The Feasibility Study in Information Systems: an Analysis of Criteria and Contents

By: Prashant Palvia and Shaiiendra Palvia

Palvia, P. and Palvia, S. "The Feasibility Study in Information Systems: An Analysis of Criteria and Contents," Information & Management, Vol. 14 (1988), pp. 211-224.

Abstract:
The feasibility study has been prescribed and described as an important step in information system development. Yet there has been little research on issues pertaining to its con-tents and criteria. This paper addresses these issues and reports research from a quasi-experimental investigation using actual system development projects. The empirical results show that the two most important factors in a feasibility study are: convincing the users that the system they get will actually meet their functional requirements, and also that the system will work effectively within the organizational environment. A surprising result was the low importance attached by respondents to meeting the needs of the clerical personnel providing inputs to and handling the outputs from the system. Also. economic factors, which have been the focus of attention for many researchers. were ranked in the middle of all factors considered.
Keywords: Feasibility studies, Cost/benefit analysis, User involvement. Quasi-experimental design. Life cycle methodologies, Transactional systems, Management information systems, Systems analysis and design, System evaluation.

Article:

1. Introduction

The importance of the feasibility study has been stressed almost unanimously by most researchers and authors in the information systems field. For example, most text-book authors, researchers, and practitioner methodologies in the area of systems analysis and design identify the feasibility study as one of the important phases of the system development life cycle [10,13-17,23, 33,40,47,49]. In fact, in most organizations, it is common to include a feasibility study as part of any major system development, effort. In spite of this agreement, the research literature does not report much about feasibility studies. For example, Ives and Olson [24], while reviewing the " user involvement" literature, did not cite a single paper directly related to feasibility studies.

In this paper, we address the central question: what should be the contents of a feasibility study? Prior research related to feasibility studies is either indirect or addresses only certain specific issues. The importance of the feasibility study is generally established in the context of the system development methodology [9,38,43] and the context of user/management involvement [11]. An aspect of feasibility studies which has received considerable attention is the cost/benefit analysis [19,26,32,42, 48]. However, in these studies, other factors related to the feasibility study have been either sidestepped or lumped as intangibles. Many textbooks and research articles [e.g. 2, 22, 29] have advocated the consideration of other factors besides costs and benefits. *Figure 1* [1] *is* a summary of the factors and criteria listed in recent systems texts. The inclusion of factors in these works is based largely on common sense and intuition, and further there is no prioritization of the factors. One article [3] develops and evaluates several factors; however these factors relate specifically to user satisfaction with computer services. Another article [34] evaluates the relative importance of several factors; but the evaluation is for the decision support system project approval process. There is also a body of literature on information systems evaluation [1,6,20,28,44] but this research focuses on information systems already in place.

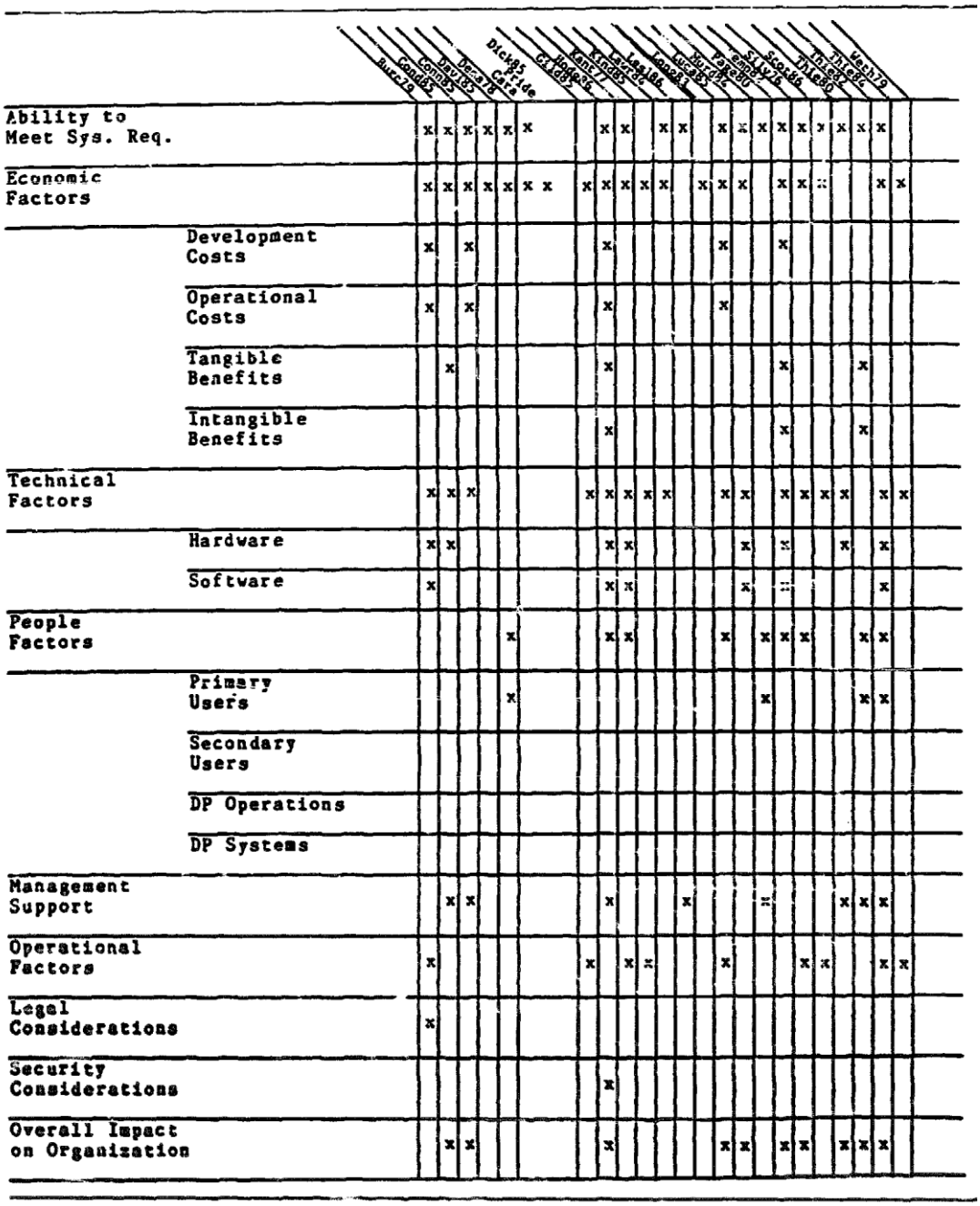

Fig. 1. Literature review of feasibility study criteria.

2. Study Goals

In order to identify the issues related to the feasibility study, we first examine the definition of a feasibility study. A commonly accepted definition of a feasibility study/analysis is:

> A feasibility study/analysis aids in evaluating the suitability of a single or multiple proposed system solution(s) to an identified business problem according to a set of criteria.

The set of criteria may be explicitly or implicitly applied in the evaluation of the system proposals. It is worth noting that the feasibility study itself is generally prepared by the system analysts/ technical staff with possible assistance from the user group. The actual evaluation is made by the user management and/or top management, with assistance from systems analysts/technical staff. Thus the feasibility study (including its preparation and evaluation) offers an excellent vehicle for achieving user involvement and commitment, as has been strongly recommended for successful system development [e.g. 11. 24].

The set of criteria (termed *criteria factors* or *factors)* by which the proposed systems solutions are to be evaluated determine what should be included in the feasibility study. It should, at least, address the criteria factors in order of their relative importance. In addition to these, the study may address other factors for "informational" reasons. However. addressing the criteria factors is critical for the preparation of the feasibility study. Therefore, in the spirit of the Parets distribution (80-20 rule), we concentrate on the contents of the feasibility study relative to the criteria factors.

The following objectives were established for our research:

A. Identify and prioritize the set of criteria by which the feasibility study should examine *the* system proposal(s).

B. Identify possible differences in the evaluation criteria and their importance from the perspective of different stakeholders (user *vs* analyst) of the system under development.

C. Identify possible differences in the evaluation criteria and their importance relative to the type of system being developed.

D. Assess the overall adequacy of the feasibility study, as well as the adequacy from the analyst's and ,user's viewpoints.

Exhibit i
Some business systems developed by the project teams.

- Point-of-sales system for a bookstore.
- Order entry, billing, and accounts receivable system for a furniture company.
- Inventory control system for a restaurant.
- Accounts payable system for a retail business.
- Client tracking, mailing, and scheduling system for a law firm.
- Sales and inventory system for a beauty parlor.
- Quote tracking and expediting system for a heatdetector company.
- Employee attendance, lateness, and benefits system for a rail car manufacturer.
- Inventory control system for an auto parts store.
- Quality control improvement system for an electronics firm.
- Customer inquiry and response tracking system for a manufacturing company.
- Image enhancement and advertising system for a bus company.
- Undergraduate catalog production system for a university.

3. Research Methodology

The research methodology was quasi-experimental. An empirical opinion-based study of professionals in the field would have yielded less-than-accurate "perception" data about the issues. A tightly controlled experimental study was deemed impractical because of the enormous effort needed in its preparation, administration and evaluation. Instead, we conducted semi-controlled experiments, where data was collected from analysts and users at the time of presentation of the feasibility study for actual system development projects.

The research was conducted in a two-year period, from 1983 to 1985, at two major American universities.[2] The authors taught project-oriented systems analysis and design classes at these universities. Each class was divided

into teams of three to five students. Each team worked on developing (i.e. defining, designing, and implementing) a real business system for industry or academia (as opposed to working, on case studies). Some examples of the business systems developed by the teams are listed in Exhibit 1.

A system development life cycle (SDLC) model was followed in building the system. The analysis and design part included the following phases/ documents:

A. Investigating Proposal/Problem Statement

B. Requirements Study

C. Alternative System Proposals

D. Feasibility Analysis/Study

E. Detailed System Design

F. Draft User Manual.

Similar life cycle methodologies are presented in many references [e.g. 8, 18, 30, 31, 45, 49]. However, the timing of the feasibility study is not very well defined in the above literature. We chose to perform this study after the proposals reached a reasonably concrete form. Our reasons for doing so are best expressed in the following [12]

> "Management would like to see the cost-benefit study completed during the survey phase. ... But the sober fact is that you cannot analyze the trade-offs until you have something to analyze. The idea of performing an early cost-benefit is largely a fiction."

The use of student analysts Mowed control (generally a requirement for a scientific study) on the system development process. There may be differences between student and practitioner analysts, but we believe that our results have field relevance for the following reasons: the student analysts were mostly seniors and MIS majors, had several data processing and MIS courses prior to taking this course, were preparing for a career ; systems analysis and design, and the applications developed by them were real business applications.

Part of the experimental control was exercised in the preparation of the feasibility studies. The criteria factors, as specified by different authors[3] in Figure 1, are similar to those presented in many books [e.g. 35]. Each analyst team was instructed on the definition and purpose of each factor, and was required to prepare the feasibility study in accordance with the criteria factors. They were asked to address each factor in the context of their own project. Thus we had some control over the process, as each study was prepared according to the criteria guidelines, which were fully explained to the analysts.

There were nine major criteria factors used for evaluation of feasibility studies. While most factor.; are self-explanatory; two need explanation. "Ability to meet system --requirements" refers to how well and how completely a proposed system alternative meets the functional requirements. "Operational factors" refer to the ability of the proposed system to work successfully in the operating environment of the organization. Some criteria factors were split into sub-categories (as shown by the indentation in Figure 1). For example, people factors were split into primary and secondary users, DP operations, and DP systems. The primary users are those for which the system is designed, while the secondary users are personnel in the user department doing clerical processing of the input to and output from the system [5]. Data was collected directly on the major factors as well as subfactors; subsequent analysis will report data on all nineteen factors.

Once the feasibility study had been completed, it was submitted to the user management for review. After this, a formal presentation was made by the analysts to the users, at which point clarifications/explanations about the criteria factors were presented. After the alternative system proposals were evaluated and an alternative was selected for implementation, a survey instrument was administered, both to the analysts and users. The questionnaire[4] included questions on the relative importance of the criteria factors of the feasibility study. The importance of each factor was evaluated on the following 5-point Liken scale:

Important
very

I——I——I——I——I——I
4 3 2 1 0

Not important
At all

In a similar manner, .the adequacy of each factor addressed in the feasibility study was evaluated as follows:

Adequately
Very

I——I——I——I——I——I
4 3 2 1 0

Not adequately
at all

In addition, questions about the profile of the respondent were included. The questionnaire also contained questions on other issues related to feasibility studies. Some were included for the sake of testing the consistency of the responses.

4. Results

There were sixty-eight responses to the questionnaires. The profile of the respondents and the systems is reported in *Figure 2*. Respondents were either clients (users) or analysts. Their orientation to business/data processing was measured and accordingly the respondents are grouped as having more business orientation, more DP orientation or an even balance. The systems being developed had features of "automation of manual operations (i.e., transaction processing)" and "information providing (i.e., MIS)". The systems were grouped as transactional, MIS, or both.

Fig. 2.
Respondent/system profile (total number of responses-68).

Respondent class	
Clients (users):	47%
DP Analysts:	53%
Respondent education	
High school:	7%
Some college:	26%
4 years college:	49%
More than 4 years:	18%
Respondent orientation	
More business:	41%
More data processing:	30%
Both:	29%
System type	
More automating (transactional):	44%
More information providing (MIS):	31%
Both:	25%

The importance ratings of the criteria factors were analyzed first on an overall basis. Next differences in the importance ratings for particular subgroups were considered. Finally, the adequacy of presentation ratings of the factors, overall, by the clients, and by the analysts, were compared.

Each factor and subfactor was ranked on its importance in feasibility assessment. A higher rating indicated greater importance. The average rating for each factor was computed. Based on the average ratings, the major factors and subfactors are prioritized as shown in *Figure 3*. *Figure 4* lists the percentage of respondents that consider a factor to be important (those giving it a rank of 3 or 4).

The factors rated highest are operational ones, and the system's ability to meet the functional requirements. The next most important factor is the overall impact of the proposed system on the organization as a whole followed by people factors and economic factors. Most prior work emphasizes only the cost-benefit portion the feasibility study; but in our results, this is in the middle, with management support and technical lower. Finally the lowest rating is for security and legal considerations.

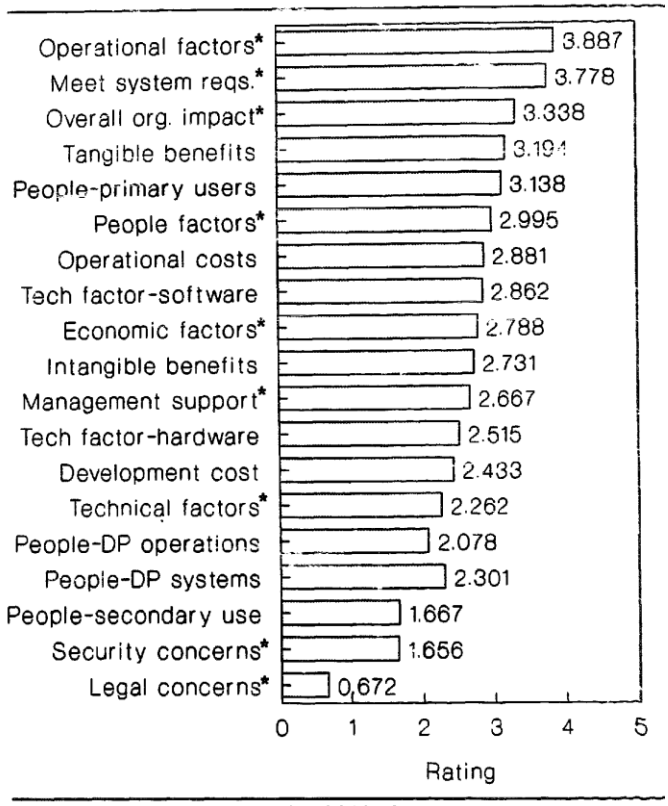

Fig. 3. Overall criteria importance rating. * Major factors.

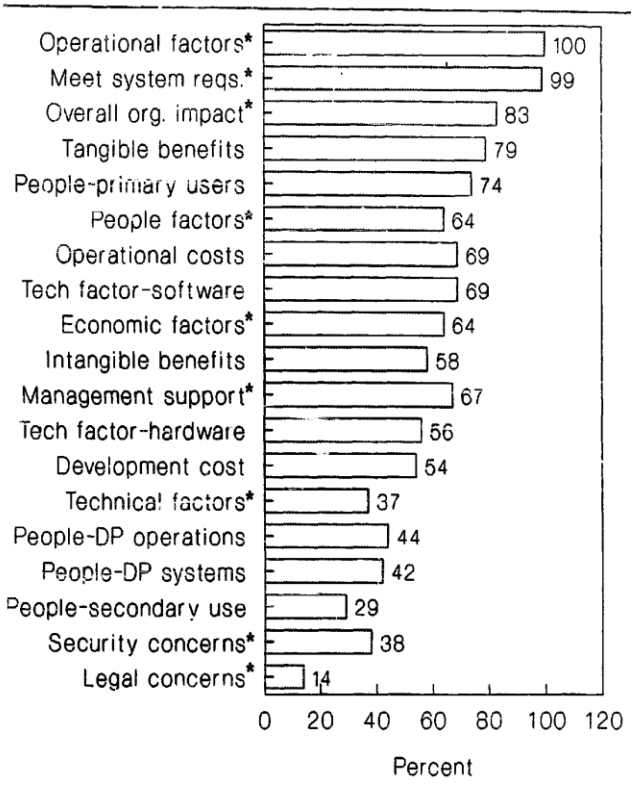

Fig. 4. Percentage of people choosing an importance rating of 3 or 4. * Major factors.

In order to test the consistency and validity of the responses and to give the respondents an opportunity to express their own criteria, they were further asked to list the three most important and the time least important criteria. These rankings were generally consistent with our results. Some new criteria were expressed, e.g. "easy to use," " timely" and "automated"; these could be classified as "operational factors".

The criteria-importance data was also classified along three dimensions: client (user) vs. analyst rating *(Figure 5),* business vs. data processing orientation of the respondent *(Figure 6),* and the type of the system being developed, i.e. primarily transactional or primarily MIS *(Figure 7).* A general observation is that the classified importance ratings are highly correlated to each other and to the overall ratings. 'The correlation between the subgroups of each dimension were significant at the 0.01 level.

	Spearman Rank Correlation	Pearson Correlation
Client/Analyst	0.967	0.997
Business/DP orientation	0.91	0.991
Transactional/MIS system	0.767	0.987

Even though the correlations are high, some differences exist. Differences, statistically significant at the 0.10 level of significance, *based on t-test,* are highlighted here.

Two marginally significant differences exist between the client and the analyst ratings: the clients rated the development costs higher than did the analyst and while both groups rated security low, the clients seemed to be slightly more concerned about it. There were several marginally significant differences identified when the data were classified by the orientation of the respondent: business or data processing. 'These show that, on a comparative basis, the business person rates the operational costs higher, while the data processing person rates the technical factors and the effect on DP people and primary users higher.

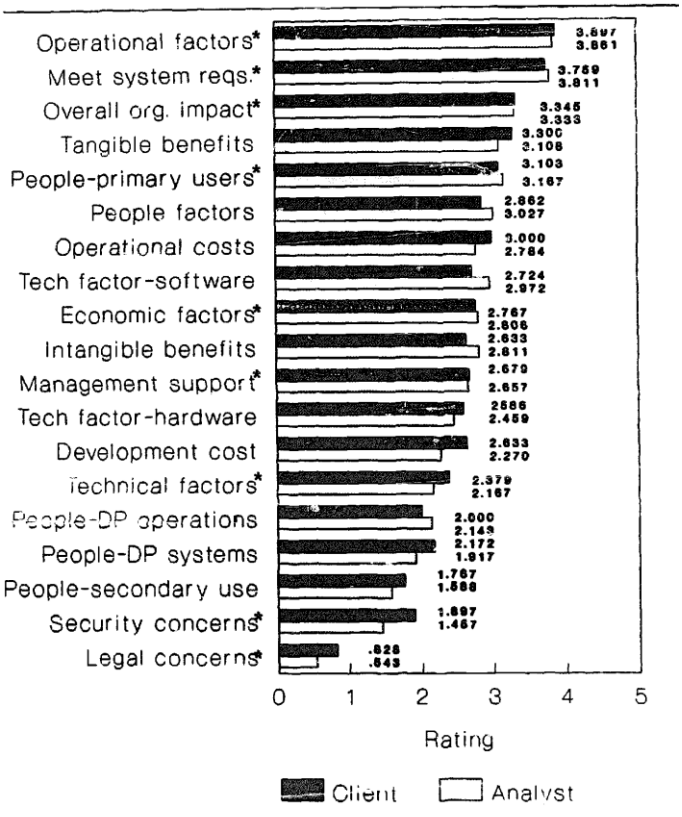

Fig. 5. Prioritization by client/analyst. * Major factors.

Filially, there were several differences identified when the data was classified by the type of system. The differences are that organizational impact, operational costs. and security concerns were rated higher for transactional systems, while people factors and software were rated higher for MIS systems. The marginally significant differences are: for transactional systems, the respondents rated the effect on DP operations higher, while for the MIS systems, the respondents rated the effect on secondary users higher.

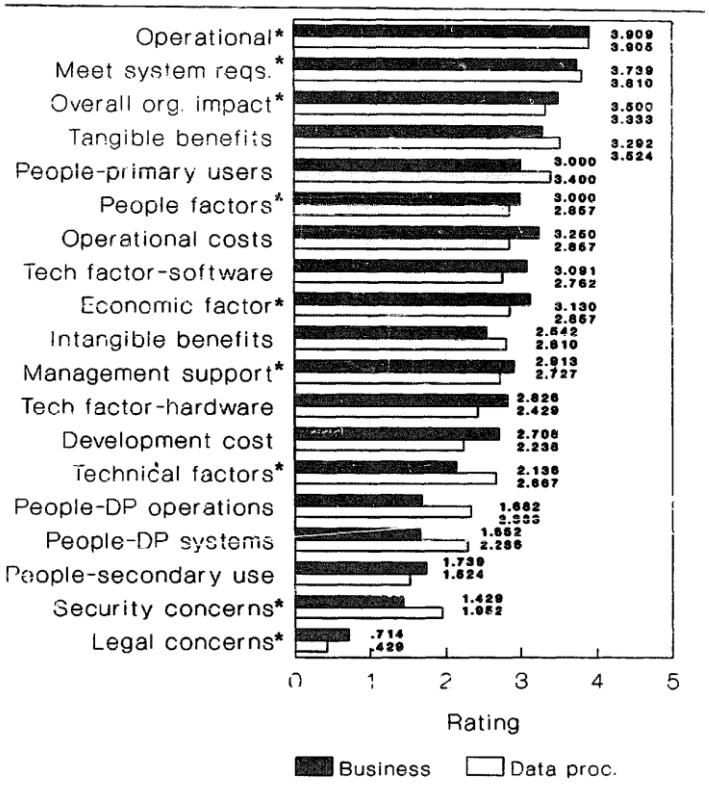

Fig. 6. Prioritization by business/data proc. * Major factors.

The ratings for adequacy of presentation are shown in *Figure 8.* These generally indicate that the feasibility study adequately addresses the criteria factors. Average scores below 3.00 on a 4-point scale may be some cause for concern. With this cutoff, the technical factors and the people factors (including secondary users, DP operations, and DP systems, but excluding primary users) are only moderately adequately addressed. Legal and security concerns are moderately addressed. Critics may suspect this data, as many of the responses are from the analysts who are evaluating their own adequacy of presentation. 'Therefore, we classified the adequacy ratings by clients and by analysts, as shown in *Figure* 9. The results are reassuring, as for almost all factors, the clients rated the adequacy higher than the analysts. Thus, analysts were more critical of their own work than their clients. Some client adequacy ratings were significantly higher than those of the analysts, e.g., software, legal and security concerns.

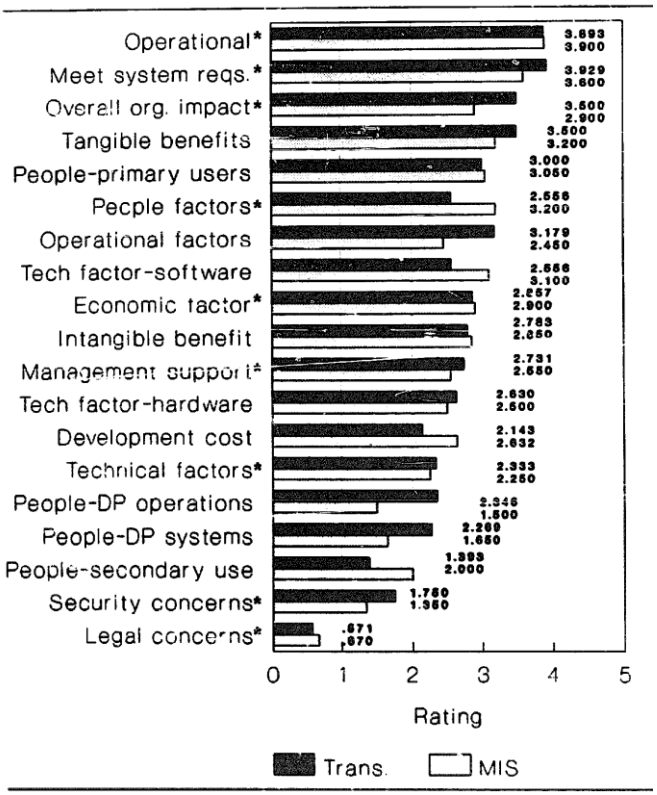

Fig. 7. Prioritization by type of prop. system. * Major factors.

5. Discussion and Utility of the Results

The two most important factors are operational ones and the system's ability to meet the functional requirements. It is vitally important for the users to be convinced that the delivered system will actually meet their requirements. Also they have to be quite sure that the system will actually work within the environment and constraints; i.e., the system should work effectively and meet the requirements. The next important factor is the overall impact of the proposed system on the organization as a whole: a new system should have a positive impact on the organization. Next, operational (ongoing) costs are rated only slightly lower than tangible benefits; however intangible and development costs are rated much lower.

There is an important lesson here: systems cannot be sold on their intangible potential or how economically they can be developed, but on their real costs (i.e., operational costs) and benefits. The economic factors are not rated highest as has been suggested in some other studies [22,29,34], but are rated generally in the middle. 'The effect on the primary users (those for whom the system is being developed) is rated next to tangible benefits. The effect on data personnel, i.e. DP operations and DP Systems is not considered very important. The low rating of the impact on secondary users is also surprising. It probably reflects the insensitivity of the stakeholders (analysts and user management) towards the clerical personnel in user departments. Lower in importance are technical factors and management support; software being more important than hardware Legal and security concerns are rated the lowest; it is perhaps understood that adequate legal and security requirements will be met by any proposed system and do not require probing for evaluation.

The clients (users) rate the development costs and security concerns slightly higher than do the analysts. 'This is possibly due to the clients being more cost-conscious in accordance with their experience from prior development projects. The frequent cost and time over-runs in development projects can be extremely frustrating. Security concerns, while rated higher by the users, are quite low on an absolute scale.

Mote significant differences in the ratings emerge when the Cam are classified by the business or data processing orientation of the respondents. In the past, it could be assumed that the client had the business orientation and the analyst had the DP orientation. This assumption may be weak now, because of the cross-education and training of both. The factors that are more important to the business person than the DP person are operational costs and, to a lesser extent, development costs and software. On the other hand, technical factors and effect on DP people and primary users are more important to the DP person. As was observed earlier, it should be expected that business oriented people will be more concerned about the cost aspects. It is further understood that the data processing oriented person will emphasize technical factors and DP concerns, while the businessman will be more concerned with the software, among the technical factors. The higher rating given by the DP oriented respondents to the primary users' concerns seems contradictory. However, it is encouraging in that it is a positive reinforcement of recommendations made in the literature.

The importance ratings of the two types of the proposed system (transactional vs. MIS) are generally significantly correlated. The major difference is that in transactional systems: the factor "impact on organization" was rated much higher. Although somewhat against our intuition, transactional systems may eliminate or drastically change previous job patterns, thereby affecting employee morale and motivation. Further, for transactional systems, the economic factors, especially operational costs, were also rated higher. This is understandable as the primary purpose for building automated systems is to reduce costs. On the other hand, software concerns and people factors become more important for management information systems, which are less well defined in purpose and use, with people able to make or break them. On the other side of the coin, the effect on DP staff is rated more important for transactional systems. This means that the contribution and significance of DP personnel is more important for the success of a transactional system.

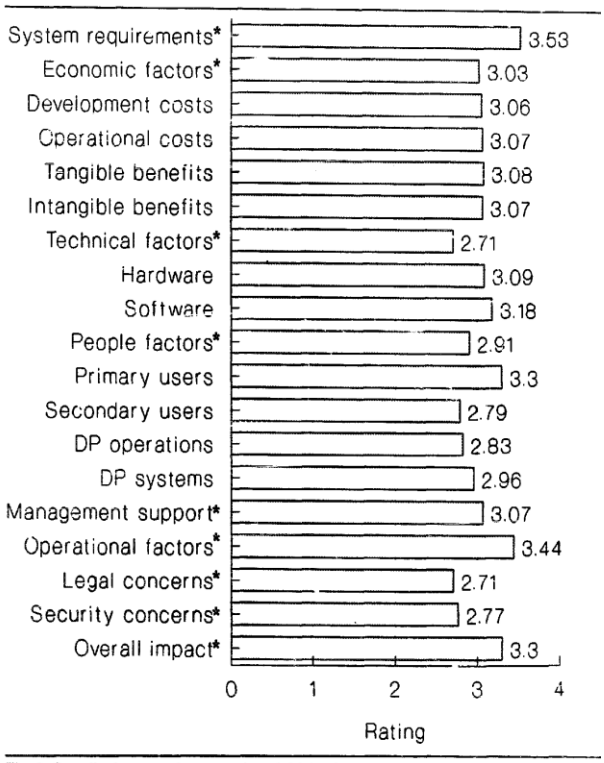

Fig. 8. Overall adequacy of presentation. * Major factors.

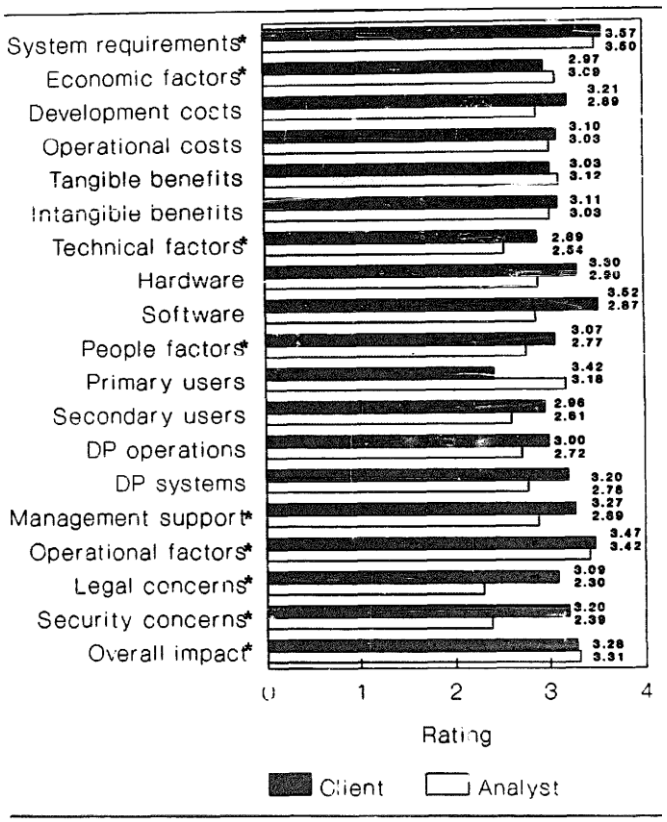

Fig. 9. Adeq. of presentation: client & analyst. * Major factors.

We reiterate that while some individual differences exist by classification subgroups, the overall ratings are still largely valid. In preparing the feasibility study, one should address the factors as suggested by the composite ratings and then fine tune the study considering the specific characteristics the organization/people mad the type of system. In particular, careful attention may be given to the type of system being developed and the attributes of the target audience.

These results also have special relevance when evaluating the different system proposals contained in lie feasibility study. In evaluating proposals, our results suggest normative guidelines for the relative importance of the factors. These rating may be converted into relative weights and perhaps modified to suit the environment. The actual assessment of the proposals and selection of the best proposal may be based on a simple factor-by-factor comparison, or a weighted score, or a more sophisticated mathematical technique.

It is encouraging to note that once the analysts were given the list of factors to address in the feasibility study, they adequately addressed all of the factors in the actual study. As was stated earlier, the clients generally felt more s strongly that the factors were adequately addressed than did the analysts. In particular, the clients gave much higher adequacy ratings than the analysts for the three factors: software, legal, and security concerns. A possible interpretation of this result is that these factors are overly represented in the study and should be downplayed. A recommended mechanism to ensure that all factors are adequately addressed in the feasibility study is to include the list of factors as a checklist in the system development methodology.

6. Summary and Conclusions

This article has addressed the important topic of feasibility studies in the development of business information systems. Specifically, the criteria/contents to be included in a feasibility study were examined. Some important criteria factors to he included are: operational factors, the system's ability to meet the functional requirements, the overall impact on the organization, the tangible benefits, the effect on primary users and the technical factors (it that order). The least important ones are legal and security concerns and the effect on clerical and data processing personnel. It must be emphasized that this prioritization is for evaluating the feasibility of the system proposals; each factor still has to be appropriately addressed during the development life cycle.

More studies should be made to corroborate and expand on the knowledge about feasibility studies. Empirical data may be collected and experiments conducted in field settings to obtain in-depth information about the criteria and contents of the feasibility study. Other issues include non-criteria related contents of the feasibility study and the proper time to perform the feasibility study and present it to management. It would be worthwhile to examine the contents of the feasibility study when it is conducted at different milestone points or when multiple feasibility studies are conducted. It will also be valuable to establish the role of the feasibility study in the context of relatively newer and emerging system development methodologies, e.g., prototyping and iterative methodologies.

Notes:

1 In figure 1, the textbooks' authors' names and year of publication arc abbreviated; also text Dick85 lists several methodologies, two of them: PRIDE and CARA, include feasibility studies.
2 1. Temple University, Philadelphia, Pennsylvania. 2. Kent State University, Kent, Ohio.
3 The determination, whether a factor was included by an author or not, was sometimes subjective.
4 The questionnaire was finalized after several iterations and pilot testing with similar subjects.

References

[1] Ahituv, N.A.: Systematic Approach toward Assessing the Value of au Information System. *MIS Quarterly.* Vol. 4, 4 December 1980.
[2] Arnovick, G.N. and Gee, L.G.: Design and Evaluation of Information Systems. *Information Processing & Management.* Vol. 14, 6-B, I978.
[3] Bailey. J.E. and Pearson, S.W.: Development of a Tool for Measuring and Analyzing Computer User Satisfaction. *Management Science,* Vol. 29, No. 5, May I983.

[4] Burch, J.G. Jr., Strater, F.R. and Gruduitski. G. *Information Systems: Theory and Practice.* John Wiley, I979.
[5] Bostrom, R.P. and Heinen, SJ. MIS Problem and Failures: A Socio-Technical Perspective. Parts I & II, *MIS Quarterly.* 1, 3, 1977.
[6] Chandler, J.S.: A Multiple Criteria Approach for Evaluating Information Systems. *M/S Quarterly.* Vol. 6, 1, March 1982.
[7] Condon, R.J. *Data Processing Systems Analysis and De-sign.* Reston Publishing. 4th Ed., I985.
[8] Connor, D. *Information System Specification and Design Roadmaps.* Prentice-Hall, 1985.
(9] Courger, D.J. Colter, M.A. and Knapp, R.W. *Advanced Systems Development /Feasibility Techniques.* John Wiley, I982.
PO] Davis, G.B. and Olson, M.H. *Management Information Systems: Conceptual Foundation, Structure and Development,* 2nd Ede McGraw-Hill, 1985.
[11] Debrabander, B. and Edstrom, A.: Successful Information System Development Projects. *Management Science,* Vol. 24, 2, Oct. I5-77.
[12] DeMarco, T. *Structured Analysis and Systems Specification.* Yourdon. Inc., 1978.
[13] Dickson, G.W. and Wetherbe, J.C. *The Management of Information Systems.* McGraw-Hill, I985.
[14] 1Doll, W.J. and Aluned, M.U.: Diagnosing and Treating the Credibility Syndrome. *MIS Quarterly.* September, 1983.
[15] Doubler, J.L. Systems Analysis... : Taking the Question Oriented Approach. *Canadian data Systems.* December, 1983.
[16] Edstrom, A. User Influence and the Success of MIS Projects: A contingency Approach. *Human Relations,* Vol. 30, 7, 1977.
[17] Gildersleeve, T.R. *Successful Data Processing Analysis.* Prentice-Hall, 1985.
[18] Gore, M. and Stubbe, J. *Elements of Systems Analysis.* William C. Brown, 3rd Ed., I983.
[19] Guimaraes, T. and Paxton, W.E.: Impact of Financial Analysis Methods on Project Selection. *Journal of Systems Management.* Feb., I984.
[20] Hamilton S.: Evaluating Information System Effectiveness. *MIS Quarterly.* Vol. 5, 4, September, I98I.
(21] Hodge, B. and Clements, J.P. *Business Systems Analysis.* Prentice-Hall, I986.
[22] Hogue, J.T. and Watson. H.J.: Management's Role in the Approval and Administration of Decision Support Systems. *MIS Quarterly. Vol.* 7, 2. June, I983.
[23] Horsey, R.: Developing Software In-House? Check Payback. *Computer World.* January 25, I983.
[24] Ives, B. and Olson, M.H. User Involvement and MIS Success: A Review of Research. *Management Science.* Vol. 29, 5, May, 1984.
[25] Kanter, J. *Management Oriented Management Information Systems.* Prentice-Hall. I977.
[26] Keim, R.T. and Janaro, R.: Cost/Benefit Analysis of MIS. *Journal of Systems Management.* September, I982.
[27] Kindred, A.R. *Data Systems and Management: An Introduction to Systems Analysis and Design.* Prentice-Hall, I985.
[28] King, W.R. and Rodriguez, J.I.: Evaluating Management Information Systems. *MIS Quarterly.* Vol. 2, 3. September, I987.
[29] Lay, P.M.Q.: Beware of Cost/Benefit Model for IS. *Journal of Systems Management.* June, 1985.
[30] Lawrence, M.J. and Jefferey, D.R. *Systems Analysis and Design.* Prentice-Hall
[31]Leslie, R.E. *Systems Analysis and Design.* Prentice-Hall, 1986.
[32] Litecky, C.R.: Intangibles in Cost Benefit Analysis. *Journal of Systems Management* February, 1981.
[33]Lucas, 14.C. *JT. The Analysis, Design. and Implementation of Information Systems.* McGraw-Hill, 1985.
[34]Meador. C.L. and Keen P.G.W.: Setting Priorities for DDS Development. *MIS Quarterly.* Vol. 8. 2. June. 1984.
[35] Mills, H.D., Linger, RC. and Hevner, A.R., *Principles of Information Systems Analysts and Design.* Academic Press, I986.
[36] Murdick. R.G,. Ross, J. F. and Claggert, J. R. *Information Systems for Modern Management.* Prentice-Hall, 1984.
[37] Page-Jones, M. *The Practical Guide to Structured Systems Design.* Yourdon Press, 1980.

[38] Robey. D. and Markus, M.L.: Rituals in Information System Design. *MIS Quarterly.* March, 1984.
[39] Scott. G.M. *Principles of management Information Systems.* McGraw-Hill, 1986.
[40] Semprevivo, P.C., *Systems Analysis. Definition. Process and Design.* SRA. Inc., 1982.
[41] Silver, G.A. and Silver, J.B. *Introduction to Systems Analysis.* Prentice-Hall, 1976.
[421 Smith, R.D.: Measuring Intangible Benefits of Computer-Based Information Systems. *Journal of Systems Management.* September, 1983.
[43] *SPECTRUM — a System Development Project Management System* Spectrum International Inc., California.
[44] Srinivasan, A.: Alternative Measures of System Effectiveness, Associations and Implications. *MIS Quarterly.* Vol. 9, 3.
[45] Theirauf, R.J. and Reynolds, *G.W . Systems Analysis and Design.* Charles E Marrill, 1980.
[46) Thierauf, R.J. *Decision Support Systems for Effective Planning and Control.* Prentice-Hall, 1982.
[47] Thierauf, R.J. *Effective Management Information Systems.* Charles E. Marrill, 1984.
[48] Wallace, R.E.: Cost/Benefit Analysis. *Journal of Information Systems Management.* Fall, 1984.
[49] Wetherbe, J.C. *Systems Analysis for Computer-Based In-formation Systems.* West Publishing, 1979.