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Managing User Expectations in Information Systems Development

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***Abstract*—**This paper provides new ways to explore the old problem of failure of information systems development in an organisation. Based on the theory of cognitive dissonance, information systems (IS) failure is defined as a gap between what the users expect from an information system and how well these expectations are met by the perceived performance of the delivered system. Bridging the expectation-perception gap requires that IS professionals make a radical change from being the proprietor of information systems and products to being service providers. In order to deliver systems and services that IS users perceive as valuable, IS people must become expert in determining and assessing users' expectations and perceptions. It is also suggested that the IS community, in general, has given relatively little attention to the front-end process of requirements specification for IS development. There is a simplistic belief that requirements are obtainable from users, they are then translatable into a formal specification. The process of information needs analysis is problematic and worthy of investigation.

***Keywords*—**Information Systems Development, Cognitive Dissonance, Expectation-Perception Gap, Requirements Analysis.

I. Introduction

AS early as in 1974, [16] recognised the importance of service quality as a major determinant of a user's positive reaction towards computer-based information systems (IS). Much IS research on user satisfaction (e.g., [23, 4, 3, 9]) also identified service delivery as vital. Due to the growth of end-user computing, information technology decentralisation and alternative sources of supply, information systems users possess substantial discretion in their use and purchase of IS functions [15]. Users now expect IS people to assist them with a myriad of tasks, such as hardware and software development, installation, connection to networks, problems solving, training and education, etc. Information systems professionals, as pointed out by [19], 'have expanded their roles from product developers and operations managers to become service providers' (p. 173). [19] suggests that IS departments should be viewed as a service enterprise responsible for providing business solutions rather than solely technical support, and individuals served by IS should be regarded as customers rather than users.

II. The Theory of Cognitive Dissonance

A service view of IS functions inevitably emphasizes the importance of managing users' expectations. A working definition of user expectations for information systems is proposed by [22] as 'a set of beliefs held by the targeted users of an information system associated with the eventual performance of the IS and with their performance using the system' (p. 494). Such a set of beliefs is formed by users in a very early phase of an IS development project. If the users perceive the performance of a delivered system is different from their beliefs, they will experience cognitive dissonance [10]. According to [22], this cognitive dissonance, beyond a threshold level, may cause the user to reject the IS, while at a lower level, it may result in a large number of error reports or change requests. Cognitive dissonance can occur even when the target system corresponds in every particular to the requirements formally agreed.

The theory of cognitive dissonance [22] suggests that: 'When an individual maintains two cognitive structures (ideas) that are inconsistent with one another, a psychological state of dissonance will occur. The individual will attempt to attain a state of consonance by changing one of the two cognitive structures' (pp. 493-494). Fig. 1 puts the theory of cognitive dissonance in IS context.

Fig. 1 illustrates the relationship between a user's expectations, perceptions and experience of a system. Disconfirmation occurs when expected performance and experienced performance of an IS differ from one another (see thick arrows B and C in Fig. 1). Cognitive dissonance predicts that when an individual experiences disconfirmation of expectations, his/her appraisal of the performance of the IS will be assimilated toward the expectation (see arrows X and Y). This results in the perception of the performance of the target system. When a user's expectation is greater than the perception, he/she will be disappointed (see shaded area P in Fig. 1). When a user's expectation is lower than the perception, he/she tends to undervalue the system.

Both user disappointment and under-valuation of a system have negative effects on the effectiveness of a delivered IS. A system with low effectiveness over time would naturally be regarded as a failure by its stakeholders. In this way, unrealistic levels of expectation from users (either unrealistically high or unrealistically low) are inimical to a project's success. System developers could reduce the chance of IS failure by helping users to generate appropriate expectations (at the notional point A of Fig. 1) of an information system.

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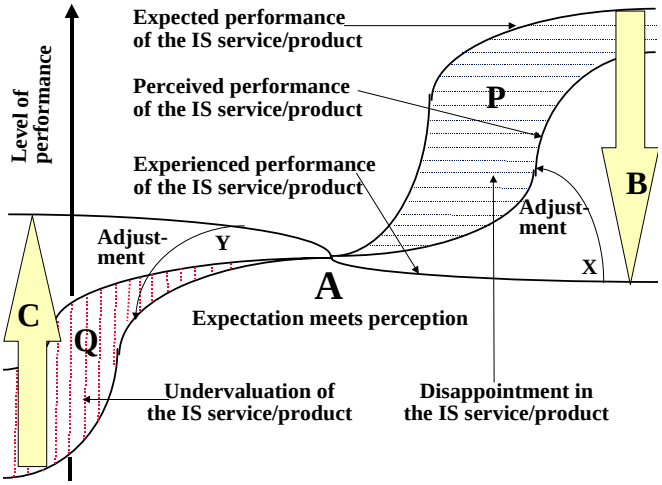

Fig. 1 The theory of cognitive dissonance in IS context

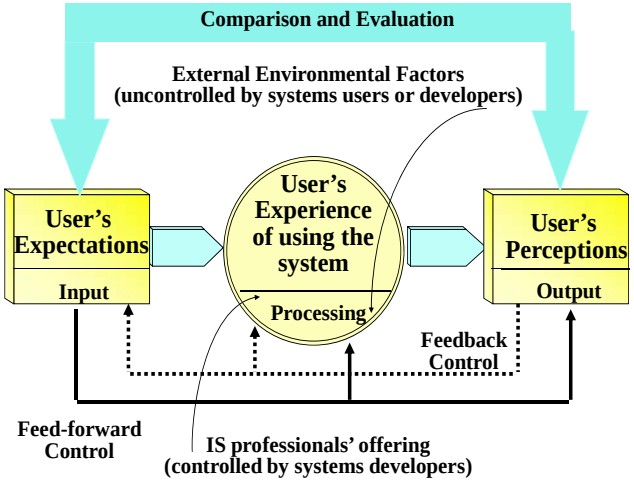

Fig. 2 The expectation-perception gap of IS development

III. An Expectation-Perception GAP as IS Failure

Based on the theory of cognitive dissonance, an IS failure can be can be assessed by a comparison of:

- an IS user's expectation of his/her requirements - stated or unstated, conscious or merely sensed, technically operational or entirely subjective, - and may be a moving target in a dynamic organisational environment, and
- the IS user's perception of the performance of the delivered system (based on conscious and unconscious judgement) after he/she has some experience of using the system.

IS failure is defined as a gap between user's expectation and perception of the performance of a delivered system. The expectation-perception gap or organisational failure of IS development is exhibited in Fig. 2.

An expectation-perception discrepancy related to a single transaction leads to user dissatisfaction. Incidences of dissatisfaction over time results in users' negative feeling and eventual rejection of the delivered information system. A delivered information system may not match users' expectations in one or more important aspects [20]: it may fail to provide sufficient functionality, its performance may be inadequate, or it may not provide a good fit with the organisation's practices and procedures. It may fail in all these respects, yet still conform to the functional, performance and design specifications formally agreed between users and developers at the outset. Systems developers may narrow the size of users' expectation-perception gap by managing the following three systems components depicted in Fig. 2:

- users' expectations of the IS as a form of feed-forward control;
- users' perceptions of the performance of the IS as a form of feedback control;
- users' experience of using the IS service or product as a form of process control.

IV. Managing User Expectations

User expectations, as discussed before, are the de facto requirements against which the success of a delivered system will be judged. Yet, most IS professionals have a mistaken idea about user expectations. The myth is that: 'Users don't know what they want. Users keep changing their minds.' System developers just wish users could work out ahead of time what they want and communicate the requirements to them in unambiguous writing. The identified requirements should then be signed and sealed once and for all. Unfortunately, such a positivistic view of requirements analysis is deemed to be too simplistic.

A. Requirements Analysis is not based on Positivism

User needs which shape user expectation do not "exist out there", ready for the "picking". The first task for IS specialists in systems development is the tackling of the 'problem of problem formulation' [6]. In fact, it may be misleading to assume that a problem exists rather than that one is constructed between various stakeholders adhering to different perspectives [12].

Users initiate an IS project when they experience a felt need for information, a holistic sense of something missing in the current system, or an awareness that technologies have the kind of capability which might help. It is legitimate for users to have only a very fuzzy idea of their requirements. User requirements are not easily articulated as they are often mental models in users' minds.

B. Users' Requirements are Constantly Changing

Even though users are able to say what they want, the problems are: what they say they want may not be what they need; what they want is continuously changing anyway; and users do not know what they might want in the future [2]. Systems users are embedded in a constantly changing organisational environment, involving relationships with other departments, funding, politics, difficult people and situation which are often unpredictable, apparently illogical and incomprehensible. In order to deal with the uncertainly, most

successful organisations have very flexible and responsive informal systems which grow and decay as required [11]. Under such circumstances, it is virtually impossible for the users to produce a set of unalterable requirement specifications.

As [11] puts it, 'No one can solve any problem where the nature of the problem is changing. Not software people, not anyone' (p. 218). The IS specialist has a difficult job trying to keep abreast of changes in technology. How much more difficult is it for those not familiar with computing to assess what their needs would be if they had access to substantial computing power [18].

C. Users have Limitations in Information Processing

Users' mental models, which generate their expectations of an IS project, are subject to distortion. This is because users, by being human, are limited in their capacity in information processing, and are biased in their selection of and demand for information [7]. [17] coined the phrase 'the magical number seven, plus or minus two' to describe human capability for processing information. It is believed that the number of symbols or 'chunks' human can hold in short-term memory is from five to nine, with a common limit of seven. To deal with this limitation, humans have built-in selection processes to filter out "overloaded" information [1]. The filtering criteria, however, in some cases, are based on bias.

Due to the availability bias, users may elucidate only those organisational requirements related to problems that are current, frequent and easier to recall from memory rather than those which are rare but perhaps more serious. After initial requirements are stated, users may selectively detect information to support only the original statement and do not undertake a fully comprehensive investigation. This is known as "confirmatory bias". "Representative bias" suggests that users tend to believe a small sample of transactions as being typical of the population from which it came.

V. Bridging the Expectation Gap

The above discussion explains why users' expectations are seldom rationalised or verbalised as most IS developers would expect. As managing user expectations is a key determinant of project success, all a systems analyst can do, in this respect, is to use tactics that may reduce the amount of user expectation that remains invisible, by eliciting as many expectations as possible form the IS users.

A. Provide users with a Basis for their Mental Models

According to [20], successful management of users' expectations requires "inducing" in (but not giving to) the users an appropriate mental model of the IS early in the project. Users have to develop their own models based on (among other factors) their background, training, profession and exposure to other information systems. Providing users with a metaphor or structure to use as a basis for their mental models increases the probability that users will formulate expectations that are more manageable to IS developers.

B. Use Scenarios to Predict User Future Requirements

The anchor provided by IS specialists should not only help users to visualise where they are, but also aid them to construct diverse pictures of where they are heading. The mechanisms employed should be able to stimulate users to think of different probable scenarios in their future working environment and the opportunities and problems they will have. Thus, instead of asking users simply to state those things which they particularly dislike with the current support system, analysts should guide users to identify their future information needs if the potential environmental changes do happen.

C. Do not Oversell the IS Project

During a project development, various activities set the level of users expectations. For example, the seller's presentation and proposals are designed to raise expectations to a level that secures contractual commitment from the users. However, this process may create the problem of overselling. As pointed out by [5] in a discussion of risk management: 'The sequential, document-driven waterfall process model tempts people to over-promise software capabilities in contractually binding requirements specifications before they understand their risk implications' (p. 32). This was confirmed by [8] with a warning: 'Apparently, formalising development plans in writing tends to ... raise user expectations without significantly improving their understanding of the systems development process' (p.8). Information systems professionals must thus be very careful and make sure their marketing strategies do not fuel user expectations to an unrealistic level which cannot be matched by the performance of the delivered system.

VI. Requirement Analysis - The Weak Link in IS Development

Tasks related to the front-end phase of information systems development is generally known as requirements specification. It starts at the point when someone has a need for information services, and ends (arbitrarily) when the needs are transformed into a blueprint for subsequent systems construction. There is an implicit belief that requirements specification is straightforward as needs are knowable and obtainable from users; they are then translatable and documentable into a formal specification. This view, unfortunately, is deemed too simplistic [12].

The truth is that "building the right system" is as important as "building the system right". It is recognised that the cost of correcting/modifying a system after installation or indeed after the early stages of the project development is high and likely to be greater than the cost of preparing an adequate requirements specification in the first place. As a rule of thumb, the cost of repairing an error rises by a factor of ten from one phase of development to the next [8], as shown in Fig. 3. The point is sufficiently clear: thorough organisational requirements analysis is a necessity for successful information systems development.

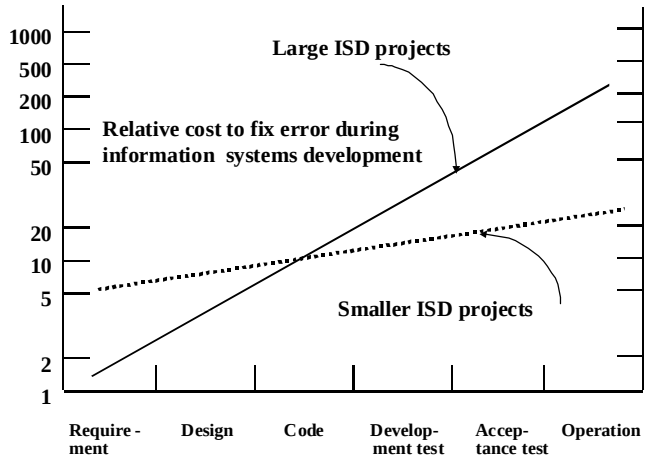

Fig. 3 Cost to fix errors during IS development

A. Thorough Organisational Requirements Analysis

To many systems developers, the "capture" of user requirements is considered to be the starting point of an IS project. This means that instead of effort being devoted to getting an understanding of the "relevance" of requirements to the perceived problems of the users, it is directed to "capturing" the requirements and recording them in increasingly rigorous form. The end point of an IS project is seen as the delivery of information systems to match the documented user requirements, whether or not the users' problems are solved.

The reality is that 'there is a vast difference between understanding needs and specifying requirements of systems' [21]. The term requirements specification is problematic as it draws two fundamentally different issues, 'requirements' and 'specification', into one process. Requirements are users' mental constructs. They describe the context of an information system, i.e., the work tasks that users can achieve by using the information system. On the other hand, a specification is oriented towards technology. It states the content of an information system, i.e., the attributes and behaviour of a system that developers have to deliver. Requirements are fuzzy, dynamic and ill-structured. A specification has to be formal, static and well defined. The requirement/specification distinction suggests that there are two identified phases of the process of organisational requirements analysis, namely the phases of organisation analysis and requirements specification as shown in Fig. 4.

Organisation analysis refers to the early process of developing a descriptive list of candidate requirements, detailing these requirements as much as possible over time, and then gaining an idea of their relative importance. Requirements specification refers to a later process of winnowing, reconciling, transforming and fully detailing the set of candidate requirements into a specification for a viable system. Both processes must be iterative and closely related to each other. A discrepancy between 'an IS as required' and 'an IS as specified' is largely responsible for most failure cases in systems development. Organisational requirement analysis, which remains as a 'weak link' [14] and vulnerable stage of IS development after two decades' effort, is thus particularly worthy of investigation.

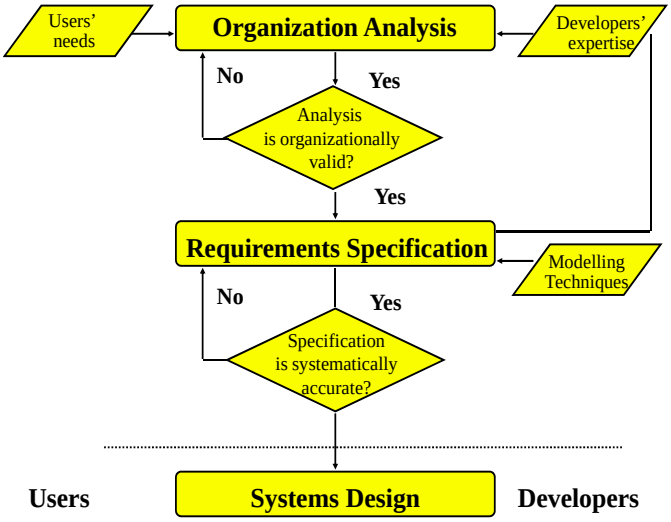

Fig. 4 Two phases of organisational requirements analysis

VII. Conclusion

Today, the delivery of information systems may best be viewed as business transactions between IS professionals and systems users. The managerial focus is directed at providing excellent services to users. Providing services that users perceive as excellent requires the service providers know what users need and want. Being wrong about users' requirements can mean spending money, time and other resources on things that do not count to users. Being wrong may even mean not surviving in a fiercely competitive market [24]. Helping users to set their expectations of the new system at an appropriate level is the first and possibly most crucial step in achieving project success. IS developers must be aware of the cognitive dissonance of users, and take measures to aid users to articulate what they want based on what they need now and possibly in the future.

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