An enriched view of decision making and information systems

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Abstract

The development of information technology (IT) over the last two decades has been very rapid indeed. In an IT-dominated field like information systems (IS), there tends to develop a kind of mismatch between practice and theory where yesterday’s theory is always trying to catch up with and make sense of practice which has already moved on. This paper takes a fresh look at some of the fundamental concepts relevant to the orderly provision of information within an organisation using IT. It discusses the subjective nature of organisational decision-making and proposes a holistic view of IS development.

The main role of an information system is that of support. Such systems exist to serve, help or support people taking action in the real world. Systems analysis aiming at information systems design, if it is to make much impact, must therefore first concentrate on the activity system of an organisation which the information system is to serve. It follows that any good IS development method should meet two criteria simultaneously: 1) it should provide mechanisms to make sense and understand the behaviour of human activities which an information system is developed to serve; 2) it should render a seamless transition between its resulting information requirements model and the process to design a technology based system to satisfy those requirements. Soft systems methods (SSM), being perception-driven, helps users understand what information they need and how to use the information. Object-oriented analysis (OOA), on the other hand, provides the base for building a data structure capable of satisfying the identified information needs. The two approaches could be complementary to each other in IS work. An integrated framework which encapsulates both methods has been developed and applied by the author in a requirements analysis project of the loan department of a commercial bank in Hong Kong.

This paper gives a full account of the integrated framework in action. The described case puts the interpretive view of IS development and decision making in practice. The learning and lessons drawn from the undertaken IS requirements analysis projects are discussed in context and in detail. Each lesson is argued by describing and reasoning the path from the actual practice to the lesson. The generalisations of this research refer to practice. This has reinforced the argument that the interpretive views of decision making and IS development is an experience-based knowledge.

1. An enriched model of the process of decision making

Information systems are seen as giving service to decision-makers of an organisation. The most common definitions of information and information systems are based on the support that they may give to decision-making. Here are two examples from IS textbooks:

- ‘Information is data that has been processed for a purpose. That purpose is to aid some kind of decision’ [1], p. 5;
- ‘Information is useful to a manager if it helps the manager’s choice of a course of action. To be precise, information is said to have value, and only if, it reduces the uncertainty in the manager’s decision problem’ [2], p. 14.

Thinking about decision-making within the field of IS has been dominated by the work of H.A. Simon [3]. In a survey of introductory texts, 84% of those texts that provided any discussion of the nature of decision-making included Simon’s three-phase model of decision-making and 50% presented this as the sole conceptual framework through which to understand decision-making [4]. Simon’s model represents decision-making as an explicit and consciously rational process, enacted by a neutral decision-maker, which involves the organisation and processing of information in order to carry out an intentional and rational act of choice. Such a rational model of decision-making is a prescriptive account of how a decision should be conducted but does not sit well with much experience of real world decision-making.
making, in which the decision-makers are influenced by political and social factors. According to [4], the simplistic way in which Simon’s work is employed in IS thinking, gives rise to three practical dangers (pp. 90-91):

- First, there is the danger of developing information systems to serve the decision-making that is thought to be happening (value free, politically neutral and objectively rational) rather than the decision-making which actually occurs.
- Secondly, there arises the danger of ignoring the important differences in organisational culture and history, which make organisations unique. This might lead to the provision of inappropriate information systems.
- Thirdly, IS analysis will ignore the important contribution which norms and standards make to the organisation’s understanding of the world and to the way in which mere data becomes perceived as meaningful and relevant to a decision.

Simon’s work has been the dominant model in IS so far, but it appears to give too little attention to the political and social conflicts and complexities of organisations. There is a growing interest in enriching the thinking of decision making through the concept of “appreciation” based on the work of Vickers [5]. A consistent thread of Vickers’ work is that the management of an organisation is primarily concerned not with goal-seeking but relationship managing. In order to maintain relationships, an organisation is constantly required to adapt to changing circumstances. Central to this adaptation is the “appreciation setting” of an organisation, which is defined as “readiness to see and value things in one way rather than another” [6], p. 160. [7] explain the operation of an appreciation system as a number of recursive loops as shown in Figure 1, where the organisation exists within a constantly changing and interacting flux of events and ideas. The process of appreciation is an on-going one through which the organisation perceives some part of this flux at a point of time, making judgements about what is perceived and, where necessary, attempting to maintain or elude relationships by actions.

![Figure 1: Appreciation, decision-making & action](image_url)

Vickers’ work does not provide an alternative model of decision-making of the same kind as Simon’s. ‘It does, however, allow us to understand the more intentional and prescriptive models in a way that is enlightening; for regarding individual decision-making as occurring within a context of appreciation leads us to an essentially different and more humanistic interpretation of the decision-making process’ [4] p. 95. The appreciative system provides a more useful model for understanding decision-making behaviour since it provides an explanation for the subjective content of decision-making. It guides ‘decision-makers to recognise particular aspects of a situation as relevant, towards a particular view of what data is needed and to a particular view of how the decision should be made’ [4] p. 97. With an
enriched, appreciative model of decision-making, human beings are recognised as autonomous rather than purely functional components of information systems. This implies the need for a shift in emphasis in IS work away from the purely technical towards the social and political environment.

2. An enriched view of information systems

Any and every organisational information system can always be thought about as entailing a pair of systems, one of which is served (people taking actions in an organisation), the other serving (meaning attribution and data processing) as shown in Figure 2 [8]. Whenever one system serves or supports another, it is a very basic principle that the necessary features of the system which serves can be worked out only on the basis of a prior account of the system served. This must be so because the nature of the system served – the way it is thought about – will dictate what counts as “service” and hence what functions the systems which provide that service must contain [9].

![Figure 2: The served-server concept](image)

The notion of a served-serving relationship between the organisation and its information systems suggests that both systems in Figure 2 are of equal importance. To understand information systems, we need to understand organisations, what they are, and how they work. The development of organisational information systems should be a two-stage process: 1) a business analysis, to make sense of the human activities performed in organisations; followed by 2) a technology-oriented analysis to define what technological facilities might support the organisational activities. Soft systems methods [10], being perception-driven, helps users understand what information they need and how to use the information. Object-oriented analysis [11], on the other hand, provides the base for building a data structure capable of satisfying the identified information needs. An integrated framework is thus developed for complementary application of both methods in IS requirements analysis as shown in Figure 3. Its elements are organised under the principles of good IS development (ISD) process implied by the enriched model of information systems (see Figure 2).

3. An application of the integrated framework – a case study

The following case present an illustrative use of the integrated framework (Figure 3) in real-life information needs analysis. It is written using a clear conceptual framework (see Figure 3) rather than a narrative. This helps to relate theory to the literature and aids generalisation. The generalisation from this single case study is about theoretical propositions not about population. The emphasis is not on methods or data but on understanding processes as they occur in their context.
3.1. Background of the case

The Alpha Bank (name disguised) is a licensed bank in Hong Kong. It operates cheque and savings accounts, and accepts deposits of different sizes and maturity dates. In the last decade, the bank has devoted a great deal of effort in producing innovation and broadening the scope of services, so deposits have grown rapidly. With a high degree of liquidity, the bank has taken a rather aggressive approach towards its lending business. Unfortunately, after the onset of the Asian financial crisis in the latter half of 1997, Hong Kong’s economy deteriorated drastically in the first half of 1998. Property and share prices fell sharply against the backdrop of high interest rates and tight liquidity. Volatile interest rates, tight liquidity, contracting credit extensions and increasing non-performing loans exerted tremendous pressure on the bank’s operation in the first half of 1998. Most loan officers of Alpha Bank also do not have sufficient credit-analysis skills to properly evaluate risk incurred in loans forwarded to customers. As a result, loan defaults have been on the increase since early 1998. In September 1998, the bank invited a team of analysts (with the author as a member) to reengineer its loan operation. One pioneer project was the setting up of a systematic procedure for overdraft approval.

3.2 Familiarisation with the organisational context

The organisational context of the systems analysis was the loan department of Alpha Bank. Because of persistent poor economic conditions in Hong Kong, the bank adhered strictly to a “progress with prudence” philosophy. The loan department was instructed to participate actively but cautiously in lending business. Loans or overdrafts should only be approved after careful assessment of the applicant’s financial creditability by the loan officers. The problematic situation of the organisation was summarised in a rich picture (Figure 4).

3.3. Formulation of relevant systems

Figure 4 not only reflected the richness of the situation of the loan department of Alpha Bank, it also allowed the project team to identify human activity systems that appeared relevant to that particular situation. Each identified human activity system was defined by a root definition and then expanded into conceptual models. After several discussions, the loan officers were able to come up with a shared meaning for the purposeful action relevant to their job duties. Figures 5 and 6 exhibit the root definition and conceptual model of the overdraft approval system respectively.
3.4. Determination of information needs

The accommodated conceptual model (Figure 6), once constructed, forms a cogent basis for an information model upon which the information system design process itself can be related. The conceptual information requirement of Alpha Bank was derived by analysing each activity in the conceptual model and examining what information categories should be available to enable the concerned staff to take that action. This activity model was thus converted into an information requirements specification as illustrated in Figure 7.

3.5. SSM based object-oriented analysis

What seemed to be beneficial to the loan department was the development of a technologically based data system that would yield the information flow required by the set of activities relevant to its overdraft approval operation. The Wider Intervention Framework adopted object-oriented analysis [11] as a step to move from information categories to data modelling. The approach taken was to embed the object-oriented analysis (OOA) techniques within soft systems methods (SSM) in order to preserve the philosophy and richness of the latter methodology. The OO diagrams, such as the event diagram (Figure 8), object-flow diagram (Figure 9) and object diagrams (Figure 10) were derived to a large extent from the activities in the SSM models.

3.6. Change, action and exit

Stage four of the integrated framework (Figure 3) is a linkage between conceptual systems analysis and real world systems design. The object models exhibited from Figure 8 to Figure 10 provided a base for the construction of IT systems which are meaningful to the loan officers of Alpha Bank. The enquiry process of SSM also constituted a learning system which has guided the staff members of the loan department to take a fresh look at the problem situation of the lending business and the bank’s operation as a whole. Such a fresh look has alerted the participants that the bank can no longer rely solely on traditional ways of doing business. Technologically-oriented products, for example, an expert system that performs credit analysis, would be needed to make the bank more efficient. The loan department should also upgrade its cash-management services to help corporate borrowers make the most of their money - and to earn the bank more fees. The management of Alpha Bank in general regarded changes as inevitable. Once logically desirable and culturally feasible changes were identified for the loan department of the Alpha Bank, practical actions were taken to implement the changes. The end point of the project was marked (arbitrarily) by the introduction of an IT-based decision support system for overdraft approval to the loan department.
Root Definition:
A bank owned and operated system to process applications for overdrafts from current account customers. The approval or denial of the application is subject to the bank’s credit assessment of the applicant.

Customers of the system:

<table>
<thead>
<tr>
<th>Advantaged: Loan officer</th>
<th>Disadvantaged:</th>
<th>Other Stakeholders: Current account customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actors</td>
<td>Loan officer and other staff of the bank</td>
<td></td>
</tr>
<tr>
<td>Transformation</td>
<td>From: Needs of making a decision on overdraft applications from current account customers</td>
<td>To: Those needs satisfied by performing proper credit assessment of the applicants</td>
</tr>
<tr>
<td>Weltanschauung</td>
<td>It is appropriate to approve or deny an overdraft application based on the loan officer’s credit assessment of the applicant</td>
<td></td>
</tr>
<tr>
<td>Owner:</td>
<td>The bank</td>
<td></td>
</tr>
</tbody>
</table>

Environmental Constraints

Constraints imposed by environment:
- The bank should endeavour to ensure that the applicant understands the principal terms and conditions of an overdraft

Constraints accepted in modelling:
- Only customers of the bank with a current account of at least 6 months can avail of the facility of overdrafts against their current accounts
- The loan officer may approve, deny or defer an overdraft application

XYZ analysis: The system expressed as ‘a system to do X by Y in order to achieve Z’

X: to process overdraft applications
Y: performing credit assessment
Z: to promote the leading business of the bank

Three ‘E’s analysis: Declaration of the measures of performance

Efficacy: Does the output count as ‘process overdraft application’?
Efficiency: Was resources use minimum?
Effectiveness: Does the provision of overdraft facilities serve to promote the leading business of the bank?

Figure 5: The root definition of ‘a system to process applications for overdrafts from current account customer’
### Table 1: Information requirements analysis for the overdraft approval system of Alpha Bank

<table>
<thead>
<tr>
<th>Activities from the model</th>
<th>Input information needed</th>
<th>Source of input information</th>
<th>Output information generated</th>
<th>Recipient of output information</th>
</tr>
</thead>
</table>
| 1 Check eligibility of the applicant | • Overdraft application  
• Customer particulars  
• Account record  
• Court Writ  
• Loan officer | • Environment  
• Control & monitor system  
• Control & monitor system  
• Environment  
• Control & monitor system | • Valid application  
• Decision on the acceptance of the application | • Activity 2  
• Environment |
| **Checklist for the completion of the activity** |  
• The customer status of the applicant is validated  
• The ages of the applicant’s current accounts are checked  
• The applicant is confirmed with no court writ restriction  
• Decision on the acceptance/denial/deferral of the application is made  
• Suggestions are made to non-eligible applicants |
| 2 Assess the application | • Valid application  
• Transaction record  
• Customer particulars  
• Account record  
• Borrowing regulation | • Activity 1  
• Control & monitor system  
• Control & monitor system  
• Control & monitor system  
• Environment | • Assessment record  
• Applicant’s portfolio | • Activity 3  
• Activity 3 |
| **Checklist for the completion of the activity** |  
• Transaction records of the applicant’s accounts are obtained and reviewed  
• Interviews with the applicant are schedule and held  
• General borrowing regulations of the bank are explained to the applicant |
| 3 Make decision on the overdraft application | • Assessment record  
• Applicant’s portfolio  
• Borrowing regulation | • Activity 3  
• Activity 3  
• Environment | • Conclusion of credit assessment  
• Overdraft limit  
• Interest rate for the overdraft amount  
• Decision on the application | • Activity 4  
• Activity 4  
• Activity 4  
• Activity 4 |
| **Checklist for the completion of the activity** |  
• Applicant’s portfolio is studied  
• Credit analysis is performed  
• Results of credit assessment are concluded  
• Overdraft limited is assigned  
• Interest rate for the overdraft amount is assigned  
• Decision on the approval/denial/deferral of the overdraft application is made |
| 4 Take related administrative procedures | • Conclusion of credit assessment  
• Overdraft limit  
• Interest rate for the overdraft amount  
• Decision on the application  
• Account record | • Activity 4  
• Activity 4  
• Activity 4  
• Activity 4  
• Control & monitor system | • Decision on the application  
• Assigned terms of borrowing  
• Updated account record | • Environment  
• Environment  
• Control & monitor system |
| **Checklist for the completion of the activity** |  
• Decision on the approval/denial/deferral of the overdraft application is confirmed to the applicant  
• Further information is requested from the applicant in case of application deferral  
• The assigned overdraft limit and interest rate is confirmed to the applicant  
• The applicant’s current account is updated the overdraft limit and interest rate in an approval case |
Figure 8: An event diagram of overdraft approval of Alpha Bank
Figure 6: The conceptual model of ‘a system to process applications for overdrafts from current account customer’

Figure 10: An object diagram of overdraft approval

Figure 9: An object-flow diagram of overdraft approval

4. Conclusion

The key features of the information systems development process implied by the above discussion are now clear. From an analysis of the information systems support appropriate for whoever is concerned with taking the intentional actions, and it is now – and only now – legitimate to turn attention to the system that will provide the support. We can think of the support system as containing a data processing element, a data storage element as well as those who operate, maintain and modify it. This simple model of the support system can then accommodate various hardware and software configurations and the selection of a suitable one becomes an issue calling for the expertise of the IT professional.
References


