ISSN 0254–2757

QI QUÆSTIONES INFORMATICÆ

Volume 5 • Number 3 December 1987

An official publication of the Computer Society of South Africa and of the South African Institute of Computer Scientists

'n Amptelike tydskrif van die Rekenaarvereeneging van Suid-Afrika en van die Suid-Afrikaanse Instituut van Rekenaarwetenskaplikes

QUÆSTIONES INFORMATICÆ

An official publication of the Computer Society of South Africa and of the South African Institute of Computer Scientists

'n Amptelike tydskrif van die Rekenaarvereniging van Suid-Africa en van die Suid-Afrikaanse Instituut van Rekenaarwetenskaplikes

Editor

Professor G. Wiechers
INFOPLAN
Private Bag 3002
Monument Park 0105

Editorial Advisory Board

Professor D.W. Barron
Department of Mathematics
The University
Southampton S09 5NH, UK

Professor J.M. Bishop
Department of Computer Science
University of the Witwatersrand
1 Jans Smuts Avenue
2050 WITS

Professor K. MacGregor
Department of Computer Science
University of Cape Town
Private Bag
Rondebosch, 7700

Prof H. Messerschmidt
University of the Orange Free State
Bloemfontein, 9301

Dr P.C. Pirow
Graduate School of Bussiness Admin.
University of the Witwatersrand
P.O. Box 31170, Braamfontein, 2017

Professor S.H. von Solms
Department of Computer Science
Rand Afrikaans University
Auckland Park
Johannesburg, 2001

Professor M.H. Williams
Department of Computer Science
Herriot-Watt University, Edinburgh
Scotland

Production

Mr C.S.M. Mueller
Department of Computer Science
University of the Witwatersrand
2050 WITS

Subscriptions

Annual subscription are as follows:

	SA	US	UK
Individuals	R10	$7	£5
Institutions	R15	$14	£10

Computer Society of South Africa
Box 1714 Halfway House

Quæstiones Informaticæ is prepared by the Computer Science Department of the University of the Witwatersrand and printed by Printed Matter, for the Computer Society of South Africa and the South African Institute of Computer Scientists.

A COMPARISON OF ACADEMIC AND PRACTITIONER PERCEPTIONS OF THE CHANGING ROLE OF THE SYSTEMS ANALYST: AN EMPIRICAL STUDY.

T D Crossman
Division of Business Information Systems
University of the Witwatersrand
WITS 2050

Abstract

Changes in technology introduce new job responsibilities and demand new skills profiles from personnel involved in application software development. Inability to perform competently within these job responsibilities can prevent the exploitation of the evolving technology. This paper describes one of the steps in a research programme which attempts to identify the skills required by the systems analyst of the future. A group of experts in application software development (both academics and practitioners) were approached to ask their opinion of the changing role of the systems analyst. This paper compares and contrasts the replies received from 9 academics and 23 practitioners.

Keywords Future systems analyst skills, opinion-seeking research.

1. INTRODUCTION

The systems analyst is sometimes regarded as the central figure in the future development of application software ([6] p102, [15] p4, [7] p248, [4] p438). Two factors, however, make it difficult to identify an appropriate skills profile for this key figure.

Firstly, although the title is widely used, there is not consensus on the definition of the systems analysis task ([2] p21-22). In fact, there is evidence that the term itself has developed beyond its original meaning ([2] p38) resulting in such varied descriptions that it has become a job title for which a literal definition is inappropriate ([16] p5).

Secondly, the rapid evolution of technology is changing the type of computer -based systems which can be built and what constitutes viable building methods. The skills required by the future systems analyst, therefore, are being held in a state of flux by advances in technology ([8] p15, [9] p6).

If, however, the changing role of the systems analyst **can** be identified, this will give direction to recruitment, education and training programmes. This, in turn, will result in the right people being correctly prepared to be productive in the new environment by effectively using the new technologies. This paper describes part of a research programme which has as its objective identifying the skill profile of the future systems analyst. One step in this process was to analyse the opinions of a group of experts on the changing role of the systems analyst.

2. EXPERT IDENTIFIED

The experts whose opinions were used as the basis of this study, were selected from two populations.

The first population was identified in "The 1986 South Africa's Who's Who in Computers" ([14] p 4-60). A random sample of 34 individuals was taken from those personnel who indicated that they managed the development of commercially-orientated application software. Those in this group are called the **practictioner experts** in this study.

The second population was identified as the senior academics in the field of Business Information Systems at South African universities. All 13 individuals in this population were selected as members of the **academic expert** group.

These experts were approached to provide their opinion of the skills required by the systems analyst of the future.

quæstiones informaticæ, 5, 3, pp 36-43, issn 0254-2757

3. ROUND ONE

As a means of diminishing some of the negative psychological factors of face-to-face discussion (particularly the distorting effect of a majority opinion, dominating personalities and group compulsion ([11] p160)), the first approach to the experts was via a mail-shot. In September 1985 each expert was sent an explanatory letter, a list of definitions (see Appendix A) and three open- ended questions about the future role of the systems analyst in the development of business application software. To help focus the experts' thoughts on the skills required by the systems analyst of the future, these questions were arranged in a specific order. Firstly, they were asked to identify the methods which they thought would be used in the future to develop computer-based systems. The second question was to identify the expected job responsibilities of the systems analyst within these development methods and the third question was to list the skills necessary to perform effectively within these job responsibilities. In an effort maintain the momentum of the research programme, the experts were asked to reply to the questions by the end of September 1985. By this dead-line, replies had been received from 6 academics and 16 practitioners (see Table 1). This constituted a 47% response-rate.

	Practitioners	Academics	Total	Percentages
Number identified	34	13	47	100%
Round 1 replies	16	6	22	47%
Round 2 replies	23	9	32	68%

table 1

Details of Expert Participation

While this response rate was lower than anticipated, these experts identified a total of 60 skills covering a broad spectrum of capabilities (see Table 2).

Unfortunately efforts to use this data as a basis for comparisons and contrasts of expert opinion were made difficult because of the following problems:

i) A surprising lack of consensus was evident. More than half the skills identified as being required by the future systems analyst were identified by just one person (11 skills by single academics and 22 skills by single practitioners). Furthermore, 42 of the 60 skills were mentioned by one group of experts but not by the other group (13 skills were identified by the academics but not the practitioners and 29 skills by the practitioners but not the academics).

ii) Some replies were hand-written on the original letters sent to the experts, some were documents of 10 or more pages long, while one reply was the abbreviated minutes of a management meeting called to discuss the questions. This suggested that the issues had been given different levels of attention by the experts.

iii) It was not certain if the experts were using important words consistently. For example, a number of replies indicated that communication skills will be important to the future systems analyst. It was not clear, however, if the components of communicating like interviewing, verbal communicating, report writing, listening and presentation preparing etc. had been regarded by each of these respondents as equally important.

iv) There was no way of knowing the strength of the respondents' opinions. To analyse the data accurately it was necessary to distinguish between skills which the experts regarded as "definitely required" and those which "may be useful under certain specific circumstances". It was not possible to make this distinction using the data received from this first approach to the experts.

These problems made it impossible to compare and contrast the expert opinion without making gross assumptions. It was decided, therefore, to approach the same group of experts again to ask the same three questions, but to provide a framework that would enable them to amplify their answers.

4. ROUND TWO

The data collected from the initial approach to the experts was grouped into categories (see

[3] p68) and used as the dimensions to the original three questions. The experts were asked to evaluate the importance of each dimension as a possible answer to the associated question on a verbally anchored 5 point Likert-type scale. In addition, the participants were encouraged to make comments about each question and introduce any new dimensions which they felt had been overlooked in the previous round.

(Space limitations precludes the inclusion in this paper of the document which was distributed, but copies are available from author by request).

The document was mailed during October 1985 to the 47 experts originally identified. The return date was set for mid-November 1985. It was encouraging to notice that there was a higher response rate (68%) to this second approach to the experts (see Table 1). Perhaps the participants found it easier to respond to the less open-ended questions.

The experts' opinions on the significance of each of the 60 skills (no new skills were identified) is given in Table 2 as median scores.

Development Tools/Method	
Determining Appropriate Development Methods	4
Determining Appropriate System Controls	5
Determining Appropriate System Security	5
Evaluating Software Packages	4
Using Strucutured Analysis Methods	4
Using Automated System Development Methods	5
Using Prototyping Techniques	5
Using Techniques Associated with Databases	5
Applying Information Technology	5
Construction Algorithms	3
COBOL Programming	3
FORTRAN Programming	1
Implementing Application Packages	4
ADA Programming	2
Using Fourth Generation Languages	5
Social/Communications	
Working In and With a Team	5
Dealing with People	5
Being Diplomatic	5
Interviewing	5
Verbal Communicating	5
Report Writing	5
Presentation Preparing	5
Teaching	5
Selling Ideas	4
Environment	
Organisation Structuring	3
Identifying User Functions	4
Implementing Office Procedures	3
Establishing Corporate Data Requirements	4
Business Practices Skills	4
Analysis	
Evaluating Existing Procedures	4
Thinking Logically	5
Problem Solving	5
Acting as Change Agent	5
Fact Finding	5
Implementing Procedures	4
Organization and Methods Skills	4
Identifying User/Management Needs	5
Hardware	
Designing Installation Configurations	3
Designing Computer Networks	3
Using Computer Networks	4
Determining Telecommunication Requirements	3
Finance	
Cost Estimating	4
Cost/Benefit Analysis	4
Costing	4
Auditing Computer Systems	3
Quantitative Methods	
Statistics	3
Management /Project Management	
Managing/Motivating People	5
Task Prioritizing	4
Strategic Planning	4
Identifying Competitive Advantages	3
Building Competitive Positions	3
Decision Making	4
Managing Change	4
Reviewing Performances	4
Project Planning	4
Project Controlling	4
Progress Monitoring	4
Scheduling	4
Estimating Timescales	4
Critical Path Analysis	3
Decision Making	4

table 2

Systems Analyst Skills Identified by Experts as being Required in the Future, with Median Scores (1 = not required; 3 = could be required; 5 = definitely required. n = 32).

5. COMPARISON OF EXPERT OPINION

To analyse the data further, three techniques were used to compare and contrast the experts' opinion.

i) The breadth of the range of opinion was noted.
ii) The median scores of the practitioners' and academics' opinions for each dimension were compared.
iii) The Mann-Whitney U test (see [13] p116-127) was used to test if the two expert groups were drawn from the same population. Processing was done on an IBM Mainframe using Release 5 of SAS Institute Incorporated' s Statistical Analysis System.

6. BOARD SPECTRUM OF OPINION

Table 3 is a list of those skills for which the experts' opinion covered the whole range of 5 categories from "not important" to "very important".

Development centre tools/methods	Applying information technology
Project management	Critical-path analysis
Finance	Cost-benefit analysis Costing Auditing computer systems
Quantitative methods	Statistics
Hardware	Designing installation configurations Designing computer networks Determining telecommunication requirements
Software	Constructing algorithm COBOL programming Implementing application packages
Environment	Organization structuring Establishing corporate data requirements Skills in business practices
Analysis	Organization and methods skills
Building systems	Building competitive positions

table 3

A List of Skills on which Expert Opinion Ranged from "Not Important" to "Very Important".

7. DIFFERENCE IN MEDIAN SCORES

In an effort to further analyze this broad spectrum of opinion, replies from the two groups of experts were compared. Group opinion was regarded as different if the group median scores were not identical. In some cases it was the academics who thought a skill was more important to the future systems analyst, while in other cases the practitioner experts indicated a skill was more central to the changing role of the systems analyst. These differences of opinion are detailed in Table 4.

more important to **PRACTITIONERS**	more important to **ACADEMICS**
Development Tools/Methods Skills	
• Using structured analysis methods	• Using automated development tools
• Algorithm construction	• Implementing packages
• COBOL programming	• Auditing systems
	• Determining appropriate development methods
Social/Communication Skills	
• Working in/with a project team	• Selling ideas
• Being diplomatic	
Analysis Skills	
• Cost-benefit analysis	• Establishing corporate data requirements
• Identifying user functions	• Applying information technology
• Identifying appropriate controls	• Implementing office procedures
• Identifying appropriate security	
Management/Project Management Skills	
• Managing change	• Project planning
• Managing people	• Identifying competitive advantages
• Reviewing performance	

table 4

Future Analyst Skills on which Practitioners and Academics Median Scores were not Identical.

8. MANN-WHITNEY TEST

For each dimension, the null hypothesis was that the two groups within the sample were drawn from the same population. The alternative hypothesis was that the two groups represented different populations (and therefore could be said to disagree). The level of significance for all tests was set at 0,05.

Only in 5 cases (from a maximum of 60) could the null hypothesis be rejected (see Table 5). In each of the other cases any apparent difference of opinion could be attributed to chance.

	Mann-Whitney (Z<0,05)	**More Important To**
Working in/with a project team	,015	Practitioners
Dealing with people	,023	Practitioners
Being diplomatic	,006	Practitioners
Verbal communicating	,031	Practitioners
Managing/motivating people	,035	Practitioners

table 5

A List of System Analyst Skills on which the EXPERTS Disagree in Terms of their Future Importance (n=32)

9 COMMENT ON COMPARISONS OF OPINION

There was evidence that the experts sometimes lacked consensus among themselves on the skills required by the systems analyst of the future. This is illustrated by the diversity of opinions and the range of skills listed in Table 3. In some cases (for example, skills in implementing application packages or skills in business practices) not only was the broad spectrum of opinion unexpected, it is disconcerting. These skills are regarded by some researchers as central to the task of systems analysis (see [10] p34-36, [5] p17, [1] p35).

Some areas of disagreement are best identified by comparing the attitudes of the two groups of experts. Traditionally significant differences are expected between practitioners and academics (with the academics believing that the practitioners read the wrong journals and the practitioners thinking that the academics need more of the aura of gun-smoke about them!).

The practitioner experts seemed to see the systems analyst of the future as a system builder involved in the details of the development phase. They agreed that fourth generation development skills will be important, but unlike the academics they also regarded traditional systems development skills as significant. Of particular note is the future value of COBOL. Academics did not regard COBOL programming skills as a requirement for the future systems analyst, but some practitioners seemed to feel strongly that, for the foreseeable future, systems will be built by systems analysts using both third and fourth generation techniques, therefore COBOL skills will be important. This practitioner experts' emphasis on skills required for involvement in the details of systems development was also noted in terms of analysis skills. Whereas the academics seemed to lay more emphasis on skills such as identifying corporate data requirements, to the practitioners it was more important for the analyst of the future to possess such skills as cost-benefit analysis and identifying appropriate system controls and security.

However the practitioners did not see the future systems analyst as a technocrat. They gave a higher rating than their academic counterparts to a range of managerial, social and communication skills. It was primarily they who indicated that the future systems analyst will require skills in managing people, reviewing their performance, working in a project team and being diplomatic. That the academics appeared to fail to support the practitioners here was astounding. (This disagreement was the result of a range of opinion on these issues among the academics themselves). In practice, it seems, there is little room for the commonly held view that the system builders can ignore social skills.

Generally speaking, when the academics' classification of the future analysts SKILLS was higher than that of the practitioners, these skills fell into the category of planning the building of information systems. Unlike the practitioners, academics appeared to place more emphasis on skills in applying information technology, identifying competitive business advantages and project planning.

When the academics did regard systems development skills as important, they placed skills at using automated development tools, implementing application packages and implementing office procedures into higher groupings than those suggested by the practitioners. This again indicated that the academics felt that the future systems analyst would be distanced from detailed systems building activities.

In essence, on the evidence of this analysis, the academic experts appeared to see the systems analyst of the future as a planner, a seller of ideas and an auditor, rather than a working member or manager of a systems building team.

Not too much emphasis, however, must be placed on these apparent differences. The statistical tests revealed far less difference of opinion than expected. All the differences which could be identified fell well outside the technical activities of systems analysis. The null hypothesis that the academic and practitioner experts were drawn from the same population and therefore had the same opinion, could be rejected for only 5 inter-personal relationship skills. It is noted that in each case the practitioner experts regarded the skills as more important than did their academic counterparts. Perhaps the practitioners are able to see more clearly the significance of the key figure in application systems development not ignoring the human aspects of using technology.

10. INDICATIONS

In spite of these differences of opinion, some indications of the skills required by the future systems analyst can be given. From the view of these experts, future systems analysis will require a broad spectrum of skills which may not be found often in single individuals. Further

research is required to determine if the systems analyst's role is expanding to such an extent that it will demand a new range of systems building job categories.

11. CONCLUSIONS

To predict the future of an environment directly influenced by an evolving technology is difficult. To find a significant degree of agreement between the practitioner and academic experts was encouraging. These agreements give some direction to the type of person to be recruited, educated and trained as systems analysts of the future. Disagreement between the experts on the value of certain interpersonal skills must act as a reminder that, perhaps particularly in the future, building computer-based systems cannot be regarded purely as a technical activity.

APPENDIX A: ATTACHMENT TO SURVEY QUESTIONS

1. Definitions

the future — between 5 and 8 years from now.
skill — the ability to perform specialized work with recognized proficiency.

2. Systems Analyst Job Activities

The systems analyst gathers data for analysis of user applications and/or problem areas in order to design and develop new applications or to modify existing applications. In this capacity, the systems analyst:

analyzes the workflow, forms, files, reports, controls, organizational policies and practices, hardware, software, existing documentation and other applications affecting the application under study;

documents existing operations and procedures and evaluates them to determine the operational effectiveness of the existing application and if an alternate approach is necessary;

designs new or modified approaches that are technically, economically, and operationally feasible;

prepares the necessary flowcharts, structure charts, decision tables, program specifications, systems test data and plans, user procedures, conversion requirements, time schedules, and cost/savings estimates for new or revised applications;

develops the necessary interfaces between data processing and user organizations;

monitors the development and implementation process;

conducts follow-up sessions to evaluate the effectiveness of recently implemented or revised applications, and prepares project activity reports for the upper echelon and steering committee.

BIBLIOGRAPHY

1. Bartol K M, Martin D C and Lyons A M, [1986],Human Resources Management: A Growing Necessity for D P Managers, *Journal of Systems Management*, **37**, 1, 32-36.
2. Chen R, [1985], The trained-user as a System Analyst, *Journal of Systems Management*, **36**, 7, 38-40.
3. Crocker P S, [1984], *Systems Analysts - Training and Experience*, NCC Publications, Manchester, England.
4. Cushing B E and Romney M B, [1987], *Accounting Information Systems and Business*

Organisations, 4th Edition, Addison-Wesley, Reading, Massachusetts.
5. Davis D L, [1983], A new breed of Computer Professional: The Information Specialist, *Proceedings of the SIGCPR 20th Annual Conference*, Charlotteville, Virginia, 14-18.
6. Gilchrist B, Dagli A and Shenkin, [1983], A The DP Population Boom, *Datamation*, **29**, 9, 100-110.
7. Jackson I F, [1986], *Corporate Information Management*, Prentice-Hall, Englewood Cliffs N.J..
8. Marino D, [1982], The changing face of MIS, *Journal of Systems Management*, **33**, 6, 14-17.
9. Meissner A M, [1986], The Changing Role of the Systems Analyst, *Journal of Systems Management*, **37**, 11, 6-15.
10. Ostle J, [1985], *Information Systems Analysis and Design*, Burgess Communications, Minneapolis.
11. Perez V L and Schuler R, [1982], The Delphi Method as a Tool for Information Requirements Specification, *Information and Management*, **5**, 157-167.
12. Pope K S, [1979], Systems Analysts and Cultural Lag, *The Australian Computer Journal*, **11**, 1, 21-26.
13. Siegel S, [1956], *Non parametric Statistics for the Behavioural Sciences*, International Student Edition, McGraw-Hill, Tokyo.
14. SYSTEMS, [1985], Systems Publishers, Johannesburg, **15**, 5.
15. Thierrauf R J, [1986], Systems Analysis and Design, 2nd Edition, Merrill Publishing, Columbus.
16. Wetherbe J C, [1979], *Systems Analysis for Computer-based Information Systems*, West Publishing, New York.

NOTES FOR CONTRIBUTORS

The purpose of the journal will be to publish original papers in any field of computing. Papers submitted may be research articles, review artilces and exploratory articles of general interest to readers of the journal. The preferred languages of the journal will be the congress languages of IFIP although papers in other languages will not be precluded.

Manuscripts should be submitted in triplicate to:

Prof. G. Wiechers
INFOPLAN
Private Bag 3002
Monument Park 0105
South Africa

Form of manuscript

Manuscripts should be in double-space typing on one side only of sheets of A4 size with wide margins. Manuscripts produced using the Apple Macintosh will be welcomed. Authors should write concisely.

The first page should include the article title (which should be brief), the author's name and affiliation and address. Each paper must be accompanied by an abstract less than 200 words which will be printed at the beginning of the paper, together with an appropriate key word list and a list of relevant Computing Review categories.

Tables and figures

Tables and figures should not be included in the text, although tables and figures should be referred to in the printed text. Tables should be typed on separate sheets and should be numbered consecutively and titled.

Figures should also be supplied on separate sheets, and each should be clearly identified on the back in pencil and the authors name and figure number. Original line drawings (not photocopies) should be submitted and should include all the relevant details. Drawings etc., should be submitted and should include all relevant details. Photographs as illustrations should be avoided if possible. If this cannot be avoided, glossy bromide prints are required.

Symbols

Mathematical and other symbols may be either handwritten or typewritten. Greek letters and unusual symbols should be identified in the margin. Distinction should be made between capital and lower case letters; between the letter O and zero; between the letter I, the number one and prime; between K and kappa.

References

References should be listed at the end of the manuscript in alphabetic order of the author's name, and cited in the text in square brackets. Journal references should be arranged thus:

1. Ashcroft E. and Manna Z., The Translation of 'GOTO' Programs to 'WHILE' programs., *Proceedings of IFIP Congress 71*, North-Holland, Amsterdam, 250-255, 1972.
2. Bohm C. and Jacopini G., Flow Diagrams, Turing Machines and Languages with only Two Formation Rules., *Comm. ACM*, **9**, 366-371, 1966.
3. Ginsburg S., Mathematical Theory of Context-free Languages, McGraw Hill, NewYork, 1966.

Proofs

Proofs will be sent to the author to ensure that the papers have been correctly typeset and *not* for the addition of new material or major amendment to the texts. Excessive alterations may be disallowed. Corrected proofs must be returned to the production manager within three days to minimize the risk of the author's contribution having to be held over to a later issue.

Only orginal papers will be accepted, and copyright in published papers will be vested in the publisher.

Letters

A section of "Letters to the Editor" (each limited to about 500 words) will provide a forum for discussion of recent problems.