

## 44 USER SURVEY ON A WAN PORTFOLIO M.I.S. USED FOR PORTFOLIO/PROJECT MANAGEMENT IN HONG KONG.

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### ***Abstract***

*This paper presents the results of research by way of a postal survey into the user expectations for a Management\_Information\_System (MIS) applied to the project/portfolio-managed delivery of a large and diverse range of projects. A random selection from the User-population was used to form a population-sample for the postal questionnaire survey. The sample frame was constrained to ensure a 95% confidence limit that the response was statistically indicative of the population; and that it included sufficient numbers of the primary classes of users to also ensure a 95% confidence limit that the response was indicative of these strata of the population. The results show that the User satisfaction is not high. The results state a range of User dissatisfactions but they do not call for a fundamental change in approach. They validate the exploitation of proven, readily available, information technology for the management of portfolio-of-projects. Portfolio-management and project management is enabled by these techniques although the survey results indicate that more can be done to improve the man-machine interface.*

**Keywords:** *Management-Information-Systems, Project management, questionnaire surveys.*



## RESEARCH ENVIRONMENT

In 1998, the Works Bureau of the Government of Hong Kong undertook objective measurement of the extent that its MIS, called the Public Works Management System (PW\_MS), contributed to the successful project and portfolio management of its large and diverse portfolio of more than two thousand public works projects. The earlier, fast track, implementation of the PW\_MS was part of a revitalised approach to the management of the HKGSAR's large programme of public works. (Fletcher and Rowlinson, 1996). The works Bureau wanted assurance that it performed well in this role. The PW\_MS is complicated but largely complies with the model proposed by Cleland and King (1986) for an MIS that serves concurrently as a project management tool and for the management to portfolios-of-projects as a whole. With this in mind, Table 1 describes in simple terms the elements of project data held within the PW\_MS for each project. It also retains the data of completed projects for legacy purposes.

The Public-Works-Programme (PWP) managed by the PW\_MS is a rolling-programme of projects that includes up to seventy-two types of public infrastructure. The projects within the PWP vary according to the policies of the HKGSAR and the consequent demand for infrastructure but the scale of the portfolio is sufficiently large to ensure that it has great diversity. Table 2 lists some of the attributes of the PWP at March 31, 1999. (Director of Accounting Services, 1998)

Data attribute	Description
<b>Project ownership and associated attributes</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Policy Secretary i.e., Client;</li> <li><input type="checkbox"/> Head of expenditure;</li> <li><input type="checkbox"/> Category of work;</li> <li><input type="checkbox"/> Government Policy Area;</li> <li><input type="checkbox"/> Works Department;</li> <li><input type="checkbox"/> Stage of development;</li> <li><input type="checkbox"/> Long and short title;</li> <li><input type="checkbox"/> Project status i.e., 'unplanned, planned, finished;</li> <li><input type="checkbox"/> District Land Office involved.</li> </ul>
Up-to-date <b>approved/ baseline plan</b> for the delivery of each PWP project	<ul style="list-style-type: none"> <li><input type="checkbox"/> a statement of the approved scope of works,</li> <li><input type="checkbox"/> the date for the planned upgrade in funding status</li> <li><input type="checkbox"/> the date of approval by the Finance Committee;</li> <li><input type="checkbox"/> the date for the planned completion of the works,</li> <li><input type="checkbox"/> the latest approved cashflow for the project,</li> <li><input type="checkbox"/> the approved budget for the project.</li> </ul>
Up-to-date <b>forecast plan</b> for the delivery of the project	<ul style="list-style-type: none"> <li><input type="checkbox"/> a 'work-schedule' for all the activities in the project</li> <li><input type="checkbox"/> A cashflow of forecast expenditure [probably at variance to the latest approved cashflow].</li> </ul>
<b>Actual</b> cost and times	<ul style="list-style-type: none"> <li><input type="checkbox"/> Up-to-date record of actual expenditure; and</li> <li><input type="checkbox"/> Up-to-date record of actual work done against the work schedule activities</li> </ul>
<b>Land Contacts/communication</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Up-to-date record of the land requirements</li> <li><input type="checkbox"/> Up-to-date record of the names and contact details of the works department staff dealing with the project at various management levels</li> </ul>

<b>Diary/notebook</b>	<ul style="list-style-type: none"> <li>□ up-to-date record of the names and contact details of the contractor/consultant staff dealing with the project at various management levels</li> <li>□ up-to-date free format text record of what is happening on the project in the form of an electronic diary which is split into a number of topic sections, such as: Critical actions/key decisions; Cost/funding; Construction; Deflation or MOD prices; Design; Environmental; Executive summary; Policy/client; Project scope; Progress summary; upgrading; Project scope; Statutory procedures; Works related/technical.</li> </ul>
<b>Baseline control audit trail</b>	<ul style="list-style-type: none"> <li>□ a sequential record of all the approved changes made to the approved baseline in terms of cashflow, upgrade dates and scope of works.</li> </ul>

**Table 1 Description of project data recorded within the PW\_MS.**

<b>PWP at 31 March, 1998</b>	<b>Values</b>
No projects	<ul style="list-style-type: none"> <li>• 886 No. – cashflow statistics are: Expenditure per annum per project, High = HKD 510 million Low = HKD &lt;0.1 million Median = HKD 3.4 million Mode = HKD &lt;0.1 million Mean = HKD 19.9 million SD = HKD 48 million</li> <li>Budgets statistics per project; High = HKD 10,990 million Low = HKD 3.3 million Median = HKD 98 million Mode = HKD 32 million Mean = HKD 360 million SD = HKD 856 million</li> </ul>
Diversity of projects	<ul style="list-style-type: none"> <li>• 48 out of 72 categories of infrastructure 10 most frequent categories of infrastructure are: 137 No Civil Eng – Land development 119 No Roads 78 No Environment – sewerage 62 No Fresh water supply 61 No Secondary schools 55 No Primary schools 36 No Civil Eng - drainage and erosion 33 No Fresh/salt water supply 27 No Tertiary education 25 No Environment - refuse disposal</li> </ul>
Diversity of Clients	<ul style="list-style-type: none"> <li>• 16 Clients. Nos projects for 10 most active Clients; 233 No Planning, Env't, Lands Bureau 147 No Works Bureau 139 No Transport Bureau 132 No Education &amp; Manpower Bureau</li> </ul>

		42	No	Housing Bureau
		41	No	Security Bureau
		41	No	Home Affairs Bureau
		36	No	Health and Welfare Bureau
		22	No	Economic Services Bureau
		15	No	Treasury Bureau
Diversity of Officers	Controlling Officers	10.	Nos	projects for Controlling Officers are;
		307	No	Director Architectural Services
		199	No	Director Territory Development
		105	No	Director of Highways
		95	No	Director of Drainage Services
		92	No	Director of Water Supply
		34	No	Director of Home Affairs
		31	No	Director of Civil Engineering
		21	No	Director of Environment
		2	No	Secretary for Works

**Table 2 Statistical indicators of the diversity of the PWP at March 1998 for the financial year 1998-1999.**

In 1991-92, the year before the implementation of the PW\_MS, the total expenditure on PWP projects was on 1,224 mutually exclusive infrastructure projects. The planned annual expenditure on these projects was US\$ 2,536 million but the audited expenditure was US\$ 1,378 million. (Director of Accounts, 1992) This under-expenditure of forty-six percent of the funds approved for expenditure i.e., an ‘outturn-variance’ of US\$ 1,159 million was unacceptable to the HKGSAR. They reacted quickly to implement new management arrangements including the introduction of the PW\_MS to help achieve better control of the PWP portfolio. The was not easy to do, the delivery process for publicly-funded infrastructure depends on a highly differentiated public works organisation in which each of the public works departments has different staffing levels, workloads, locations, and each undertake different types of work. The PW\_MS is used as a management tool to integrate this highly differentiated delivery organisation.

By comparison, five years later after implementation of the PW\_MS - in 1997-98 – the total expenditure on the PWP was on 1,048 mutually exclusive projects. The planned annual expenditure on these projects was US\$ 2,486 million but the audited expenditure was HK\$ 2,351 million (Director of Accounts, 1998). This was an improved performance with under-expenditure of twenty-two percent of the funds approved for expenditure i.e., a lesser ‘outturn-variance’ of US\$ 681 millions compared to US \$ 1,159 million in 1991-92. Irrespective of this apparent benefit derived in part from the PW\_MS: in 1998, the Secretary for Works of the HKG SAR requested an objective appraisal of the PW\_MS to determine:

- the extent that the PW\_MS was successfully used for the management of individual projects;
- the extent that the PW\_MS was successfully used to help manage the portfolios-of-projects overall;
- the extent that other means of data collection and reporting are used for both of these functions; and,
- to identify the requirements for an improved MIS.

He agreed to a postal survey to get qualitative answers to these questions but he insisted on it being achieved with as little effort as possible on the part of the respondents.

## POSTAL SURVEY OF USERS OF THE PW\_MS

### Population-sample

The population is taken from the list of authorised users registered within the PW\_MS. These are individuals who have a functional role in the delivery of the public works projects. For example, project managers and their support staff, are trained for data-entry and the interactive use of the PW\_MS to plan, monitor, and provide forecasts on their projects. Programme Managers are trained in the interactive use of the PW\_MS to obtain status reports on projects, and on a portfolio-of-projects.

The data on the population of works-department authorised users of the PW\_MS users was provided by the Public Works Administration Unit, of the Works Bureau, in January 1999 after a check to ensure it was up-to-date. The population for the survey is 584 unique authorised users of the PW\_MS employed within the works departments of the public works organisation. This overall population can be separated into two user classes: programme managers, and project managers. The attributes of the population supplied by the Works Bureau are listed in Table 3.

<b>Data attribute</b>	<b>Comment</b>
User Class Code	Unique character code string for one of 24 types of user class. The combination number is made of: <i>(a) prefix to denote role:</i> <i>HQ = works dept headquarters role</i> <i>PGM = programme manager role</i> <i>PJM = project manager role.</i> <i>(b) suffix to denote works department</i> <i>ARCHS = architectural services</i> <i>CED = civil engineering services</i> <i>DSD = drainage services</i> <i>EPD = environmental services</i> <i>HAD = home affairs</i> <i>HYD = highways</i> <i>TDD = territory development</i> <i>WSD = water supplies</i>
Individual name	Full name
Initials	Given name initials
Dept/Div	Organisational address suitable for internal distribution of mail
Post	Organisational position/grade
Telephone	
Fax	

**Table 3 Attributes of the population sample supplied by the PWSAU of the WB.**

The numbers in each of the user classes are listed in Table 4.

Userclass	No	Userclass	No	Userclass	No
HQARCHS	1	PGMARCHS	2	PJMARCHS	13
HQCED	4	PGMCED	4	PJMCED	68
HQDSD	13	PGMDS	5	PJMDS	86
HQEPD	4	PGMEPD	5	PJMEPD	39
HQHAD	2	PGMHAD	0	PJMHAD	0
HQHYD	3	PGMHYD	9	PJMHYD	128
HQTDD	8	PGMTDD	2	PJMTDD	78
HQWSD	0	PGMWSD	1	PJMWSD	110

**Table 4 The Population in terms of numbers in each Userclass.**

A random selection from the population was used to form a population-sample for the postal questionnaire survey that satisfied the requirement for a minimum but representative input from the population. The sample frame was constrained to the following criterion:

- The sample-size should provide a 95% confidence limit that it represents the response of the population;
- The sample size should include sufficient numbers of the ‘HQ/PGM’ class to provide a 95% confidence limit that it represents the response for that strata of the population;
- The sample size should include at least 10% of numbers of each of the works department PJM strata.

A stratified random sampling technique described by Hoinville (1977), and Sinclair (1975) was used to select the respondents from the HQ/PGM population strata and also the PJM population strata. Fellows and Liu (1997), and Easterby et al (1991) advise how the population sample size can be calculated to achieve a desired level of confidence so that the results obtained from the population-sample are representative of the population. This assumes prior knowledge of the statistical parameters of the population but these were unknown in this case. However, Easterby et al, suggests a heuristic in formula (1) for estimating the sample size needed to give the required number of responses to a question, assuming well-balanced responses.

$$n = P(100-P)/E^2 \dots\dots\dots(1)$$

where:

*n* = is the sample size required.

*P* = is the percent occurrence of the state/condition.

*E* = is the maximum error required.

There was no prior work that had established confidence in the probable outcome for this survey, so a 95% confidence level was adopted. Substituting an evens occurrence in (1) gives the greatest value for *n*. Using Easterby’s suggested formula for ‘finite population correction’ (2), ‘*n*’ can be adjusted to account for the size of the population or the population strata.

$$n^1 = n/(1+(n/N))\dots\dots\dots(2)$$

where:

*n* = is the sample size from (1).

*N* = is the total population size (63No. HQ/PGM strata; 521 No. PJM strata).

*n*<sup>1</sup> = is the sample size required.

From (2), the calculated random-sample to be taken from the HQ/PGM and the PJM stratum are thirty-eight numbers and eighty-four numbers respectively. This does not take into account any bias introduced by a reduced response caused by staff changes, misdirected mailing, or a reluctance to participate. An arbitrary fifty-percent response rate is assumed resulting in a proposed population-sample comprising a census of the HQ/PGM strata and a random-sample of one hundred and sixty eight of the PJM strata. A simple-random-sample of the PJM strata of the population was generated using the random-number feature of Microsoft Excel software. The attributes of the derived population-sample are listed in Table 5.

<b>Population Strata</b>	<b>Numbers in population-sample</b>
HQ/PGM	63 No. (100% of the population strata)
PJM	168 No. <ul style="list-style-type: none"> <li><input type="checkbox"/> ARCH = 5 No. (38% sub-strata)</li> <li><input type="checkbox"/> CED = 20 No. (29% sub-strata)</li> <li><input type="checkbox"/> DSD = 31 No.(36% sub-strata)</li> <li><input type="checkbox"/> EPD = 14 No. (36% sub-strata)</li> <li><input type="checkbox"/> HAD = 0 No. (no sub-strata)</li> <li><input type="checkbox"/> HYD = 39 No. (30% sub-strata)</li> <li><input type="checkbox"/> TDD = 27 No. (35% sub-strata)</li> <li><input type="checkbox"/> WSD = 32 No. (29% sub-strata)</li> </ul>

**Table 5 Attributes of the population-sample**

## Questionnaire

The questionnaire was constructed using the mind-mapping and hierarchical breakdown analysis methods of Buzan (1995). The individual questions were developed from this beginning using the guidelines of Sinclair, Wright and Barnard (1975), Oppenheim (1966) and Hoinville. This was to ensure a consistent form of query, and consistency in the data so that it is suitable for statistical or frequency analysis. Each stage of development was sequential to allow continual improvement from specialists and expert practitioners with revisions at each stage of feedback.

The number of population sectors was optimized to support statistical analysis of the results and to highlight the significant sectoral patterns of response. Table 6 shows the range ‘User-role’ descriptions within the PW\_MS that could be potentially used to define sectors of the population-sample. The items in *italic* are external roles taken up by personnel not employed by the public works departments and not included in the population sample.

Role (abbr)	Description
APJM	Assistant Project Manager
CD	<i>Client Department Representative</i>
CLIREP	<i>Client Representative</i>
DIRECTOR	Director of a Works Department
EPD	<i>EPD [environment protection department] Representative</i>
FB	<i>Finance Branch Representative</i>
FM	Functional Manager
LD	<i>Lands Department Representative</i>
PAT	<i>Project Action Team Representative</i>
PB	<i>Policy Branch Representative</i>
PC	<i>Prime Contractors' Representative</i>
PD	Project Director
PGM	Works Department Programme Manager
PJM	Project Manager
SCR	<i>Sub-Contractor's Representative</i>
SUPPORT	General Support Person
TL	Team Leader
WD	<i>Works Department Representative</i>

**Table 6 Designated project roles available from within the PW\_MS.**

The Questionnaire is in four parts preceded by a short ‘preliminaries’ section that measures each respondent’s participation in the delivery of PWP projects and to the extent of their first-hand use of the PW\_MS.

- Part one of the Questionnaire, measures the adequacy of the PW\_MS and identifies user ideas to improve it. These questions are designed to address how well the PW\_MS satisfies the traditional project control requirements of managing the project dynamics of scope, cost and time, and if there is a need for resource management within the functionality of the PW\_MS. User satisfaction with the effort involved in data capture and data entry, and the frequency for up-dating the raw data is polled. Respondents are asked to state if they get added value from the PW\_MS and whether cited major features/functions of the software should be increased, kept the same or reduced. In this manner, satisfaction with the general aspects of the PW\_MS is measured.
- Part two of the Questionnaire, measures the extent that the PW\_MS meets the need for a project management tool. It also asks for details of the shortfall and the redundancy in these tools. Specific attributes of the PW\_MS are identified in each question.
- Part three of the Questionnaire, measures the adequacy of the PW\_MS for the purposes of managing a portfolio-of-projects. It assumes that the respondent has an interest in global performance, i.e. performance of a group of projects overall. Specific multi-project attributes of the PW\_MS are addressed in each question.

- Part Four of the Questionnaire measures the extent that other IT and manual systems are used to manage PWP projects singly or within groups. This series of questions is in four parts. The first sub-division measures the use of non-PW\_MS computer-based project management functions. Respondents are asked to identify the software used for these purposes. The second sub-division measures the use of manual methods for project management. It queries the project management attributes used in the first sub-division. Respondents are also asked to state what manual records are used for these processes. The third sub-division measures the use of non-PW\_MS computer-based Management Information Systems to record/process data for the management of groups of projects. Respondents are asked to identify the IT systems used for these purposes. The fourth sub-division measures the use of manual methods to record/process data for the management of groups of projects. Respondents are asked to state the physical records that are used for these purposes.

‘Tick-it’ questions are used in preference to ‘open-ended’ questions. This ensures a consistency in the response that enables statistical analysis of the results. The ‘Tick-the-box’ questions are designed for a rapid response from the respondent to encourage completion of the questionnaire. To encourage participation, the questions in this questionnaire call for responses, which will broadly identify a trend rather than accurately measure a quantum. The response to the question, is, in general, either the extreme of the spectrum of answers, i.e., ‘yes’ or ‘no’, or ‘keep’ or ‘change’ with a further mid-range option such as, i.e., ‘mostly’ or ‘sometimes’. The wording in this questionnaire is varied to suit the question, but in general, the tick-the-box options used throughout the questionnaire are designed to be consistent throughout the instrument. The marks, which are assigned to the options within each question, are weighted to represent the relative importance of the answer with a higher value assigned to a positive affirmation in favour of the PW\_MS. However, there is more mutual exclusivity in each of the possible responses. In this survey it is important to note when a respondent cannot offer an opinion because of a lack of knowledge on that topic. In these instances the code string ‘na’ denotes the response. Statistical methods are used to analyse the responses for each question, or the groups of questions.

The questionnaire was distributed to the population-sample on Monday, January 23, 1999. The postal distribution followed the guidance given by the Hoinville et al. The response period was three weeks. The on-going concern of the Secretary for Works to limit the imposition on the public works staff precluded the use of reminders to encourage greater participation in the survey.

## RESULTS

The total rate of response achieved was sixty-five percent of the population-sample. Details are shown in Table 7 and in Table 8.

Deadline Date	Response		HQ/PGM (portfolio managers)		PJM (project managers)	
	No	%	No	%	No	%
Feb 16	84	35%	20	28%	64	38%
Later	76	32%	26	37%	50	30%
<b>Total</b>	<b>160</b>	<b>67%</b>	<b>46</b>	<b>65%</b>	<b>114</b>	<b>68%</b>

**Table 7 Rate of response from the postal survey of PW\_MS Users.**

The response received from the population-sample exceeded the thresholds calculated as being representative for the population.

Respondents could, if appropriate, tick the ‘not used’ response for the ‘tick-it’ questions. This measures the extent that the population does not use a feature of the PW\_MS. It is a ‘non-participative’ response whereby the respondent is not then expected to have an opinion on the efficacy of the function/feature of the PW\_MS that is being measured. Otherwise the response received for each question is ‘participative’ as it is based on a user’s knowledge of the feature/function of the PW\_MS that is being queried. These are both evaluated as part of the analysis of the results of the postal survey.

User Class	Class size	Response Nos	% of Class	SumResponse Strata (Nos)	Response Strata (%)
HQArch	1	0	0%	HQ = 31	76%
HQCED	4	3	75%		
HQDSD	13	8	62%		
HQEPD	4	4	100%		
HQHAD	2	2	100%		
HQHYPD	3	3	100%		
HQTDD	8	7	88%		
HQWSD	7	4	57%%		
PGMArch	2	1	50%	PGM = 16	55%
PGMCED	4	1	25%		
PGMDSD	5	2	40%		
PGMEPD	5	2	40%		
PGMHYPD	9	8	89%		
PGMTDD	3	1	33%		
PGMWSD	1	1	100%		
PJMArch	5	4	80%		
PJMCED	20	13	65%		
PJMDS	31	13	42%		
PJMEPD	14	13	93%		
PJMHYPD	39	25	64%		
PJMTDD	27	24	89%		
PJMWSD	32	22	69%		

**Table 8 Response from the postal survey of PW\_MS Users by User class.**

The results from the ‘Preliminary’ part of the postal survey of a population sample of the PW\_MS Users show

- 53% of the PW\_MS Users are managing five or less PWP projects;
- 45% of ‘HQ and portfolio manager’ strata of the User population manage ten or less PWP projects
- 54% of the user community does not personally log onto the PW\_MS;
- 31% of the user community uses a proxy operator
- the frequency of logging onto the PW\_MS is rarely at a weekly interval, it is most often at monthly interval or, to lesser degree at the obligatory quarterly interval.

The results from the analysis of Part 1 'Improving the PW\_MS' of the postal survey of a population sample of PW\_MS Users shows:

- 80% of the population sample is qualified to express an opinion about the functions/features of the PW\_MS i.e., the results represent the population of PW\_MS Users;
- There is no evidence that features/functions of the PW\_MS are redundant;
- The 'scope statement' and the cashflow features of the traditional project management aspect of the PW\_MS should be retained;
- The work-schedule and baseline dates feature of traditional project management within the PW\_MS should be changed or the requirement reduced;
- A 'staff resources' feature within the PW\_MS that gives data on staff resource demands, capacity, and performance is not required;
- The 'effort in data entry' to the PW\_MS is not satisfactory. The procedural requirement for monthly updating of the PW\_MS is not supported in general, but the 'HQ and portfolio' strata of the population sample tend towards a preference for a monthly updating of data. The frequency of updating of the data should be changed to reflect the differences between 'high impact' and other projects in the PW\_MS database. 45% of the population-sample recommend a frequency of updating at 'monthly intervals for high impact projects and quarterly intervals for the others';
- The PW\_MS is deemed 'sometimes useful' and that it is 'sometimes' worth keeping the data up to date;
- There is not a mandate to change or reduce the features/functions of the PW\_MS;
- The PW\_MS pre-formatted, on-screen or hardcopy reports are deemed 'useful';
- The data supplied from the PW\_MS are 'useful';
- The PW\_MS is deemed to be 'an effective, centralised, single-source of accurate PWP data/information';
- The PW\_MS 'is effective for the management of the groups of projects in the hierarchical breakdown structures in the WBS, OBS, FRS, and the CRS' but these are under-utilised.
- However, the response-time of the PW\_MS is too slow. It should as fast as using 'a stand-alone PC for word-processing' and it should be as easy to use 'Microsoft Excel or Lotus 123 spreadsheet software'

In overall terms, a majority of the user population deem the PW\_MS as 'sometimes' satisfactory to use, or better. Although a 24% to 39% of the positive participative response say that it is not satisfactory to use.

The conclusion drawn from this analysis of Part 2 'Use of the PW\_MS' for management of Category C, B, and A PWP projects' of the postal survey of a population sample of PW\_MS Users shows that:

- there is no evidence that features/functions of the PW\_MS are redundant. However, many are 'severely under-utilised'.
- The 'positive participative' assessment of the user population is the 'right amount' - no element of the PW\_MS was deemed inadequate or excessive to requirements.

The conclusion drawn from results of Part 3 'Use of the PW\_MS' in the management of *groups* of Category C, B, and A PWP projects' of the postal survey of a population sample of PW\_MS Users shows that:

- there is no evidence that features/functions of the PW\_MS are redundant. However, project contacts; screen traffic lights; summation information on groups of projects; cashflow performance; milestone variance; spending performance; poor performance identified; and quarterly reports diary data: group features/functions of the PW\_MS are severely under-utilised. This is taken to mean that the PW\_MS is not meeting the needs of the majority of the User population for the purposes of managing more than one project.
- The data and the functionality are deemed as being the 'right amount' in all cases cited, but this is based on a 'positive participative' minority of the population sample. These results should not be taken as indicative that the cited features/functions are deemed adequate by the User Population overall.

The results from the results of Part 4 'Non-PW\_MS' methods used for the management of PWP projects of the postal survey of a population sample of PW\_MS Users shows that:

- non-PW\_MS computer-based systems are 'sometimes' used for the project management of PWP projects. The percent 'not used' response to these questions ranges from 22% to 46%. Of the named types of software used for these purposes, 'spreadsheet' is the most commonplace response except in the case of 'project costs' where database software is the significant response. Manual methods are also 'sometimes' used for the project management of PWP project functions cited in the questionnaire. The percent 'not used' response to these questions ranges from 22% to 44%. However, 'staff resources', and manual work scheduling/CPM for the 'HQ and portfolio manager' sub/strata, are under utilised. 'Files' are the most commonplace manual record used for this purpose.
- 49% to 72% percent of the population sample/strata state that non-PW\_MS computer-based systems are 'not used' for the management of groups of projects. The positive participant respondents 'sometimes' use computer-based systems for this purpose. . The named types of software: 'database, spreadsheet, or package software', are all used for this purpose. 53% to 75% percent of the population sample/strata respond that manual methods are 'not used' for the management of groups of projects. 'Files is the predominant type of records used for this purpose.

## CONCLUSION

The overall conclusion carried forward from this postal survey of the degree of satisfaction of the public works department with the PW\_MS, are:

- a majority of the user population deem the PW\_MS as 'sometimes' satisfactory to use, or better. Although a 24% to 39% of the positive participative response say that it is not satisfactory to use. However, the response-time is too slow. It should as fast as using 'a stand-alone PC for word-processing' and it should be as easy to use 'Microsoft Excel or Lotus 123 spreadsheet software'
- The project management features/functions of the PW\_MS are not deemed by the Users to be redundant, inadequate or excessive. There is not a mandate to change or reduce the features/functions of the PW\_MS.
- The 'effort in data entry' to the PW\_MS is not satisfactory. The procedural requirement for monthly updating of the PW\_MS is not supported in general, but the 'HQ and portfolio' strata of the population sample tend towards a preference for a monthly updating of data. The frequency of updating of the data should be changed to reflect the differences between 'high impact' and other projects in the PW\_MS database. Forty-five percent of the population-sample recommends a frequency of updating at 'monthly intervals for high impact projects and quarterly intervals for the others'.
- The PW\_MS is not meeting the needs of the majority of the User population for the purposes of managing more than one project.

In this respect the PW\_MS is said to have failed User expectation for a MIS that can satisfactorily accommodate the Cleland and King proposition for project management and portfolio management serviced by the same system.

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