the extent to which the IS facilitates updating to satisfy new requirements (Maintainability); the level of richness and thoroughness of the functions supported by the IS (Functionality); the degree to which the output is free of undesirable or unnecessary information (Conciseness); and the degree to which the system is compatible with other existing systems and technology within the organization (Compatibility).

Variables also grouped under other constructs that may not represent factors. These groupings were not reported in Table 7 due to their lower than one eigenvalues.

The fifth technical factor, "Processor", is measured by the extent to which the set of vocabulary, syntax, and grammatical rules to interact with the IS are powerful and flexible (Language); the degree to which the IS can be tailored to users' own style of interaction (Flexibility); and the extent to which the IS can be operated easily and well on configurations other than its current one (Portability). "Processor" may not represent a factor, as indicated by its eigenvalue.

The sixth technical factor is named "Task Performance" and is measured by the level of consistency, reliability, and dependability of task performance as a result of utilizing the IS (Confidence); the extent to which the IS can perform its intended functions satisfactorily (Reliability); the extent to which the IS can be accessed and the selective use of its components is facilitated (Availability); and the extent to which the IS can function

within the amount of available resources and without waste of resources (Resource Utilization). "Task Performance" may not represent a factor, as indicated by its eigenvalue.

The seventh and last technical factor, "Work Redesign", is measured by the degree to which the user is protected or shielded from miscarrying the task (Criticality); the extent to which new ideas or methods are possible with the use of the IS (Novelty); and the level of reduction in the complexity of the task due to the use of the IS (Simplification). "Work Redesign" may not represent a factor as indicated by its eigenvalue.

With reliability coefficients of .86 and .81, the reliability of the first two factors ("Interface" and "Content") indicate that measurement of these construct are relatively free of contamination from other systematically varying constructs. Reliability coefficients of the other factors indicate, however, that the constructs may have a broader definition than the one measured by the instrument used in this research. Constructs that are broadly defined, as in the case of "Task Selection" (.64), "Software Quality" (.58), Processor (.51), "Task Performance" (.59), and "Work Redesign", (.47), require that many dimensions be measured. The number of dimensions required may sometimes be more than someone could handle. In these cases, it is preferable to have a measure that is less reliable, with a reliability coefficient under the .70 mark (Nunnally, 1978) but easier to work with and to understand.

Item	Description
48	Inclusion
55	Innovation

Table 8 Items eliminated from further analysis

As shown in Table 8, two items, Inclusion and Innovation, have been eliminated from further analysis. Their elimination is due to the technical impossibility for SPSS to find a proper solution for the rotated factor matrix. A total of seventeen variables are used to assess the quality of IS considered from a social perspective.

		Life-Cycle Considerations	Fit with user's tasks
QS43	Conformity	0.07	-0.81
QS51	Bureaucratization	0.08	-0.55
QS57	Feasibility	0.11	-0.53
QS42	Benignity	-0.04	-0.50
QS44	Certainty	0.05	-0.42
QS56	Economic Performance	0.26	-0.38
QS46	Enthusiasm	0.86	0.08
QS45	Managerial Support	0.69	-0.15
QS49	User Commitment	0.55	0.05
QS47	Personnel Assistance	0.39	-0.07
QS50	IS Understanding	0.35	-0.12
Eigenvalues		4.60	1.01
Pct of var		27.00	6.00
Cum pct of var		27.00	33.00
Alpha Coefficients		0.73	0.77

Table 9 Rotated factor matrix (social factors)

Of the several extractions attempted using the data from the social items of the questionnaire, the four-factor solution appeared to be the easiest to interpret. The rotated factor matrix for social variables is shown in Table 9. The highest loading of each of the variables is shown in the shaded cells of the rotated factor matrix. The cumulative percentage of total variance explained by the four factors is 42.40%. Of the four factors, only two ("Life-cycle Considerations" and "Fit with User's Task") exhibit eigenvalues greater than 1. The other two factors ("Quality of Working Life" and "Organizational Fit") exhibit eigenvalues lower than 1, meaning that they may not represent factors. Conclusions drawn from the last two factors must then be made with caution. Examination of the residuals of the reproduced correlation matrix showed that only 9% of the residuals were over .05, which is a good indication that the four-factor solution is a good fit for the data.

The first social factor, "Life-Cycle Considerations", is measured by five items: the degree to which management contributed to and supported the development of the IS (Managerial Support); the level of promotion and active support for the system from a champion of the project (Enthusiasm); the extent to which training and education programs designed for users and or managers facilitate effective utilization and control of the system (Personnel Assistance); the extent to which users provided the development team with resources during the development of the system (User Commitment); and the extent to which members of the IS staff possess the knowledge of the different business functions of the organization (IS Understanding).

The second social factor, "Fit with User's Task", is measured by the extent to which the system is perceived by the people affected as being non-threatening (Benignity); the extent to which the IS matches users' expectations (Conformity); the extent to which the IS reduces the level of uncertainty of the user decision environment (Certainty); the degree to which the performance of the tasks is standardized and formalized into "one best way" (Bureaucratization); the improvements in the efficiency and/or effectiveness of the organization brought about by the IS (Economic Performance); and the extent to which the system is viable in terms of cost-benefit analysis (Feasibility).

The third and fourth groupings of variables may not represent factors since their respective eigenvalues were lower than one. These groupings were not shown in Table 9.

The third social factor, "Quality of Work Life", is measured by two items: the amount of variety, challenge, autonomy, and recognition in the work content arising from using the IS (Stimulation); and the extent to which the system brings about reductions to the workload and stress in the work lives of users (Relief). "Quality of Work Life" may not represent a factor, as indicated by its eigenvalue.

The fourth social factor, "Organizational Fit", is explained by four items: the level of learning about the organization that results for novice end users as a consequence of utilizing the IS (Education); the extent to which maintenance and upgrading of the system enables the organization to keep up with change by means of organizational learning

(Adaptiveness): the extent to which the use of the system brings about rationality and consensus in decision making (Agreement); and the amount of strategic benefit accrued to the organization due to implementation of the system (Competitiveness). "Organizational Fit" may not represent a factor, as indicated by its eigenvalue

With reliability coefficients of .73 and .77 respectively, "Life-cycle Considerations" and "Fit with User's Task" seem to be relatively free of contamination from other constructs. The two other factors, on the other hand, seem to have a broader definition than the one used in the instrument. As was the case with technical factors, the potential reliability of the instrument may be a concern.

Identification of Differences in the Perceptions of IS Quality

Eleven analyses of variance were performed, one for each factor identified in the factor analyses, to determine whether there is a difference in the perceptions of IS managers, end users and developers concerning IS quality. Data used to produce ANOVA analyses were obtained by grouping scores and averaging them on a factor basis. "Interface", for example, is the first factor of the social sub-system and is measured by four items (User Friendliness, Ease of Learning, Ease of Use, and Control). Scores for these four variables were averaged for all observations. This average was then used to compare results between sub-groups of respondents. These steps were repeated for all eleven factors. Groups were defined as the role played by the respondent with respect to IS in their organizations. The coding scheme was as follows: value 1 was given to IS managers, 2 was given to end-users, while value 3 was attributed to IS developers.

To assess that the data were appropriate for an ANOVA, we checked for any violation of the homogeneity of variances hypothesis. Cochran's C and Bartlett-Box F statistics are reproduced in Tables 10 to 20. No violation of the homogeneity of variances hypothesis could be observed.

By looking at the ANOVA tables, it becomes obvious that with the exception of "Life-cycle Considerations", there appears to be no difference in the perception of IS quality among IS managers, end users, and developers. In none of the cases could the SPSS ANOVA program find a difference in the means of the sub-groups. For the "Life-cycle

Considerations" factor, however, SPSS could find a difference between the mean score of managers and end users. No differences could be found, though, between managers and developers, or developers and end-users.

Analysis of Variance					
Source	D F	Sum of Squares	Mean Squares	F Ratio	F Prob
Between Groups	2	.1385	.0693	.2187	.8039
Within Groups	144	45.6192	.3168		
Total	146	45.7577			
Tests for Homogeneity of Variances					
Cochrans C = Max. Variance/Sum(Variations) = 3608, P = .911 (Approx)					
Bartlett-Box F = 16.7, P = .846					
Maximum Variance / Minimum Variance 1.205					

Table 10 ANOVA table - Interface

Analysis of Variance					
Source	D F	Sum of Squares	Mean Squares	F Ratio	F Prob
Between Groups	2	.0595	.0297	.3194	.7271
Within Groups	145	13.5060	.0931		
Total	147	13.5655			
Tests for Homogeneity of Variances					
Cochrans C = Max. Variance/Sum(Variations) = 3579, P = .965 (Approx)					
Bartlett-Box F = .094, P = .910					
Maximum Variance / Minimum Variance 1.130					

Table 11 ANOVA table - Content

Analysis of Variance					
Source	D F	Sum of Squares	Mean Squares	F Ratio	F Prob
Between Groups	2	.0232	.0116	1.045	.9008
Within Groups	146	16.2145	.1111		
Total	148	16.2377			
Tests for Homogeneity of Variances					
Cochrans C = Max. Variance/Sum(Variations) = 3847, P = .522 (Approx)					
Bartlett-Box F = 343, P = .710					
Maximum Variance / Minimum Variance 1.273					

Table 12 ANOVA table - Task selection

Analysis of Variance					
Source	D F	Sum of Squares	Mean Squares	F Ratio	F Prob
Between Groups	2	1 2980	.6490	2 7365	.0682
Within Groups	144	34 1505	.2372		
Total	146	35.4485			
Tests for Homogeneity of Variances					
Cochrans C = Max Variance/Sum(Variances) = .3430, P = 1.000 (Approx)					
Bartlett-Box F = .019 , P = .981					
Maximum Variance / Minimum Variance 1 063					

Table 13 ANOVA table - Software Quality

Analysis of Variance					
Source	D F	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	.9745	.0373	.0917	.9124
Within Groups	144	58 4673	4060		
Total	146	58 5418			
Tests for Homogeneity of Variances					
Cochrans C = Max Variance/Sum(Variances) = .3481, P = 1.000 (Approx.)					
Bartlett-Box F = .125 , P = .882					
Maximum Variance / Minimum Variance 1.132					

Table 14 ANOVA table - Processor

Analysis of Variance					
Source	D F.	Sum of Squares	Mean Squares	F Ratio	F Prob
Between Groups	2	.1281	.0641	.5103	.6014
Within Groups	143	17.9547	.1256		
Total	145	18.0829			
Tests for Homogeneity of Variances					
Cochrans C = Max. Variance/Sum(Variances) = .3561, P = .999 (Approx.)					
Bartlett-Box F = .076 , P = .927					
Maximum Variance / Minimum Variance 1.132					

Table 15 ANOVA table - Task Performance

Analysis of Variance					
Source	D F	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	.7852	.3926	1.5137	.2235
Within Groups	146	37 8698	.2594		
Total	148	38 6550			
Tests for Homogeneity of Variances					
Cochrans C = Max Variance/Sum(Variances) = .4052, P = .294 (Approx.)					
Bartlett-Box F = .808 , P = .446					
Maximum Variance / Minimum Variance 1.491					

Table 16 ANOVA table - Work Redesign

Analysis of Variance					
Source	D F.	Sum of Squares	Mean Squares	F Ratio	F Prob
Between Groups	2	2.8530	1.4265	3.4986	.0329
Within Groups	142	57.8980	.4077		
Total	144	60.7510			

Tests for Homogeneity of Variances

Cochrans C = Max Variance/Sum(Variations) = 3430, P = 1.000 (Approx.)

Bartlett-Box F = .016, P = .984

Maximum Variance / Minimum Variance 1.046

Multiple Range Test

Tukey-HSD Procedure

Ranges for the .050 level -

3.35 3.35

The ranges above are table ranges

The value actually compared with Mean(J)-Mean(I) is

.4515 * Range * Sqrt(1/N(I) + 1/N(J))

(*) Denotes pairs of groups significantly different at the .050 level

		G G G
		r r r
		p p p
Mean	Group	1 3 2
2.0656	Grp 1	
2.2756	Grp 3	
2.4167	Grp 2	*

Scheffe Procedure

Ranges for the .050 level -

3.50 3.50

The ranges above are table ranges

The value actually compared with Mean(J)-Mean(I) is

.4515 * Range * Sqrt(1/N(I) + 1/N(J))

(*) Denotes pairs of groups significantly different at the .050 level

		G G G
		r r r
		p p p
Mean	Group	1 3 2
2.0656	Grp 1	
2.2756	Grp 3	
2.4167	Grp 2	*

Table 17 ANOVA table - Life-cycle Considerations⁴

⁴Groups are as follows:

- Group1: IS Managers
- Group2: End Users
- Group3: IS Developers

Analysis of Variance					
Source	D F	Sum of Squares	Mean Squares	F Ratio	F Prob
Between Groups	2	2968	1484	3.2675	.0409
Within Groups	144	6.5397	.0454		
Total	146	6.8364			
Tests for Homogeneity of Variances					
Cochrans C = Max Variance/Sum(Variances) = 4506, P = .061 (Approx)					
Bartlett-Box F = 2.437, P = .088					
Maximum Variance / Minimum Variance 1.995					

Table 18 ANOVA table - Fit with User's Task

Analysis of Variance					
Source	D F	Sum of Squares	Mean Squares	F Ratio	F Prob
Between Groups	2	1.3821	.6910	9.893	.3743
Within Groups	146	101.9803	.6985		
Total	148	103.3624			
Tests for Homogeneity of Variances					
Cochrans C = Max Variance/Sum(Variances) = 4047, P = .299 (Approx)					
Bartlett-Box F = .990, P = .372					
Maximum Variance / Minimum Variance 1.452					

Table 19 ANOVA table - Quality of Working Life

Analysis of Variance					
Source	D F	Sum of Squares	Mean Squares	F Ratio	F Prob
Between Groups	2	1.0960	.5480	1.1316	.3254
Within Groups	143	.69.2510	.4843		
Total	145	70.3470			
Tests for Homogeneity of Variances					
Cochrans C = Max Variance/Sum(Variances) = .3749, P = .671 (Approx)					
Bartlett-Box F = .283, P = .754					
Maximum Variance / Minimum Variance 1.216					

Table 20 ANOVA table - Organizational Fit

Examination of relationships between technical and social factors

	SOCIO	TECHNO
SOCIO	1.0000 (145) P= .	.7087 (137) P= .000
TECHNO	.7087 (137) P= .000	1.0000 (141) P=

Table 21 Correlation between technical and social sub-systems

Although sample size did not allow for the examination of non linear relationships between technical and social factors, it did allow for the examination of linear relationships. Pearson correlation coefficients were used as a measure of linear association between the technical and the social sub-systems. All scores for technical variables were summed on a factor basis to yield a single technical score. The same procedure was performed on social variables. The totals for both sub-systems were compared using SPSS Correlation procedure.

Table 21 shows the results of the correlation analysis. As this table shows, there is a strong positive linear relationship between social and technical variables, thereby suggesting a strong linear relationship between the social and the technical sub-systems.

	LCCONS	FITTSY	QWL	CPGFIT	INTERFACE	CONTENT	TASKSEL	SOFTQUAL	PROCESS	TASKPERF	WRKREDES
LCCONS	1 0000										
	P=										
FITTSY	4948	1 0000									
	P= 000	P=									
QWL ⁵	3401	3625	1 0000								
	P= 000	P= 000	P=								
CPGFIT	3945	.4075	3645	1 0000							
	P= 000	P= 000	P= 000	P=							
INTERFACE	4229	6089	3182	3032	1 0000						
	P= 000	P= 000	P= 000	P= 000	P=						
CONTENT	2747	5033	1933	2496	4366	1 0000					
	P= 001	P= 000	P= 018	P= 002	P= 000	P=					
TASKSEL	1254	- 0286	1062	1573	- 1099	0299	1 0000				
	P= 130	P= 729	P= 194	P= 056	P= 182	P= .716	P=				
SOFTQUAL	4295	4807	2794	3430	5217	4400	1357	1 0000			
	P= 000	P= 000	P= 001	P= 000	P= 000	P= 000	P= 099	P=			
PROCESS	2797	.1940	3154	3164	4359	1481	- 0479	4047	1 0000		
	P= 001	P= 019	P= 000	P= 000	P= 000	P= 072	P= 562	P= .000	P=		
TASKPERF	1602	5354	2916	2956	5936	4582	0668	5143	3255	1 0000	
	P= 000	P= 000	P= .000	P= 000	P= 000	P= 000	P= .420	P= 000	P= .000	P=	
WRKREDES	3523	.4233	3722	3890	4545	1970	1666	3118	2877	3568	1 0000
	P= 000	P= 000	P= 000	P= 000	P= 000	P= 016	P= 041	P= 000	P= 000	P= 000	P= .

Table 22 - Correlation matrix of socio-technical quality factors

⁵QWL: Quality of Working Life

Table 22 shows the correlation matrix of the socio-technical quality factors. Correlation coefficients in the matrix show the linear association between factors. Factors included in the matrix are those identified with the help of factor analysis.

The strongest linear associations between variables are between "Interface" and "Fit With User's Task" (.6089); "Content" with "Fit With User's Task" (.5033); "Task Performance" with "Fit With User's Task" (.5354); "Interface" with "Software Quality" (.5217); and "Interface" with "Task Performance" (.5936). No negative correlations could be observed. One of the factors, "Task Selection", does not seem to be linearly associated with any other factor in the socio-technical quality model: none of the correlation coefficients of this factor with other factors in the model were significant.

DISCUSSION

The small sample size, as mentioned earlier, prevented us from performing a single factor analysis that would have given indications on the elements that make up a socio-technical measurement instrument designed to assess IS quality. It was possible, however, to examine the presence of a strong linear relationship between the social and the technical sub-systems.

As observed by authors interested in socio-technical issues (Bostrom and Heinen, 1977; 1977a; Conrath and Sharma, 1992; Eason, 1988; Emery, 1959; Van Eijnatten, 1993), the technical sub-system is not solely concerned with technology. The task to be automated is also part of the technical sub-system. Factor analysis performed on technical items in the questionnaire yielded three task-related factors: "Task Selection", "Task Performance", and "Work Redesign". These factors are an indication that the technical evaluation of an IS cannot go without accounting for the characteristics of the task for which the IS has been developed and is being used.

Still referring to the original list of dimensions used to produce the questionnaire, the section concerned with the technical system itself has been split into two factors: "Software Quality" and "Processor". Together, these factors measure the quality of the technical system while they provide indication as the two-sided nature (software and hardware) of IS quality, especially of computer-based IS. The section of the technical dimensions identified as "Output" has also been split. Two factors now define output quality: "Interface" and "Content". Here again, the measurement gains in granularity, as

it allows identification of the elements that taken together form a measurement of output quality.

Factor analysis performed on social dimensions produced a new factor that was interpreted as "Fit with User's Task", which combines Conformity and Bureaucratization. This is in accord with Lyytinen (1987), who advocated that IS development focus be shifted from the technical sub-system to the user sub-system. The assessment of IS quality, from a technical or from a social perspective should be made using an instrument that covers more than a single aspect of IS. That instrument should cover aspects affecting users, the technical system, the task, and the organization, as mentioned by numerous authors (Bostrom and Heinen, 1977; Conrath and Sharma, 1992; Eason, 1988; Mumford, 1987).

Comparison of population means for IS managers, end users, and developers demonstrated that there does not appear to be any differences between perceptions of IS quality for most of the factors that measure IS quality. These results are not in line with the findings and conclusions of a number of researchers over the years (Bostrom and Heinen, 1977; Hamilton and Chervany, 1981a; Rivard, 1995). Alternative explanations may provide a clue for these results. First, the sample size may limit the generalization of the results and therefore force us to draw conclusions that are limited to the setting of the present study only. Second, the moderate reliability coefficients observed for most of the factors are an indication that the instrument is not accurately measuring what it purports to and may lead to erroneous conclusions. This is a problem that is frequently found in

the area of IS research (Galletta and Lederer, 1989; Klenke, 1992; Straub, 1989). Finally, the response rate may have had a negative influence over the validity of the results, since nearly 87% of those who received it chose not to respond to the questionnaire. It then becomes impossible to determine what makes non-respondents different from respondents.

The development of a socio-technical model of IS quality is based on the assumption, held by socio-technical authors (Bostrom and Heinen, 1977; 1977a; Conrath and Sharma, 1992; Davis et al., 1992; Eason, 1988; Emery, 1959; Lyytinen, 1987; Mumford, 1987), that optimization of the system can only be achieved through the joint optimization of the social and the technical sub-systems. This assumption requires that a relationship exist between the social and the technical sub-systems. The correlation analysis performed demonstrates that the joint optimization assumption is indeed a valid assumption. The implications of the strong positive relationship are twofold. First, optimization of the whole system is not possible if the social and the technical sub-systems are not jointly optimized. Second, the assessment of IS quality can only be achieved if the social and the technical aspects are taken into consideration in a global, integrated fashion. Although strong, the linear relationship between social and technical factors is not perfect. Had social and technical factors been perfectly correlated, one would need only to evaluate one of the sub-systems to have an evaluation of the quality of an IS as a whole. Because the two sub-systems do not show perfect correlation, an instrument such as the one proposed in this study is needed to have a comprehensive evaluation of IS quality. Socio-

technical evaluation of IS quality takes into account the fact that the technical and the social sub-systems are not perfectly correlated.

Limitations of this study

As mentioned earlier, sample size coupled with the low response rate is a major limitation of the study. A response rate of 13% means that 87% of those who received the questionnaire did not, for various reasons, respond to it. Since the questionnaire was not coded and with such a high proportion of non respondents, it is impossible to determine whether there exists a difference between respondents and non respondents. Any inferences, generalizations, or conclusions made based on the results of this study must then be made cautiously.

CONCLUSIONS

The assessment of IS quality is a topic that will probably fuel many more discussions and many more papers in the future. However, IS quality must be measured using measurement instruments that are not limited to one aspect of IS, but that rather cover all perspectives of IS. This is why IS researchers interested in the measurement of IS quality should continue their efforts in developing a measurement instrument that covers the aspects of task, technology, people, and organization.

The resulting measurement instrument should be used by stakeholders to measure IS quality. In other words, IS users, managers, and developers should use this instrument to evaluate the quality of the IS of which they are part. The evaluation of the quality of an IS is better served if a participatory approach is adopted in the evaluation process. Stakeholders' participation favors the integration of multiple viewpoints which, in turn, favors the acceptance of the resulting measures (Hamilton and Chervany, 1981a, Saraph et al., 1989). Further research is needed to identify who the stakeholders are, what makes them different in the way they view IS and, the implications that these differences have on the assessment of IS quality.

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**APPENDIX A - TABLE OF THE LITERATURE SUPPORT FOR THE SOCIO-
TECHNICAL QUALITY DIMENSIONS**

Dimensions	References in literature
<u>The Technical Subsystem</u>	
Task: The activities for which decision support is performed by the information system.	
<u>Task Selection - Variables pertaining to the characteristics of the task that have been chosen for the application of the information system.</u>	
1. Difficulty The extent to which the task is complex and knowledge-intensive.	Conrath and Sharma, 1992; Sanders and Courtney, 1985
2. Scarcity The degree to which there is a shortage of expertise or skills to execute the task.	Conrath and Sharma, 1992
3. Utility The significance of the task in terms of its consequences and the frequency with which the task is undertaken.	Bailey and Pearson, 1983; Conrath and Sharma, 1992; Sanders and Courtney, 1985
4. Interdependence The level to which the task is intertwined with other tasks in the organization.	Sanders and Courtney, 1985
5. Structure The extent to which the task is well defined and invariable.	Sanders and Courtney, 1985
<u>Task Performance - Variables pertaining to the effect of the information system on task performance</u>	
6. Confidence The level of consistency, reliability, and dependability of task performance as a result of utilizing the system.	Aldag and Power, 1986; Bailey and Pearson, 1983; Cats-Baril and Huber, 1987; Conrath and Sharma, 1992; Dickson DeSanctis and McBride, 1986; Goslar, Green and Hughes, 1986; Miller, 1993
7. Realism How close the system is to the natural way of performing the task	Conrath and Sharma, 1992
8. Criticality	Conrath and Sharma, 1992

Dimensions	References in literature
The degree to which the user is protected or shielded from miscarrying the task.	
9. Efficiency The extent to which the information system will reduce the time and cost required to complete the task.	Benbasat and Dexter, 1986; Boehm et al., 1978; Cats-Baril and Huber, 1987; Goslar, Green and Hughes, 1986
<u>Work Redesign - Variables pertaining to the effect of the information system on the nature of the work.</u>	
10. Novelty The extent to which new ideas or methods (new tasks) are possible with the use of the information system.	Conrath and Sharma, 1992; Sanders and Courtney, 1985
11. Simplification The level of reduction in the complexity of the task due to the use of the information system.	Cheney and Dickson, 1982; Conrath and Sharma, 1992; Davis, 1989
Technology: The technical system itself.	
12. Interactivity The degree to which the system's dialogue with the end user is clear and concise.	Boehm et al., 1978; Conrath and Sharma, 1992
13. Language The extent to which the set of vocabulary, syntax, and grammatical rules used to interact with the information system are powerful and flexible.	Bailey and Pearson, 1983
14. Reliability The extent to which the information system can perform its intended functions satisfactorily.	Boehm et al., 1978; Conrath and Sharma, 1992

<p>15. Maintainability</p> <p>The extent to which the information system facilitates updating to satisfy new requirements.</p>	Boehm et al., 1978; Conrath and Sharma, 1992
<p>16. Availability</p> <p>The extent to which the information system can be accessed and the selective use of its components is facilitated.</p>	Bailey and Pearson, 1983; Boehm et al., 1978; Carr, 1992; Conrath and Sharma, 1992; Miller, 1993, Srinivasan, 1985
<p>17. Flexibility</p> <p>The degree to which the information system can be tailored to users' own style of interaction.</p>	Bailey and Pearson, 1983; Carr, 1992; Miller, 1993
<p>18. Completeness</p> <p>The extent to which all parts of the information system are present and fully developed.</p>	Boehm et al., 1978
<p>19. Testability</p> <p>The extent to which the information system facilitates the establishment of acceptance criteria and supports evaluation of its performance.</p>	Boehm et al., 1978
<p>20. Portability</p> <p>The extent to which the information system can be operated easily and well on configurations other than its current one.</p>	Boehm et al., 1978
<p>21. Response time</p> <p>The extent of the quickness with which the information system responds to users' requests.</p>	Bailey and Pearson, 1983; Conrath and Sharma, 1992; Carr, 1992; Srinivasan, 1985
<p>22. Functionality</p> <p>The level of richness and thoroughness of the functions supported by the information system.</p>	Boehm et al., 1978; Conrath and Sharma, 1992

<p>23. Resource utilization</p> <p>The extent to which the information system can function within the amount of available resources and without waste of resources.</p>	Boehm et al., 1978; Kriebel and Raviv, 1982
<p>24. Security</p> <p>The degree to which the information system is protected against misuse.</p>	Bailey and Pearson, 1983; Carr, 1992
<p>25. Predictability</p> <p>The extent to which the information system provides consistent responses to operations and functions.</p>	Carr, 1992
<u>Output - Characteristics of the information product generated by the information system</u>	
<p>26. Specificity</p> <p>The level of content relevance and completeness of the information produced by the information system</p>	Bailey and Pearson, 1983; Conrath and Sharma, 1992; Doll and Torkzadeh, 1988; King and Epstein, 1983
<p>27. Accuracy</p> <p>The degree of correctness of the output information.</p>	Bailey and Pearson, 1983; Boehm et al., 1978; Doll and Torkzadeh, 1988; Miller, 1993; Srinivasan, 1985
<p>28. Precision</p> <p>The degree of variability of the output information from that which it purports to measure.</p>	Bailey and Pearson, 1983; Conrath and Sharma, 1992; Doll and Torkzadeh, 1988
<p>29. Currency</p> <p>The extent to which the information is up to date.</p>	Bailey and Pearson, 1983; King and Epstein, 1983; Miller, 1993
<p>30. Timeliness</p> <p>The extent to which the output information is available in a time suitable for its use.</p>	Bailey and Pearson, 1983; King and Epstein, 1983; Miller, 1993; Srinivasan, 1985
<p>31. Conciseness</p> <p>The degree to which the output is free of undesirable/unnecessary information.</p>	Bailey and Pearson, 1983; Carr, 1992

<p>32. Understandability</p> <p>The degree of comprehension that a user possesses about the purpose of the information system.</p>	<p>Boehm et al., 1978; Carr, 1992; King and Epstein, 1983; Srinivasan, 1985</p>
<p>33. Presentation</p> <p>The extent to which the layout of the output is appropriate.</p>	<p>Conrath and Sharma, 1992</p>
<p>34. Compatibility</p> <p>The degree to which the system is compatible with other existing systems and technology within the organization.</p>	<p>Bailey and Pearson, 1983; Conrath and Sharma, 1992</p>
<p>35. Documentation</p> <p>The extent to which the documentation of the information system describes it and gives clear instructions for its utilization.</p>	<p>Bailey and Pearson, 1983; Conrath and Sharma, 1992</p>
<p>36. User friendliness</p> <p>The degree to which the information system is not frustrating and is enjoyable to use.</p>	<p>Aldag and Power, 1986; Conrath and Sharma, 1992;</p>
<p>37. Ease of learning</p> <p>Ease with which users can make use of the information system</p>	<p>Carr, 1992; Davis, 1989</p>
<p>38. Ease of use</p> <p>The extent to which the information system is easy to use and not cumbersome.</p>	<p>Carr, 1992; Davis, 1989</p>
<p>39. Control</p> <p>Degree to which users feel in command while interacting with the information system.</p>	<p>Carr, 1992</p>

<u>The Social Sub-System</u>	
People - Those involved with the usage, management, and development of the information system	
<u>Quality of Work Life - Variables related to the impact of the information system on the user</u>	
40. Stimulation The amount of variety, challenge, autonomy, and recognition in the work content arising from using the information system.	Aldag and Power, 1986; Cheney and Dickson, 1982; Conrath and Sharma, 1992
41. Relief The extent to which the system brings about reductions to the workload and stress in the work lives of users.	Conrath and Sharma, 1992
42. Benignity The extent to which the system is perceived by the people affected as being non-threatening.	Aldag and Power, 1986; Cats-Baril and Huber, 1987; Conrath and Sharma, 1992
43. Conformity The extent to which the information system matches users' expectations.	Bailey and Pearson, 1983; Ginzberg, 1981
44. Certainty The extent to which the information system reduces the level of uncertainty of the user decision environment.	Cheney and Dickson, 1982
<u>Life-Cycle Considerations - Variables related to the information system development process</u>	
45. Managerial support The degree to which management contributed to and supported the development of the information system.	Bailey and Pearson, 1983; Conrath and Sharma, 1992; McDoniel et al., 1993; Ravichandran and Rai, 1994; Sanders and Courtney, 1985

46. Enthusiasm The level of promotion and active support for the system from a champion of the project.	Conrath and Sharma, 1992
47. Personnel assistance The extent to which training and education programs designed for users and or managers facilitate effective utilization and control of the system.	Conrath and Sharma, 1992; Guimaraes and Gupta, 1988
48. Inclusion The extent to which the positive involvement and participation of users and managers are solicited during the development of the system.	Amoako-Gyampah and White, 1993; Byers and Blume, 1994; Conrath and Sharma, 1992, Ginzberg, 1981; Miller, 1993
49. User commitment The extent to which users provided the development team with resources (financial as well as time) during the development of the system.	Byers and Blume, 1994; McDoniel et al., 1993
50. IS understanding of business function The extent to which members of the IS staff possess the knowledge of the different business functions of the organization.	Byers and Blume, 1994
Organization - The macro-level context in which the information system is applied.	
<u>Organizational Fit - Aspects of changes brought about to the organizational structure</u>	
51. Bureaucratization The degree to which the performance of the tasks is standardized and formalized into "one best way".	Conrath and Sharma, 1992; Sanders and Courtney, 1985
52. Education The level of learning about the organization that results for novice end users as a consequence of utilizing the system.	Conrath and Sharma, 1992; Kleintop et al., 1994; Miller, 1993; Sanders and Courtney, 1985

<p>53. Adaptiveness</p> <p>The extent to which maintenance and upgrading of the system enables the organization to keep up with change by means of organizational learning.</p>	Conrath and Sharma, 1992; Miller, 1993
<p>54. Agreement</p> <p>The extent to which the use of the system brings about rationality and consensus in decision making.</p>	Conrath and Sharma, 1992
<p>55. Innovation</p> <p>The extent to which the information system establishes an innovative, high-tech corporate culture and public image of the organization.</p>	Conrath and Sharma, 1992; Javenpaa and Ives, 1990
<p><u>Economic Benefits - Variables related to the effects of the information system on the financial results of the organization</u></p>	
<p>56. Economic performance</p> <p>The improvements in the efficiency and/or effectiveness of the organization brought about by the information system.</p>	Conrath and Sharma, 1992; Jarvenpaa and Ives, 1990; Miller, 1993
<p>57. Feasibility</p> <p>The extent to which the system is viable in terms of cost-benefit analysis.</p>	Conrath and Sharma, 1992
<p>58. Competitiveness</p> <p>The amount of strategic benefit accrued to the organization due to the implementation of the system.</p>	Conrath and Sharma, 1992; Jarvenpaa and Ives, 1990;

APPENDIX B - INTRODUCTION LETTER TO THE QUESTIONNAIRE

Dear Madam / Sir

The purpose of this questionnaire is to explore perceptions of factors that are thought to have an influence on the quality of Information Systems (IS). The questionnaire is intended for IS managers, developers, and end-users.

Enclosed, you will find one copy of the questionnaire along with a prepaid postage return envelope. Your response is anonymous and will be used for academic purposes only. It will take approximately 30 minutes to complete the questionnaire. Your participation in this survey is important to this study, please answer all questions and return the questionnaire before April 22, 1995 in the enclosed postage prepaid envelope.

If you would like to receive an executive summary of the results of this study, please attach a business card to your questionnaire.

If you have any questions regarding our research project, do not hesitate to contact us by phone at 514-848-2978, by fax at 514-848-2824, or through mail at the following address:

Luc Rochette - IS Quality Survey
c/o Prof. Khalifa
Department of Decision Sciences and MIS
Concordia University - Faculty of Commerce and Administration
1455 de Maisonneuve Blvd W.
Montréal, Québec
H3G 1M8

Thank you in advance for your participation in this survey.

Luc Rochette
M.Sc. Student
Concordia University

Chère Madame, cher Monsieur,

Le but de ce questionnaire est d'explorer les perceptions concernant les facteurs susceptibles d'avoir une influence sur la qualité des systèmes d'information (SI).

Ce questionnaire est destiné à être complété soit par les gestionnaires du développement des SI, soit par les développeurs, soit, encore, par les utilisateurs finaux d'un SI. Vos réponses demeureront anonymes et ne seront utilisées qu'à des fins académiques. Nous estimons que vous devriez consacrer environ 30 minutes à compléter ce questionnaire. Votre participation à cette étude est importante, veuillez répondre à toutes les questions et nous retourner le questionnaire complété avant le 22 avril 1995 dans l'enveloppe de retour préaffranchie.

Si vous êtes intéressé à recevoir un sommaire exécutif des résultats de cette étude, veuillez accompagner votre questionnaire complété d'une carte d'affaires

Si vous avez des questions concernant notre projet de recherche, n'hésitez pas à nous contacter par téléphone, au numéro 514-848-2978, ou, par télécopieur, au numéro 514-848-2824; ou encore, par courrier, à l'adresse suivante:

Luc Rochette - Étude de la mesure de la qualité des systèmes d'information
a/s Prof. Khalifa
Département des Sciences de la décision et des Systèmes d'information
Faculté de Commerce et d'Administration - Université Concordia
1455 Boulevard de Maisonneuve Ouest,
Montréal, Québec
H3G 1M8

Nous vous remercions à l'avance de votre participation à cette étude

Luc Rochette
Étudiant à la maîtrise en
Sciences de la décision et en
systèmes d'information de gestion
Université Concordia
Montréal, Qc.

**APPENDIX C - QUESTIONNAIRE USED IN THE SURVEY IN ITS FRENCH
AND ENGLISH VERSIONS**

INFORMATION SYSTEMS QUALITY

A Study Conducted by:

Faculty of Commerce and Administration

Concordia University

Montréal, Québec

Project Directors:

Mohamed Khalifa, Ph.D.

Luc Rochette

1. Demographics

Please select the most appropriate response for all following questions (1 through 6).

1. Please specify the type of organization in which you are involved.

Service _____ Government _____
Manufacturing _____ Education _____
Other (please specify): _____

2. Please specify your role with respect to information systems (IS) in your organization.

Manager of IS development: _____ (*Please go to question 3 below*)
End user: _____ (*Please go to question 4 below*)
IS developer: _____ (*Please go to question 5 below*)

3. This question is intended for IS managers.

Please specify, by name, the most important IS of which you managed the development.

(*Please proceed to question 6 below*)

4. The next three sub-questions are intended for end users, as specified in question 2.

a). Please identify, by name, the IS which you use the most as part of your everyday work life.

b). How long have you been using this IS?

Years: _____ Months: _____

c). Did you participate in the development of this IS?

Yes: ____ No: ____

(*Please proceed to question 6 below*)

5. This question is intended for IS developers.

Please specify, by name, the most important IS that you helped develop.

6. The next two sub-questions refer to the information system you specified previously.

a). Please specify the type of the specified IS.

Transaction processing system: _____ Decision support system: _____
Expert system: _____ Information reporting system: _____
Executive information system: _____
Other (please specify): _____

b). Please specify the business function in which the specified IS is being used.

Sales and marketing _____ Production _____
Purchasing _____ Human resources _____
Finance and accounting _____
Other (please specify) _____

II. Assessment of the quality of the specified information system

Please rate the IS specified in the previous section against the following quality variables.

Please answer questions by circling the appropriate number.

1. Strongly Agree 2. Agree 3. Indifferent 4. Disagree 5. Strongly Disagree

The next 5 questions refer to the characteristics of the tasks that are supported or performed by the IS.

- | | | | | |
|---|---|---|---|---|
| 1. The task supported by the IS is complex and knowledge-intensive | 1 | 2 | 3 | 4 |
| 2. There is a shortage of skills or expertise to execute the task supported by the IS. | 1 | 2 | 3 | 4 |
| 3. The task supported by the IS is significant in terms of its consequences and the frequency with which it is undertaken | 1 | 2 | 3 | 4 |
| 4. Task supported by the IS is intertwined with other tasks in the organization | 1 | 2 | 3 | 4 |
| 5. The task supported by the IS is well defined and invariable. | 1 | 2 | 3 | 4 |

The next 4 questions refer to the effect of the information system on task performance

- | | | | | |
|--|---|---|---|---|
| 6. Utilizing the IS has improved the level of consistency, reliability, and dependability of task performance. | 1 | 2 | 3 | 4 |
| 7. The IS is close to the natural way of performing the task it supports | 1 | 2 | 3 | 4 |
| 8. The IS protects or shields the user from miscarrying the task it supports. | 1 | 2 | 3 | 4 |
| 9. The IS reduces the time and cost required to complete the task it supports | 1 | 2 | 3 | 4 |

The next 2 questions refer to the effect of the IS on the nature of the work

- | | | | | |
|--|---|---|---|---|
| 10. New ideas or methods for performing the task (or new tasks) are possible with the use of the IS. | 1 | 2 | 3 | 4 |
| 11. Use of the IS has reduced the level of complexity of the task. | 1 | 2 | 3 | 4 |

The next 28 questions relate to the technical characteristics of the IS

- | | | | | |
|--|---|---|---|---|
| 12. The IS's dialogue with the end user is clear and concise. | 1 | 2 | 3 | 4 |
| 13. The set of vocabulary, syntax, and grammatical rules used to interact with the IS are powerful and flexible. | 1 | 2 | 3 | 4 |
| 14. The IS can perform its intended functions satisfactorily | 1 | 2 | 3 | 4 |
| 15. The information system facilitates updating to satisfy new requirements. | 1 | 2 | 3 | 4 |
| 16. The IS can be accessed relatively easily and the selective use of its components is facilitated. | 1 | 2 | 3 | 4 |
| 17. The IS can be tailored to users' own style of interaction. | 1 | 2 | 3 | 4 |
| 18. All of the parts of the IS are present and fully developed. | 1 | 2 | 3 | 4 |
| 19. The IS facilitates the establishment of acceptance criteria and supports evaluation of its performance. | 1 | 2 | 3 | 4 |
| 20. The IS can be operated easily and well on configurations other than its current one. | 1 | 2 | 3 | 4 |
| 21. The IS is quick to respond to users' requests. | 1 | 2 | 3 | 4 |

Please answer questions by circling the appropriate number:				
1. Strongly Agree	2. Agree	3. Indifferent	4. Disagree	5. Strongly Disagree
22. The functions supported by the IS are rich and thorough.	1	2	3	4
23. The IS can function within the amount of available resources and without waste of resources.	1	2	3	4
24. The IS is protected against misuse.	1	2	3	4
25. The IS provides consistent responses to operations and functions.	1	2	3	4
26. The information produced by the IS has content relevance and is complete.	1	2	3	4
27. The information produced by the IS is correct.	1	2	3	4
28. The information produced by the IS does not vary from that which it purports to measure.	1	2	3	4
29. The information produced by the IS is up to date.	1	2	3	4
30. The information produced by the IS is available in a time suitable for its use.	1	2	3	4
31. Output generated by the IS is free of undesirable/unnecessary information.	1	2	3	4
32. The user understands the purpose of the IS.	1	2	3	4
33. The layout of the information produced by the IS is appropriate for its intended use.	1	2	3	4
34. The IS is compatible with existing systems and technology in the organization.	1	2	3	4
35. The IS documentation IS gives clear instructions for its utilization.	1	2	3	4
36. The use of the IS is not frustrating and is enjoyable.	1	2	3	4
37. The IS is easy to learn.	1	2	3	4
38. The IS is easy and not cumbersome to use.	1	2	3	4
39. Users have the feeling they are in command while interacting with the IS.	1	2	3	4

The next 5 questions refer to the impact of the IS on the user

40. The use of the IS has increased the amount of variety, challenge, autonomy, and recognition of the content of users' work.	1	2	3	4
41. The use of the IS reduces the workload and the level of stress in the work lives of its users.	1	2	3	4
42. People affected by the IS do not perceive it as being threatening to them.	1	2	3	4
43. The IS matches users' expectations.	1	2	3	4
44. The IS reduces the level of uncertainty of the user's decision environment.	1	2	3	4

The next 6 questions refer to the IS development process

45. Management contributed to and supported the development of the IS.	1	2	3	4
46. The development of the IS was promoted and actively supported by a champion of the project.	1	2	3	4
47. Training and education programs designed for users and/or managers facilitated effective utilization and control of the IS.	1	2	3	4
48. The positive involvement and participation of users and managers were solicited during the development of the IS.	1	2	3	4
49. Users provided the development team with resources (financial as well as time) during the development of the system.	1	2	3	4

Please answer questions by circling the appropriate number:

1. Strongly Agree 2. Agree 3. Indifferent 4. Disagree 5. Strongly Disagree

50. Members of the IS staff involved in the development of the IS possess the knowledge of the different business functions of the organization. 1 2 3 4

The next 8 questions refer to the organizational effects of the IS

51. Performance of the task supported by the IS is standardized and formalized into "one best way". 1 2 3 4

52. Novice end users have learned about the organization as a consequence of using the IS. 1 2 3 4

53. Maintenance and upgrading of the IS enables the organization to keep up with change by means of organizational learning. 1 2 3 4

54. Use of the IS brings about rationality and consensus in decision making 1 2 3 4

55. The IS establishes an innovative, high-tech corporate culture and public image of the organization. 1 2 3 4

56. The IS has brought about improvements in the efficiency and/or effectiveness of the organization 1 2 3 4

57. The IS is viable in terms of cost-benefit analysis. 1 2 3 4

58. The implementation of the IS has brought about an improvement in the amount of strategic benefits to the organization. 1 2 3 4

III. Overall impressions

In this section, you are asked some overall impressions about the IS you specified in the demographics section of the questionnaire.

Please check the most appropriate response for questions below (1 through 4).

1. Please specify your satisfaction/dissatisfaction with the degree to which the IS matched your expectations.

Highly satisfied:	___	Satisfied:	___
Indifferent:	___	Dissatisfied:	___
Highly dissatisfied:	___		

2. Please rate the effectiveness of the IS in meeting your organization's needs.

Extremely effective:	___	Very effective:	___
Somewhat effective:	___	Marginally effective:	___
Not at all effective:	___		

3. Please indicate to the best of your knowledge the economic viability of the IS.

Benefits greatly exceed costs:	___	Benefits exceed costs:	___
Benefits roughly equal costs:	___	Benefits are lower than costs:	___
Benefits are much lower than costs:	___		

4. Please rate the level of utilization of the IS?

Always (100% of the time)	___	Very frequent (about 90%):	___
Frequent (about 75%)	___	Average (50%):	___
Occasionally (about 25%)	___	Seldom (about 10%):	___
Never (0%):	___		

QUALITÉ DES SYSTÈMES D'INFORMATION

Une étude de:

La Faculté de Commerce et d'Administration

Université Concordia

Montréal, Québec

Projet sous la direction de:

Mohamed Khalifa, Ph.D.

Luc Rochette

1. Informations démographiques

Pour les questions suivantes (questions 1 à 6), veuillez indiquer la réponse la plus appropriée

- 1 Veuillez indiquer le champ d'activités de l'organisation dans laquelle vous œuvrez.

Service _____ Gouvernement _____ Manufacturier _____
Éducation _____ Autres: _____

- 2 Veuillez indiquer votre rôle par rapport aux systèmes d'information (SI) dans votre organisation.

Gestionnaire du développement. _____ (Veuillez vous rendre à la question 3 plus bas)
Utilisateur: _____ (Veuillez vous rendre à la question 4 plus bas)
Développeur _____ (Veuillez vous rendre à la question 5 plus bas)

- 3 Cette question s'adresse aux gestionnaires du développement des SI

Veuillez identifier, par son nom, le SI le plus important dont vous avez eu la charge de superviser le développement.

(Veuillez vous rendre à la question 6 plus bas)

- 4 Les trois prochaines sous-questions s'adressent aux utilisateurs des SI

a) Veuillez identifier, par son nom, le SI que vous utilisez le plus dans le cadre de votre travail.

b) Veuillez indiquer pendant combien de temps vous avez utilisé ce SI.

Nombre d'années _____ Nombre de mois. _____

c) Veuillez indiquer si vous étiez membre de l'équipe de développement du SI que vous avez identifié

Oui. _____ Non _____

(Veuillez vous rendre à la question 6 plus bas)

- 5 Cette question s'adresse aux développeurs de SI

Veuillez identifier le SI le plus important pour lequel vous étiez membre de l'équipe de développement

6. Les prochaines sous-questions se rapportent au SI que vous avez identifié dans les questions précédentes

a) Veuillez indiquer le type de ce SI.

Système transactionnel. _____ Système d'aide à la décision. _____
Système expert: _____ Système de contrôle de gestion: _____
SI pour exécutif _____
Autre (spécifier). _____

b) Veuillez indiquer le champ d'application du SI

Ventes et marketing. _____ Production _____
Acquisitions _____ Ressources humaines: _____
Finance et comptabilité: _____
Autre (spécifier) _____

II. Évaluation de la qualité du SI

Veillez évaluer le SI identifié dans la partie démographique en fonction de critères d'évaluation de la qualité des systèmes d'information

Veillez répondre aux questions suivantes en encerclant la réponse la plus appropriée					
1. Très d'accord 2. D'accord 3. Indifférent 4. En désaccord 5. Très en désaccord					
Les 5 prochaines questions se rapportent aux caractéristiques des tâches choisies pour l'application du SI					
1. La tâche supportée par le SI est complexe et requiert beaucoup de connaissances.	1	2	3	4	5
2. Il y a pénurie d'expertise et de talents pour l'exécution de la tâche supportée par le SI.	1	2	3	4	5
3. La tâche supportée par le SI est significative en termes de ses conséquences et de la fréquence de son exécution	1	2	3	4	5
4. La tâche supportée par le SI est interreliée avec d'autres tâches dans l'organisation.	1	2	3	4	5
5. La tâche supportée par le SI est bien définie et invariable.	1	2	3	4	5
Les 4 prochaines questions portent sur l'effet du SI sur l'accomplissement de la tâche.					
6. L'utilisation du SI a augmenté le niveau de cohérence et la fiabilité de l'accomplissement de la tâche	1	2	3	4	5
7. Le SI se rapproche de la façon naturelle d'accomplir la tâche	1	2	3	4	5
8. Le SI protège l'utilisateur des erreurs dans l'exécution de la tâche supportée	1	2	3	4	5
9. Le SI réduit le temps ainsi que les coûts requis pour l'exécution de la tâche	1	2	3	4	5
Les 2 prochaines questions portent sur l'effet du SI sur la nature du travail.					
10. L'utilisation du SI permet le développement de nouvelles idées et l'application de nouvelles méthodes.	1	2	3	4	5
11. L'utilisation du SI a réduit le niveau de complexité de la tâche	1	2	3	4	5
Les 28 prochaines questions portent sur l'aspect technique du SI.					
12. Le dialogue entre le SI et l'utilisateur est clair et concis	1	2	3	4	5
13. L'ensemble des règles de vocabulaire, de syntaxe et de grammaire utilisées pour l'interaction avec le SI est puissant et flexible	1	2	3	4	5
14. Le SI peut accomplir ses différentes fonctions de façon satisfaisante	1	2	3	4	5
15. Le SI peut être facilement modifié pour la satisfaction des nouveaux besoins	1	2	3	4	5
16. Le SI est facile d'accès et l'utilisation sélective de ses composantes est facilitée.	1	2	3	4	5
17. Le SI peut s'adapter aux différents styles d'interaction des utilisateurs	1	2	3	4	5
18. Toutes les parties du SI sont présentes et complètement développées	1	2	3	4	5
19. Le SI facilite l'établissement de critères d'acceptation et supporte l'évaluation de sa performance	1	2	3	4	5
20. Le SI peut être aisément exploité sur une configuration autre que sa configuration courante.	1	2	3	4	5

Veuillez répondre aux questions suivantes en encerclant la réponse la plus appropriée:					
1. Très d'accord 2. D'accord 3. Indifférent 4. En désaccord 5. Très en désaccord					
21. Le SI répond rapidement aux requêtes des utilisateurs.	1	2	3	4	5
22. Les fonctions supportées par le SI sont riches et approfondies.	1	2	3	4	5
23. Le SI peut fonctionner à l'intérieur des ressources disponibles et sans gaspillage de ressources.	1	2	3	4	5
24. Le SI est protégé contre les mauvaises utilisations.	1	2	3	4	5
25. Le SI fournit une réponse cohérente aux opérations et aux fonctions	1	2	3	4	5
26. L'information produite par le SI est pertinente et complète.	1	2	3	4	5
27. L'information produite par le SI est correcte.	1	2	3	4	5
28. L'information produite par le SI ne varie pas par rapport à ce qu'elle doit mesurer.	1	2	3	4	5
29. L'information produite par le SI est à jour.	1	2	3	4	5
30. L'information produite par le SI est disponible à temps pour son utilisation.	1	2	3	4	5
31. L'information produite par le SI est libre d'information indésirable ou inutile.	1	2	3	4	5
32. Les utilisateurs comprennent le but du SI.	1	2	3	4	5
33. Le format de l'information produite par le SI est approprié pour son utilisation.	1	2	3	4	5
34. Le SI est compatible avec les autres systèmes et technologies existant dans l'organisation	1	2	3	4	5
35. La documentation du SI le décrit et donne des indications claires quant à son utilisation.	1	2	3	4	5
36. Le SI est plaisant et non frustrant à utiliser.	1	2	3	4	5
37. Le SI est facile à apprendre.	1	2	3	4	5
38. Le SI est facile à utiliser et son utilisation n'est pas encombrante.	1	2	3	4	5
39. Les utilisateurs ont la sensation d'être en position de commande lors de leur interaction avec le SI.	1	2	3	4	5

Les 5 prochaines questions portent sur l'impact du SI sur l'utilisateur.

40. L'utilisation du SI a amélioré la variété, le challenge, l'autonomie et la valorisation du contenu du travail de l'utilisateur.	1	2	3	4	5
41. L'utilisation du SI réduit la charge de travail et le niveau de stress dans la tâche de l'utilisateur	1	2	3	4	5
42. Les gens affectés par le SI ne le perçoivent pas comme représentant une menace.	1	2	3	4	5
43. Le SI répond aux attentes des utilisateurs	1	2	3	4	5
44. Le SI réduit le niveau d'incertitude dans l'environnement décisionnel de l'utilisateur.	1	2	3	4	5

Les 6 prochaines questions portent sur le processus de développement du SI.

45. La direction a contribué au et a supporté le développement du SI.	1	2	3	4	5
46. Un champion du projet de développement du SI en a fait la promotion et l'a activement supporté.	1	2	3	4	5
47. Les programmes de formation destinés aux utilisateurs et aux gestionnaires ont permis l'utilisation et le contrôle effectifs du SI.	1	2	3	4	5

Veuillez répondre aux questions suivantes en encerclant la réponse la plus appropriée.
1. Très d'accord 2. D'accord 3. Indifférent 4. En désaccord 5. Très en désaccord

- | | | | | | |
|---|---|---|---|---|---|
| 48. L'implication et la participation des utilisateurs et des gestionnaires ont été sollicités pendant le développement du SI. | 1 | 2 | 3 | 4 | 5 |
| 49. Les utilisateurs ont contribué du temps aussi bien que des ressources monétaires à l'équipe de développement pendant le développement du SI | 1 | 2 | 3 | 4 | 5 |
| 50. Les membres du personnel des systèmes d'information impliqués dans le développement du SI possédaient la connaissance des différentes unités administratives de l'organisation. | 1 | 2 | 3 | 4 | 5 |

Les 8 prochaines questions portent sur l'impact du SI sur la structure organisationnelle.

- | | | | | | |
|--|---|---|---|---|---|
| 51. L'exécution de la tâche supportée par le SI est standardisée et formalisée de la "meilleure manière qui soit". | 1 | 2 | 3 | 4 | 5 |
| 52. Les utilisateurs novices à l'organisation en possèdent une meilleure connaissance après avoir utilisé le SI. | 1 | 2 | 3 | 4 | 5 |
| 53. L'entretien et la mise à niveau du SI permettent à l'organisation de se tenir à jour. | 1 | 2 | 3 | 4 | 5 |
| 54. L'utilisation du SI a entraîné la rationalité et le consensus dans le processus de prise de décision. | 1 | 2 | 3 | 4 | 5 |
| 55. Le SI donne une image avant-gardiste à l'organisation. | 1 | 2 | 3 | 4 | 5 |
| 56. Le SI a entraîné des améliorations dans l'efficacité et l'efficience de l'organisation. | 1 | 2 | 3 | 4 | 5 |
| 57. Le SI est économiquement viable. | 1 | 2 | 3 | 4 | 5 |
| 58. L'implantation du SI a entraîné une amélioration des avantages stratégiques de l'organisation | 1 | 2 | 3 | 4 | 5 |

III. Impressions générales

Pour les prochaines questions (questions 1 à 4), veuillez cocher la réponse la plus appropriée

1. Veuillez indiquer dans quelle mesure le SI a-t-il satisfait à vos attentes

Hautement satisfait:	___	Satisfait:	___
Indifférent:	___	Insatisfait:	___
Hautement insatisfait:	___		

2. Veuillez évaluer l'efficacité du SI dans la satisfaction des besoins de l'organisation.

Extrêmement efficace:	___	Très efficace:	___
Passablement efficace:	___	Marginalement efficace:	___
Pas du tout efficace:	___		

3. Veuillez évaluer, au meilleur de vos connaissances, la viabilité économique du SI.

Les bénéfices excèdent de beaucoup les coûts:	___
Les bénéfices excèdent les coûts:	___
Les bénéfices sont à peu près égaux aux coûts.	___
Les bénéfices sont inférieurs aux coûts	___
Les bénéfices sont de beaucoup inférieurs aux coûts:	___

4. Veuillez indiquer votre niveau d'utilisation du SI

Toujours (100 % du temps):	___	Très fréquemment (environ 90 %)	___
Souvent (environ 75 %)	___	La moitié du temps (50 %)	___
Occasionnellement (environ 25 %)	___	Rarement (environ 10 %)	___
Jamais (0 %)	___		