



A Quantitative Assessment of IT Risk Factors in Developing Countries: The Case of Oman

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ABSTRACT

A summary is presented of some of the IT risk factors that have been identified in developing countries. These are then used to put into context a quantitative survey that was conducted in the public sector in Oman. The objective of the survey was to identify and prioritise risk factors that surround IT deployment in the Omani public sector. It was found that risk indifference, lack of unified IT strategy and poor IT infrastructure are at the top of Omani IT professionals concerns.

INTRODUCTION

Deploying Information Technology (IT) is a challenging, risk laden, exercise for IT implementers. To mitigate such risks a number of both quantitative and qualitative risk management approaches have been proposed, for instance (Keil et al, 1998 & Kontio and Basili, 1997), however, each approach it is critical that the relevant risk factors of a project can be effectively identified and assessed. Over the past twenty years typical risk factors for such projects have been reported in the literature, however, these have arisen from a predominantly western/developed-country perspective. More recent studies have shown that some of the risks encountered in IT deployment within developing countries differ from those of the developed world: these are often related to specific cultural and organisational characteristics, see for instance, Badri (1992) & Harris and Davison (1999). Comparative analysis of these two sets of literature seems to indicate that, whereas developed "western" countries concentrate on IT strategic issues, developing societies are pre-occupied by operational issues: such as management's awareness of MIS capabilities, human resource development, quality of data and standards (Palvia and Palvia, 1996). This is, perhaps is due to the late introduction of IT in many developing countries.

The literature addressing IT issues in the developing world includes analysis of

- Saudi Arabia (Attiyyah, 1989),
- Pakistan (Hassan, 1994),
- Bahrain (Khan, 1991),
- Oman (Jawad and Reeve, 1997),
- India (Joshi and Sauter, 1991), and
- Singapore (Sircar and Rao, 1986).

Other articles examining a cluster of countries include:

- Gulf Cooperation Council (GCC) countries (Badri, 1992), and
- China, Hong Kong, Malaysia, New Zealand, Tanzania, and Thailand (Harris and Davison, 1999).

In this paper we focus on the specific case of IT deployment in the Omani public sector. Oman has an area of 312,000 square kilometres in the east of the Arabian Peninsula, and a population of 2.3 million (Ministry of National Economy, 2000). It is one of the six GCC countries (which share many cultural, economical, historical, and geographical ties (Badri 1992)). IT usage has increased very quickly in Oman in the last two decades. Unfortunately, with the increasing sophistication of the systems used, and the prevalence of IT within government organisations, there has been an associated growth in IT

deployment risks. We seek to identify and discuss these risks within the remainder of this paper.

RESEARCH DESIGN

The authors aim to develop and evaluate a risk framework for IT deployment in Omani government departments. The project has four phases, Figure 1 summarises these, and follows Eisenhardt's (1989) approach.

Phases I and II are complete. Phase I used expert opinion and focus groups within Oman to define an initial set of risk factors that were considered to be relevant (Al-Wohaibi et al, forthcoming). The resultant factors (and their categorization) are shown in Table-1.

Figure 1: The research methodology phases

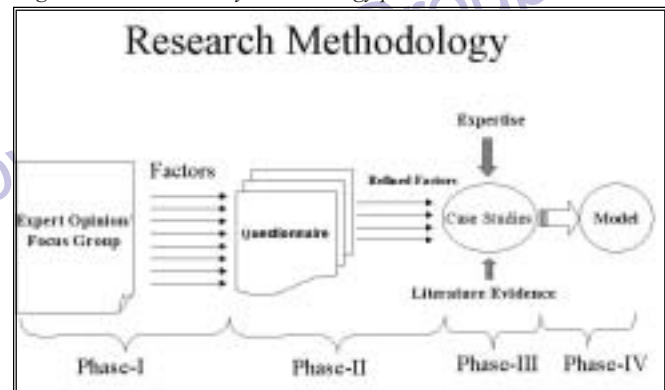


Table 1: A summary of "Omani" risk factors identified in Phase I

CATEGORY	FACTOR	DISCUSSED ELSEWHERE
Human resource deficiency	Limited expertise	Khan, 1991 & Moynihan, 1997
	Non-technical IT management	*
	Poor training	Jordan, 2000
Organisational inefficiencies	Lack of IT technical awareness	Moynihan, 1997
	Bureaucratic decision making	Flowers, 1996; and Keil et al, 1998
	Lack of unified IT strategy	*
	Poor IT infrastructure	Palvia and Palvia, 1996
Immature IT business culture	Limited use of project management approaches	Abdel-Hamid and Madnik, 1990
	Risk indifference	Kontio and Basili, 1997
	Lack of collaboration	*
	Lack of public oversights	*
	Reliance on localised systems solutions	Flowers, 1996, p 128

Survey Design

In Phase II an attitudinal questionnaire was developed (based on these initial results), issued, and the results analysed: this is the focus of the current paper. The Phase II results are inputs to Phase III providing a structure around which to conduct comparative case studies of current Omani government IT projects. We sought to evaluate the following question: "What is the perception of the critical risk factors facing IT deployment in Oman?" Questionnaires were mailed to the most senior IT official in each of the thirty government departments of Oman, with the request that the predefined factors be rated, and that any additional factors should be added and rated.

The questionnaire was divided into three sections. The first collected general information about the organization and the respondent (including procurement methods, size of IT department, role, experience, and qualification of the respondent). The second asked the respondents to rate the impact of the factors in their organisations: a Likert scale was used for rating (Frankfort-Nachmias and Nachmias, 1992). For each factor, five values were used: *critical*, *high*, *medium*, *low* and *not relevant*, with associated numbers (5,4,3,2,1). The third section encouraged respondents to specify previously unmentioned factors that they strongly felt generated risks within their organization.

A pilot survey was conducted after the initial design using five experienced IT professionals. Twice the surveyor was present which was beneficial as it enabled discussion about the questionnaire format and content: as a result of the pilot minor modifications were made.

The Data Analysis Approach

The risk specific information collected from the questionnaires was collated and coded in a database to enable computer-supported analysis. Thereafter, the factors were prioritised in order of significance. To accomplish this two ranking approaches were used: percentage and mean.

Percentage Rating

The percentage of respondents marking a factor as "*critical*" or "*high*" was calculated. Ultimately, for factors to be classified as significant they needed to score a value of 50% or more (this is similar to the approach used by Keil et al (1998)). Once the percentage rating is calculated the factors can be ranked.

Mean Rating

The raw data provided by each respondent was used to calculate the mean of each factor. In this scheme the numeric scaling values are used, thus for any one factor its mean (and standard deviation) could be calculated. The authors were wary of using the mean alone since there are doubts about its reliability, since it is affected by extreme values. However, in practice, the risk factor rankings determined using the two approaches were very similar.

FINDINGS AND DISCUSSIONS

Summary of Data Analysis

Before discussing the resultant analysis of the risk factors we summarise the respondents' profiles.

- Within the roles there were: 18 Directors (72%), 1 Consultant (4%), 5 Manager/Section Heads (20%) and 1 "other" (4%).
- Their academic qualifications were: 2 PhDs (8%), 7 Master Degrees (28%), 12 Bachelor of Science Degrees (48%), 3 IT diplomas (12%), and 1 other (4%). In particular, 84% held at least a Bachelor of Science degree in an IT related subject.
- In terms of project management: 4 had managed 1-3 projects (16%), 4 had managed 4-6 projects, and 17 had managed more than 6 projects (68%).
- In terms of IT Experience: only 1 had less than a one year (4%), 5 had between 1 and 5 years (20%), 3 had between 6 and 8 years (12%), and 16 had more than 8 years experience (64%).

The profiles indicate that the respondents were predominantly experienced and formally educated IT professionals. Moreover, with their experience they could be expected to have a strong awareness of the risk issues facing IT deployment in Oman.

The analysis of risk factor data provided rankings based on the percentage and mean (as outlined above). The resultant risk factor rankings, shown in Table-2, were very similar: the only difference in placement occurs for factors 1 and 2, and 5 and 6. The data was also analysed to detect any correlations between factors. Only four have any notable values (over 0.6, these will be identified where appropriate).

Table 2: Summary of factor rankings including analysis of percentage rankings for grouped respondents

Factor	For all respondents					%age ranking By role			
	%age-based ranking	Mean	Std Dev	Mean-based ranking		Director	Other	8 or more years	Less than 8 years
Risk Indifference	72	1	3.84	0.8	2	3	1	3	2
Lack of Unified IT strategy	70	2	3.94	0.86	1	2	2	1	1
Poor IT Infrastructure	60	3	3.64	1.49	3	1	11	7	3
Lack of IT Technical Awareness	60	3	3.6	0.76	4	6	3	5	4
Lack of Collaboration	60	3	3.56	1.12	6	4	10	4	9
Limited use of Project Management Approaches	56	6	3.59	0.76	5	5	5	2	11
Poor IT Training	52	7	3.48	0.83	7	7	8	6	5
Limited IT Expertise	50	8	3.4	0.84	8	8	6	8	8
Reliance on Localised Systems Solutions	48	9	3.34	0.69	9	9	9	10	7
Bureaucratic Decision Making	46	10	3.33	0.72	10	10	4	11	6
Non-Technical IT Management	44	11	3.32	0.9	11	11	7	9	10
Lack of Public Oversight	40	12	2.92	1.44	12	12	12	12	12

In addition to the rankings using the full data sets the data was analysed by grouping respondents based on role and experience. As indicated, there is little change to the rankings as a result of this discrimination, however where discrepancies are apparent these are discussed in section 3.2.

Significant Risk Factors in Oman

Based on the "50%" rule for the percentage rankings, Table-2 identifies eight factors that are believed to be important in Oman. The two factors of "risk indifference" and "lack of unified IT strategy" are within the top three for all ranking analyses that have been undertaken. Within this section we discuss the findings for each of the eight significant factors, in order of the percentage-based ranking.

Risk Indifference (Ranking: 1)

This factor was top of the list of important factors affecting IT deployment in Omani government organisations. It also stayed as one of the three most significant factors whether grouping respondents by roles or experience.

Lack of Unified IT Strategy (Ranking: 2)

This factor was one of the top three factors when grouping respondents by roles or experience. This corroborates Badri's (1992) study of IS issues facing IT chief executives in the GCC where incorporating IS strategy was top of executives concerns.

Poor IT Infrastructure, Lack of IT Technical Awareness, and Lack of Collaboration (Each Ranking: 3)

Poor IT infrastructure, Lack of IT technical awareness, and Lack of collaboration were equally ranked (by percentages). However, deviation in this ranking can be observed when the respondents are grouped based on role and experience.

The risk of "Poor IT infrastructure" is placed at opposite ends of the spectrum by the directors and other roles: although when the data is analysed on the basis of experience in IT it is brought more into the middle ground. It is not clear how the "years of experience" and roles

of the respondents correlate, but perhaps it can be inferred that the directorate level sees the establishment of the IT infrastructure as strategically important for the future. Whereas those at middle management and operational level are less concerned with such issues. Similarly, "lack of collaboration" is placed at opposite end of the ranking by the directors and others, with similar discrepancies between the respondents based on years of IT experience. This factor can also be considered as essentially strategic in nature. The underlying issues need to be explored within the case study phase of the research. The "lack of IT technical awareness" occupies the middle risk range for all groupings: reflecting that both operational and strategic issues are affected by this factor.

Limited Use of Project Management Approaches (Ranking: 6)

This factor is confirmed as a mid-level risk whether the data is analysed on the percentage basis for all respondents, on a mean basis (where it is ranked 5th) or for the groups discriminated by role. However, there is deviation in the assessment of this risk when the respondents are grouped by IT experience. The more experienced group rank it highly, in second place, whereas the less experienced group place this near the bottom (as a minor risk) in 11th place. This is an issue to explore within the next case study phase to determine whether the high rank among more the experienced group reflects their involvement in a more expensive range of projects where the need for good management is apparent. The predominant view that this is a significant risk factor is confirmed in the literature where the ability of managers to make reasonable estimates is important for system success (Grafton and Bytheway, 1996).

Poor IT Training (ranking: 7) and Limited IT Expertise (Ranking: 8)

These factors are both seen as low (but not insignificant) IT deployment risks by the respondents. They have been acknowledged as risks in software projects by other researchers. For instance, insufficient staffing has been isolated as one risk facing software projects worldwide (Keil et al, 1998), and Jordan (2000) believes training is a fundamental requirement in IT investment. Tallon and Kraemer (2000) have claimed that the availability of young trained IT workforce was a key attractor for multinational companies locating to Ireland during the 1980s.

Minor Risk Factors

Four risk factors did not pass the "50%" criterion: therefore, these factors are considered to have minor impact on IT deployment in Oman. The factors are: Reliance on Localised Systems Solutions, Bureaucratic Decision Making, Non-Technical IT Management, and Lack of Public Oversight.

"Reliance on localised systems solutions" was near the border at 48%. This factor and "limited use of project management approaches" had a correlation coefficient of 0.62, perhaps indicating that risk mitigation of the latter factor could impact positively on the deployment of localised solutions.

"Bureaucratic decision making" was seen as important only by the non-director group, however, it is strongly correlated (0.68) with a lack of technical awareness, possibly indicating that for those uncertain of their skills there is "safety" in adopting bureaucratic approaches as personal accountability can be limited.

The factor "Non-technical IT management" was perceived as relatively unimportant: the only dissenting voice being the "other" group perhaps reflecting some experience within this group of being managed ineffectively by non-technical managers. However, the profile data (see section 3.1) indicates that all the respondent IT departments have an IT-qualified head.

"Lack of public oversight" is seen as an insignificant risk for all groupings and both ranking methods. This correlates with Watad's (1999) study of local government in Colombia: he argues that public scrutiny may inhibit IT adoption as public managers tend to be conservative rather than innovative with IT applications, reacting more to

external pressures than taking initiatives. These views contrast with Flowers' (1996) findings that western governments' projects experience a high level of public scrutiny.

Additional Factors

Some respondents listed additional risk factors. These factors can be grouped into three categories: (i) those that were in the original questionnaire but were rephrased (ii) those outside the scope of IT deployment and (iii) those relevant to the research and that may be considered in subsequent enquiries. The set of new factors were:

- Presence of IT Champion
- Realistic Project Objectives
- Lack of Top Management Support
- Dynamic IT Technology
- Emphasis of political factors over pragmatic factors
- Third Part Consultancy

The first four factors have been observed and reported elsewhere for instance (Watad, 1999). However, it is interesting to note that in Jawad and Reeves' (1997) study they determined that the "*the concept of IT champion does not exist in Oman*". The emergence of this factor now may signify a maturing IT environment in Oman. The fifth factor "emphasis of political factors over pragmatic factors" is similar to the micro contingent variable "power and politics" identified by Markus (1983) and confirmed by others. The sixth factor "third party consultancy" is viewed by some IT directors as an opportunity (consultants acting as catalysts) but it is also frequently identified as a risk. For instance, the Standish Group review of 16,000 IT projects noted that none of the projects with heavy participation by large consultancies were completed on time or within budget (Jonson, 1997). Jonson (1997) records that consultants are typically paid on "time spent" "... *so the more time they take to complete a project, the more revenue they get. It's a built-in conflict of interest.*"

CONCLUSION

The attitudinal survey has enabled the researchers to evaluate the relative perceived importance of the risk factors derived in Phase I of the project to analyse these against the existing literature. There is evidence to show that risk indifference, lack of unified IT strategy and poor IT infrastructure are at the top of Omani IT professionals' concerns. These perhaps reflect the comparative immaturity of IT culture in Oman. Within this research project the next phase will undertake detailed case studies of selected IT projects from the Omani government. In-depth interviews with IT managers, system analysts and selected users, explore and establish the relevancy of the factors that were earlier identified by the questionnaire. These will enable the design of an appropriate risk assessment model for the Omani public sector. The fourth and final phase of the research will be to test this model on a wider range of projects.

REFERENCES

- Abdel-Hamid, T. & Madnik, S. (1990). The Elusive silver lining: how we fail to learn from software development failures. *Sloan Management Review*. 32 (1), 39-48.
- Al-Wohaibi, Mohammed Ali., Fawaz A. Masoud, and Helen M. Edwards. (Forthcoming). Fundamental risk factors in deploying IT/IS projects in Omani government organisations. *Journal of Global Information Management*.
- Attiyyah, Hamid S. (1989). Determinants of Computer System Effectiveness in Saudi Arabian Public Organisations. *International Studies of Management and Organisation*. 19(2). 85-103.
- Badri, M. A. (1992). Critical Issues in Information Systems Management: An International Perspective. *International Journal of Information Management*. 12, 179-191.
- Eisenhardt, Kathleen M. (1989). Building Theories from Case Study Research. *Academy of Management Review*. 14(4). 532-550.
- Flowers, Stephen (1996). *Software Failure: management failure*. John Wiley: West Sussex.

- Frankfort-Nachmias, C. and D. Nachmias (1992). *Research Methods in Social Science*, Fourth edition, Edward Arnold.
- Graften, Whyte and Bytheyway (1996). Factors affecting information systems success. *International Journal of service Industry Management*. 7(1). 74-93.
- Harris, Roger and Robert Davison. (1999). Anxiety and Involvement: Cultural Dimensions of Attitudes Toward Computers in Developing Societies. *Journal of Global Information Management*. 7(1). 26-38.
- Hassan, Syed Zahoor. (1994). Environmental Constraints in Utilizing Information Technologies in Pakistan. *Journal of Global Information Management*. 2(4). 30-39.
- Jawad, Ali Qaism and Richard Reeves. (1997). Successful Acquisition of IT systems. *RandD Management Centre*, Cranfield University, 1997
- Jonson, (1997). "Tipping the scales your way." *Datamation*. Sept 1997: "<http://datamation.earthweb.com/servc/11outlit.html>"
- Jordan, Dianne. (2000). Training Should be Strategic Issue for CEOs. *Information Management*. 13(3/4), 12-13.
- Joshi, K. and V. L. Sauter. The opportunities and Constraints Affecting an Informatics Policy: The India experience. *Information and Management*. 20(5) 313-322.
- Keil, M, Paul, E., Lyytinen, K, and Schmidt, R. C. (1998). A framework for identifying software project risks. *Communication of the ACM*. 41(11), 76-83.
- Khan, Emdad. (1991). Organization and Management of Information Systems Functions; comparative study of selected organizations in Bahrain. *Information and Management*. 21. 73-85.
- Kontio, Jyrki and Basili, Victor R. (1997). Empirical Evaluation of a Risk Management Method. *SEI Conference on Risk Management*. Atlantic City, NJ.
- Markus, M. L. (1983). Power, Politics, and MIS Implementation. *Communications of the ACM*. 26(6). 430-444.
- Ministry of National Economy (2000). *Facts and Figures 1999*. Information and Publication Centre, Muscat, Oman.
- Moynihan, T. (1997). How Experienced project Managers Assess Risk. *IEEE Software*. 14(3), 35-41.
- Palvia, Prashant C., and Palvia Shailendra C. (1996). Understanding the global information technology environment: Representative World Issues. In: *Global Information Technology and Systems Management*. Palvia, Prashant C., Palvia Shailendra C., and Edwards, M. Roche (Edt). Ivy League Publishing: Nashua, NH, USA.
- Sircar, S. and Rao, Venkata. (1986). Information Resource Management in Singapore: The State of the Art. *Information and Management*. 11(4). 181-190.
- Tallon, Paul P., and Kraemer, Kenneth L. (2000). Information Technology and Economic Development: Ireland's Coming of Age with Lessons for Developing Countries. *Journal of Global Information Technology Management*. 3(2). 4-23.
- Watad, Mahmoud M., (1999). The Context of Introducing IT/IS-Based Innovation into Local Government in Colombia. *Journal of Global Information Management*. 7(1), 39-45.

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