Measuring Organizational Performance

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Abstract
This paper reports on the analysis methods used during a recent multinational experiment that was aimed at exploring concepts for a new planning process within a coalition of nations. In February 2004 over 400 participants from Australia, Canada, France, Germany, United Kingdom and the United States of America took part in the multinational experiment conducted in a distributed collaborative environment. These participants formed a virtual coalition headquarters in order to plan an appropriate response to a crisis situation. This new planning process required a "whole-of-government" approach encompassing government departments, coordination of coalition partners, government agencies, non-government organizations and other international organizations. The effective conduct of this process required the development and application of appropriate organizational structures and processes together with supporting information systems and technologies.
The challenge for the analysts and researchers was to design and develop valid and robust measures of organizational performance. We found that changes to the way the constructs were operationalized are required in order to take account of the practical complexities of measuring performance.

Background and History
The Multinational Experiment 3 (MNE3) is the third experiment in what was originally planned as a series of 4 incremental experiments focused upon Coalition and Allied forces. The experiments are supported and organized by the J9 cell in the United Stated Joint Forces Command (USJFCOM).
The aim (Whalen 2004) of MNE3 was to:
"To explore concepts and supporting tools for effects based planning within a coalition environment in order to assist the development of future processes, organizations and technology and Joint Task Force level of command."
Associated with this aim were 3 objectives (Whalen 2004)
"*To develop and assess processes used to support Coalition Effects Based Planning,*
To develop and assess organizational constructs to support Coalition Effects Based Planning and
To identify technology requirements to support Coalition Effects Based Planning"

Multinational experimentation will continue as an important part of USJFCOM's experimentation program. The data collected from Multinational Experiment 1, Multinational Experiment 2 and Multinational Experiment 3 will guide Multinational Experiment 4 (the next experiment in the series). The aims of MNE4 are currently being developed and are likely to include an investigation of the deployment of Coalition and Multinational forces, and the issues identified through such an undertaking.

Effects Based Planning as designed for Multinational Experiment 3 (MNE3)

MNE3 was a US led activity that examined how an ad hoc coalition conducts Effects Based Operations (EBO). While it concentrated on an Effects Based Planning (EBP) process associated with EBO it also attempted to look at the technology requirements to support EBP and the organisational structure. The documented objectives (Pepper 2003c; Whalen 2004) for MNE3 were:

Objective 1- Develop & Assess processes to support Coalition Effects Based Planning based on the assumption that successful coalition Effects Based Planning requires an effective set of supporting processes

Objective 2- Develop & Assess organizations to support Coalition Effects Based Planning. Based on the assumption that successful coalition Effects Based Planning requires efficient supporting organizations and structures and

Objective 3- Identify technology requirements to support Coalition Effects Based Planning. Based on the assumption that successful coalition Effects Based Planning requires a useful suite of supporting technologies.

To examine and execute the experiment a number of supporting concepts were tested. This report does not include these but instead focuses upon two: the EBP process see Pepper (2003a), Pepper (2003b), and Pepper (2003c).

The HQ is organised as shown at Figure 1. The Command Group is supported by: Plans, Operations, Information Superiority (IS), and Knowledge Management (KM) Teams. Specialist HQ Logistics Staff are embedded within the Plans and Operations Teams. Flexible throughout, the Headquarters (co-ordinated by the ACOSs) ensures that best use is always made of the expertise available to accomplish mission-specific requirements. A key aspect of the HQ is the cross-functional team organization as compared with the traditional hierarchical structure.

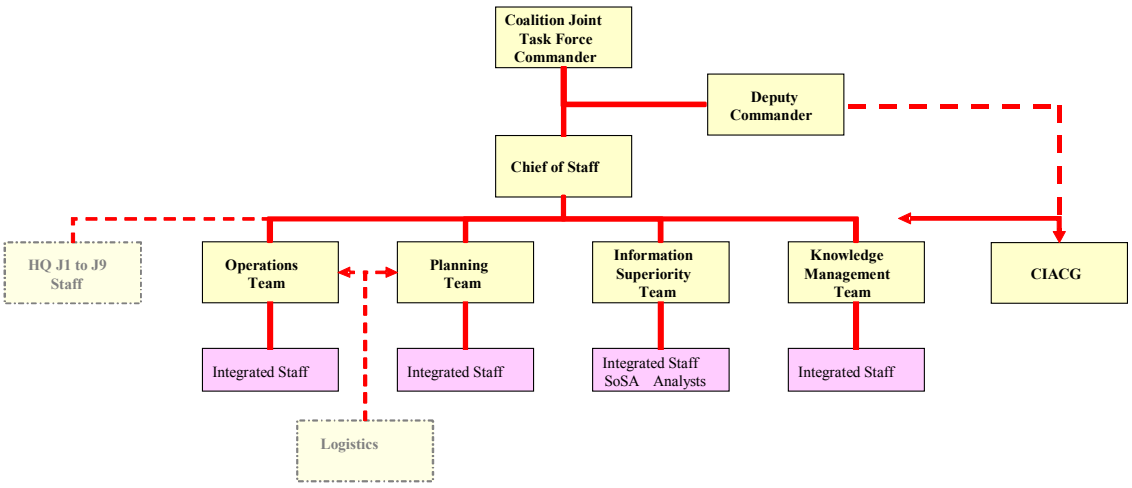
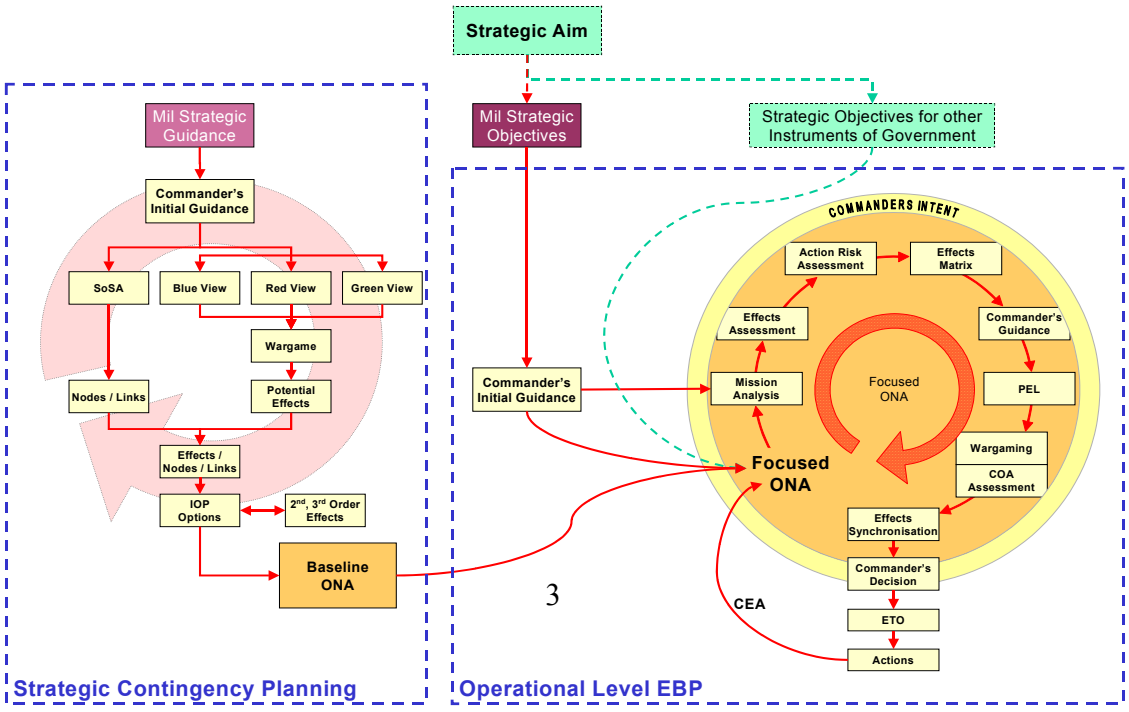


Figure 1. HQ Organization - manning.

Effects Based Planning Process

This section of the paper will attempt to describe some of the key points associated with the EBP process developed and executed in the experiment. It is argued that a successful EBO campaign relies upon the ability to identify the effects that will lead to success and the resources/actions with which to achieve them. This is the purpose of the EBP process.

Underpinning this work and related to the drive for a different approach to planning is recognition of the limitations associated with current military linear planning processes. These suffer from time delays between the identification of a problem and the implementation of a plan to resolve it. Problems at the Strategic level may take days or weeks to resolve due to the time take to develop a plan whilst those at the tactical level may depend upon information of presented in and requiring resolution in a fraction of a second. As a result, the planning and decision processes across the echelons of command can become out of phase. This could lead to de-synchronised planning cycles: or the emphasis upon de-confliction rather than synchronisation. As a consequence, it is unlikely that



actions undertaken at the tactical level could ever be fully synchronised with the activity occurring at the strategic level. These difficulties are not always rooted within technology but frequently within the processes themselves. In essence, little more than satisfactory de-confliction of echelon, component and function, is achieved when we actually aspire to a closer integration of all three. At the core of the process is a means by **Figure 2. The Effects Based Planning Process.**
which the effects are identified, selected and assessed. The challenge is to accurately assess the utility of the many effects that are identified which would support the commander achieving his strategic objective/aim with the resources available. Added to this are the so-called 2nd and 3rd order effects that may or may not be desirable – but acceptable given a developing situation. As can be seen from Figure 2, the EBP process
comprises two sections. The left of the diagram entitled 'Strategic Contingency Planning ' deals with the strategic long-term contingency planning for a particular subject or region of interest. It is closely modelling upon the ONA process. This element of the process was NOT undertaken during the MNE3 experimentation activity. The second section of the process entitled ' Operational level EBP' was the subject of MNE3 with the outcome being an Effects Tasking Order (ETO). Note again that the box labelled 'actions' was not undertaken. This second section starts by having a clear required strategic aim for a particular campaign and from this the associated military strategic objectives: Now Military Effects-based planning can begin, most importantly a carefully focused ONA, fed from all sources of information is required to support this process.
One challenge readily identified as a result of developing the EBP process was the ability to assess/measure the success or failure of an effect. This is a critical component just as in a traditional military campaign is Battle Damage Assessment (BDA). Here we have the ability to measure or assess the kinetic actions thus supporting a mechanistic and attrition view of conflict. However in EBO the impact of actions on the will and behaviour requires additional understanding and study. Further detailed description on the process steps can be found in (Pepper 2003b) and (Pepper 2003c).

Boards Centres and Cells.

The organisational structure used during MNE3 was based upon the USHQ. In addition to this, as part of the process, a series of Boards, Centres and Cells were developed. These organisational units were formed from staff from the US HQ, but in practice would include representatives from the Components, International Organisations etc. (See figure 3). Boards are formal, non-standing organizations with designated membership that meet as required. They provide input to centres and the JTFC. The following examples boards may be used: Joint Coordination Board (JCB), Effects/Actions/COA/Sync Board (EACOSB) and Joint Knowledge Management Board (JKMB).

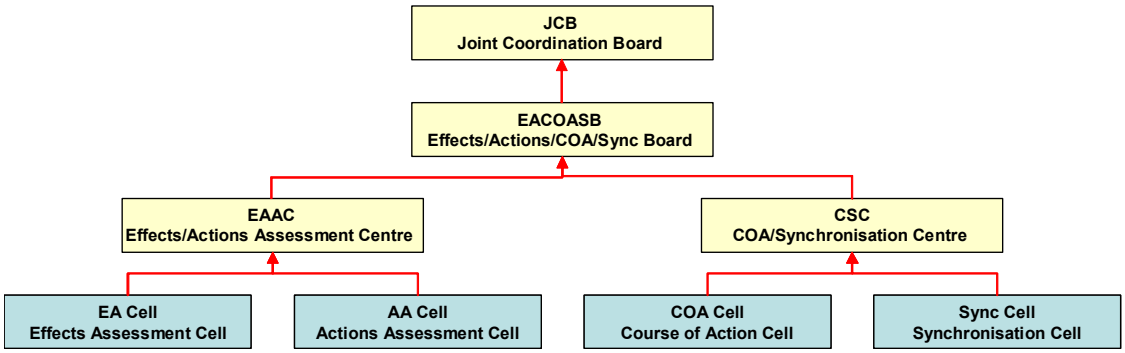
Centres again are formal, standing organizations that meet and conduct major planning or operations business with the HQ on a regular basis. Once established, centres would normally operate on a 24-hour basis. These centres included and Effects/Actions Assessment Centre (EAAC) and a COA Synchronisation Centre (CSC).

Figure 3. A portion of the BCC structure employed during MNE3.

Finally cells are again formal structures but are non-standing, functionally oriented units that meet on a regular basis to provide input to boards and centres. These included and effects assessment cell, an action assessment cell and a system of systems analysis cell.
Working Groups - Informal, non-standing organizations mission-tailored for a specific event or action. Working groups provide input to centres, boards, and cells and would be formed on an ad-hoc basis. During the MNE each Board, Centre and Cell were allocated members from the Coalition HQ in line with the concept of operations and the TTP's.

Theoretical background

The research reported here is a conceptual extension of three distinct areas of research; the Technology Acceptance Model also known as TAM (Davis 1986, 1989, Davis Bagozzi & Warsaw 1989, Davis & Venkatesh 1996), Organisational Effectiveness (Creed, Stout & Roberts 1993; LaPorte & Consolini 1991, Damadoran & Olphert 2000) and Usability (Shackel, 1986, Eason, 1988). The TAM (see Figure 4.) developed by Davis (1986) represents a comprehensive and coherent way of explaining psychological aspects of technology acceptance and uptake. TAM investigates the ability to predict peoples' acceptance of technology including computer acceptance and to predict intentions from attitudes, perceived usefulness, perceived ease of use and other related variables. It may also be used to identify limitations of technology. In this experiment the TAM has been utilized to assess perceptions of a new process rather than a new technology.
The original TAM (Davis 1986) posits that Perceived ease of use has a direct effect on perceived usefulness and is defined as "the user's perception of the extent to which using a particular system will be free from effort" (Davis & Venkatesh 1996, p20). Perceived usefulness is "the user's perception of the degree to which using a particular system will improve his/her performance" within an organisational context." (Davis & Venkatesh



1996, p20).
External variables are predicted to affect perceived ease of use and perceived usefulness, which in turn influence behavioural intention which contributes directly to actual usage. In the TAM external variables provide a link between internal beliefs, attitudes and intentions

and may include system design features, training, user involvement in design and information about the system.

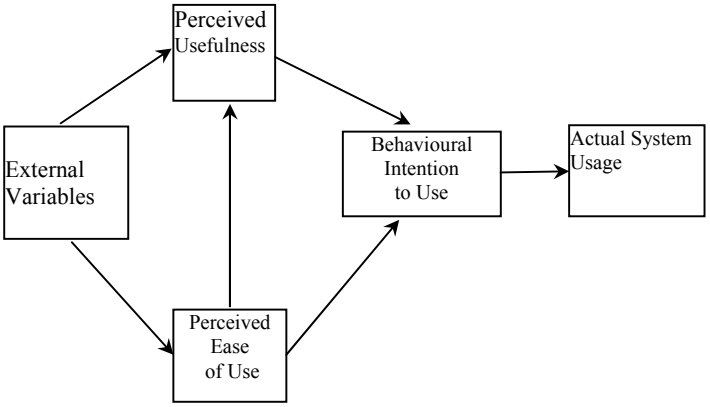


Figure 4. The Technology Acceptance Model (Davis, et al, 1989).

A large number of experiments relating to TAM have been validated the model including Adams, Nelson & Todd (1992), Hendrickson, Massey & Cronan (1993) and Szajna (1994). Taylor and Todd (1995) studied the applicability of TAM in the use of a computer resource centre. Igbaria investigated the broader applicability of TAM in relation to perceived usefulness and perceived ease of use (Igbaria & Davis, 1995). Liao and Landry (2000) investigated organisational acceptance in a commercial banking system and found considerable support for TAM. Thong, Hong and Tam (2003) also assessed organisational context variables. Venkatesh and Davis (2000) found social influences (subjective norm, 'voluntariness' and image), and cognitive aspects (job relevance, output quality, results demonstrability and perceived ease of use) significantly influence user acceptance.

While Davis et al (1989) utilized measures of computer usage many other researchers have used satisfaction as a surrogate measure of actual usage (Doll & Torkzadeh, 1988, Ives, Olson & Baroudi, 1983; Lane, Palko & Cronan, 1994). Others utilized user satisfaction as a measure of system effectiveness (Igbaria, Schiffman & Wieckowski, 1994; Martinsons & Ching, 1999; Melone, 1990; Mitchell & Zmud, 1999 and Srinivasan, 1985). Also Rawstorne, Jayasuria and Caputi (1998) and Yoon (1996) argue that user satisfaction is an appropriate measure in place of use where system use is mandated. The use of user satisfaction as a surrogate indicator of use is also appropriate where limits are imposed by the worksite or study site or where there is a lack of system monitoring software, or because of possible bias introduced while obtaining direct measures of system usage. In this study user satisfaction was employed as a surrogate measure of system usage because of limitations imposed by the worksite and because system use was mandated by the organization.

The measures of organisational constructs employed in this study conceptually extend this work to include attributes of organisational behaviour and are founded in the work of Creed Stout and Roberts (1993) and Prasad & Prasad (1994). It is frequently the potential of the technology, not the prevailing political or social forces that drive concern for effectiveness. Certain technologies pose risks for an organization that must be addressed and an organization's decision to implement technologies is often based on technical rather than organisational or human considerations. Considering technology as a fundamental of the

culture of the organization can foster a greater understanding of the processes and practices that impact organisational effectiveness. It is necessary to think about the nature of an organization's technology, the dynamics of the evolution of technology, and the implications of technological evolution on organisational effectives (Creed et al 1993). Damodoran & Olphert (2000), and Prasad & Prasad (1994) stress that technology can support and maintain a beneficial shift in organisational culture, and that this shift highlights the value of new technologies and promotes their use. Two aims of highly effective organizations such as the Department of Defence are: 1) to manage complex demanding technologies ensuring they avoid failures that would adversely affect the organization and 2) to maintain the capacity to meet periods of very high demand often under considerable time pressure (La Porte & Consolini, 1991).

Usability measures were also utilised in this experiment. These are closely tied to fitness for purpose and ease of use. Shackel (1991) suggested that usability, as he defined it, was comprised of four components or criteria:

- Flexibility (e.g. a capacity to cope with some specified deviation from the specified environment),
- Learnability (e.g. effective use shall be developed within a pre-defined training scheme and system of user support),
- Effectiveness (e.g. the required range of tasks must be accomplished at equal or better than a specified performance level), and
- Attitude (e.g. there will be acceptable levels of human cost in terms of fatigue, discomfort, frustration, personal effort - these being the factors that are most likely to colour a user's attitude toward the system).

In 1988, Eason suggested that usage of an information system is the single most reliable indicator of usability. In those environments where the user has discretion over their use of a system, usage will decline as usability lessens and may decline to the point where the system will be discarded. The relationship between usability and usage will be moderated by the usefulness of the system. In effect, trade-offs are made between usefulness and usability.

Method

The Coalition Federated Battle Lab Network (CFBLNet) is a wide area network (WAN) that provided the venue to conduct research (MNEI, MNE2 and MNE3 are typical examples) in an international forum. It is maintained and operated with the support of staff from DSTO staff and OCIO staff based in Canberra. The CFBLNet provides the network infrastructure, general applications and analytic tools and is vital to the conduct of the Multinational series of experiments. An Effects Based Planning tools developed by Qinetiq in the UK and used during MNE3.

Self-report questionnaires were utilised during MNE3. This totalled over 66 questionnaires administered during the three weeks of the experiment. Only a small portion of the results from the MNE3 questionnaires will be reported here.

The technology uptake questionnaire was comprised of previously developed scales such as the TAM (Davis, 1986, Davis & Venkatesh, 1996) as well as purpose-derived scales relating to organisationally relevant constructs and system usability. Participants were also asked to comment on each question. This was designed to elicit and explore information about EBP, its acceptance, and use that would not be apparent in the Likert style questions.

Most questions on Technology Uptake were included on the basis of previously published research Davis (1989), Adams, Nelson and Todd (1992) and Igbaria, Schiffman & Weickowski (1994), and covered the areas of: perceived usefulness, and perceived ease of use. The Perceived Usefulness and Perceived Ease of Use scales were originally developed by Davis (1985, and 1989) and were found to have high reliability and validity. The Perceived Usefulness scale consisted of 6 questions covering productivity, effectiveness and performance, and being able to accomplish tasks more quickly. The Ease of Use Questions reflect the degree of effort required and incorporates learnability, effectiveness and flexibility and is closely related to Shackel's usability criteria (Shackel 1991). Other questions were derived from three sources: Shackel's (1991) usability criteria which includes flexibility, learnability, effectiveness and attitude. Attitude is describe in terms of the level of fatigue, discomfort, personal effort and frustration required to use technology. In this study this was operationalized as organisational processes (flexibility) and training (learnability). The Ease of Use scale developed by Davis was also utilised to assess aspects of learnability, effectiveness and flexibility.

The questions relating to organisational behaviour are a derivative extension of the work of LaPorte and Consolini (1991) and Creed Stout and Roberts (1993) on High Reliability Organisations have been adapted to study organisational behaviours and technology uptake (shared understanding, work systems, tasks and roles, management practices and efficiency).

Satisfaction was used as a surrogate measure of actual usage as it was not possible to obtain objective measures of actual usage. In this study a 12-item user satisfaction scale was employed. This scale comprised questions relating to the information provided by the system including precision, sufficiency, accuracy, clarity, and timeliness. It also included questions relating to ease of use, user friendliness and the usefulness of the outputs from the system. This scale has been refined over several years of professional practice but is based on the work of Doll & Torkzadeh (1988) on the measurement of end user computing satisfaction and refining the user satisfaction scales developed by Ives Olson & Baroudi (1993) and Henderson & Treacey (1986). Doll and Torkzadeh concluded that their user satisfaction instrument had adequate reliability across a variety of applications, was short, easy to use and was appropriate for both research and practical purposes.

Participants

There were 152 players who answered the questionnaires distributed during MNE3. MNE3 involved investigating the organizational processes, organizational constructs and the technology requirements to support the EBP process utilizing a real world scenario. This paper focuses only on the results relating to the Organizational constructs. The original research proposal included Environment, Command, Strategy, Organizational Culture, Organizational Structure, Task Requirements (workload) Socio technical systems measures, Processes and Practices, Resources, Motivation and Efficiency and Effectiveness. However the experimental controllers determined that not all constructs could be measured during MNE3. This paper reports the results of a selection of the constructs examined in MNE3. Although a reduced number of organizational constructs were investigated during MNE3 a large amount of data has been collected.

Results and Initial Analysis

To ensure content validity a thorough survey of the relevant literature was conducted in order to understand the important aspects of the main variables and components so that any important dimensions of any variable would not be overlooked or rejected. The questionnaires were assessed for validity (measuring the phenomenon they were intended to measure) and completeness (they included all relevant items) and reliability (making it unlikely that questions would be misinterpreted). A few of the questions were reworded to improve reliability.

The post-implementation validation of the constructs and the statistical relationships between them includes an analysis of the relationships between the constructs using correlation, multiple regression analysis and Principle Components Factor Analysis. A principal components analysis was used to identify the components or factors making a significant contribution to the variance in user satisfaction. A principal components analysis identifies the extent to which factors are associated with one another and represent a concept (a measure of unidimensionality). Items that fail to load significantly on a construct should be removed from consideration.

Insight as to why variables are important was obtained from the comments provided in the questionnaires, the results of which are reported below.

On average participants had 5 years and 6 months Military experience. Of the participants 25.5% had prior experience with EBP and 30.5% had experience in working in a distributed collaborative environment.

A Chronbach Alpha test was conducted to ascertain the level of internal consistency and reliability of the scales used. Table 1 displays the Mean, Standard Deviation and Chronbach Alpha for each scale used in this study. The generally accepted cut-off for reliability is 0.7. As can be seen in Table 1 alphas ranged from 0.6280 to .9508. Two variables Tasks and Roles, and Management Practices are below the 0.7 cut-off point. If these variable are excluded the range of alphas for this study was between .7071 and .9508. However these scales are being developed and the cut off of .6 may be acceptable. The low alpha indicates that these scales require further refinement.

Scale	Mean	Standard Deviation	Chronbach Alpha
Satisfaction	3.47	1.12	.9495
Shared Understanding	4.70	0.89	.7908
Perceived Usefulness	3.29	1.28	.9508
Perceived Ease of Use	3.52	1.07	.8724
Tasks and Roles	4.04	0.56	.6280
Work Systems	5.18	0.98	.7932
Management Practices	4.23	1.14	.6729
Task Requirements	4.82	1.06	.7071
Efficiency	3.80	1.30	.7546

Table 1. List of Scales of questions with mean scores, standards deviation and Chronbach's alpha.

An initial indicator of participant acceptance of the EBP is based on (Davis et al 1989) TAM. This postulates that ease of use, usefulness and satisfaction are good indicators of subsequent use. In MNE3 this model has been refined to assess the EBP process. Players rated EBP on a seven point agree/disagree Likert type scale with 1 = strongly disagree, 4 = neutral, 7 = strongly agree. A rating of 4 or more indicates that it is likely that EBP will be accepted and used by participants. A summary of the results attained appears in Table 2.

Scale	**Multinational Experiment 1 (Groove) (N=9)**				**Multinational Experiment 2 (ONA)**						**Multinational Experiment 3 (EBP)**	
	Vignette1		**Vignette 2**		**W1 (N=44)**		**W2 (N=48)**		**W3 (N=47)**		**(N = 137)**	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Usefulness	5.00	0.81	5.13	0.94	4.31	1.38	4.56	1.15	4.61	1.20	3.35	1.43
Ease of Use	4.81	0.80	5.55	0.76	4.39	1.43	4.70	1.32	4.66	1.31	3.54	1.38
Satisfaction	4.18	0.96	4.72	1.10	4.36	1.10	4.47	1.00	4.47	1.10	3.50	1.23

Table 2. Usefulness, Ease of Use and Satisfaction ratings relating to Groove (MNEI), the ONA Process (MNE2), and the EBP process (MNE3). A mean rating of 4 or higher indicates acceptance and satisfaction.

Participants were given the opportunity to add comments to their responses to the questionnaires administered during MNE3. A number of useful suggestions were submitted in relation to what needed to be changed to improve EBP. These comments related to the EBP process, the organizational constructs and to the technologies used. There was no single issue emerging in relation to the EBP process that needed attention, however the most common responses indicated that the user friendliness of the tools to support EBP needed to be improved, some of the stages in the EBP process needed to be consolidated (e.g. Effects Assessment and Actions Assessment), that some of the process steps needed to be conducted in a different order (e.g. put Coarse of Action Analysis before the Priority Effects List step), and the concept of operations needed to be easier to read. In particular participants indicated what needed improvement, this included in order of priority: training and experience, staffing levels, understanding individual roles, Command level guidance and the generation of the Effects Tasking Order (the output of the EBP process).

Players were also asked whether or no the organizational structure implemented during MNE3 supported the EBP process. These results need care during interpretation, as the original organizational structure was changes by the participants early in the experiment. These results were obtained later in the experiment and reflect the new structure implemented by the players. Further analysis of this data is required. **Table 3** displays the results of questions obtained during MNE3. These questions were narrative questions and did not have ratings associated with them.

Question	Yes	D.K.	No	Other
Does the BCC organization structure support EBP?	66 %	0%	18%	16%
Does Cmd/Ops/Plans/IS/KM structure support EBP?	67%	11%	6%	16%

Table 3. Results relating to the appropriateness of the organizational structure employed during MNE3.

In addition to the rating of the BCCs participants offered comment relating to the BCCs generally and in relation to specific aspects of the BCCs. In summary these indicated that there were too many BCCs, that some had too few members and some had too many members, that the BCC structure was not working and that players used the Plans, Ops, IS/KM structure in preference to the BCC structure. Further analysis is required to determine exactly what changes took place and when these occurred.
It is important to note that the combination of a the lack of player familiarity with the EBP process, the tools, BCCs and the inexperience of players interact in such a way that the interpretation of results is difficult. An example of the preliminary results relating to effectiveness appears in Table 4. These results are consistent across the "high priority" steps in the EBP process and indicate where improvements need to be made.

Question	No change	D.K.	Better tools	Better training	Simplify	Better HCI
What changes would you make to the Effects Assessment (EA) step to make it more effective?	18%	12%	34%	18%	11%	7%

Table 4. Changes suggested for Effects Assessment step of the EBP process to be more effective.

Participants were also asked to identify what was the most difficult and time consuming aspects of EBP, comments can be divided into 2 main components; those that relate to EBP and those that relate to the Operational Net Assessment (ONA) database. Comments about what was most difficult in the EBP process included the tools used, understanding EBP, forming teams, and identifying effects, effect/target groups, actions, Course of action analysis, Wargaming, and effects assessment.

	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
Model					R Square Change	F Change	df1	df2	Sig. F Change
PU, PEOU	.537	.288	.280	.8589	.288	33.994	2	168	.000
PU, PEOU, EFF	.628	.394	.383	.7946	.106	29.303	1	167	.000
PU, PEOU, EFF, SU	.645	.416	.402	.7842	.022	6.219	1	166	.014

Table 5. Regression analysis of variables contributing to satisfaction with the system.

A regression analysis was conducted and the results of this are presented Table 5. The variables that made a significant contribution to satisfaction with the system were perceived usefulness, perceived ease of use, organisational processes, efficiency and shared understanding. Taken together these variables accounted 41.66% of the variance in satisfaction.

Component	Eigenvalues	% of Variance	Cumulative %
Shared understanding	2.863	35.783	35.783
Perceived usefulness	1.186	14.829	50.612
Perceived ease of use	1.001	12.512	63.126
Tasks and Roles	.806	10.078	73.204
Work Systems	.648	8.102	81.305
Management Practices	.574	7.175	88.480
Task requirements	.515	6.443	94.923
Efficiency	.406	5.077	100.000

Table 6. Principal Components Analysis showing total variance explained

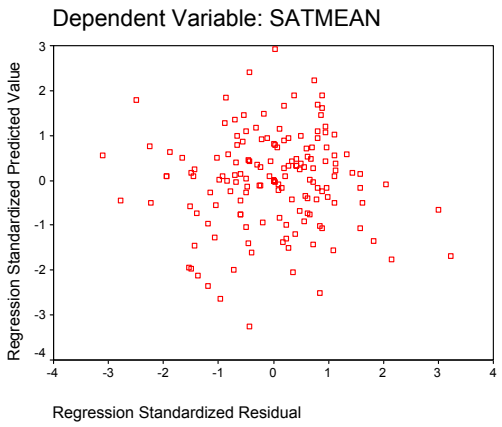


Figure 5. Scatter Plot of regression standardised residual

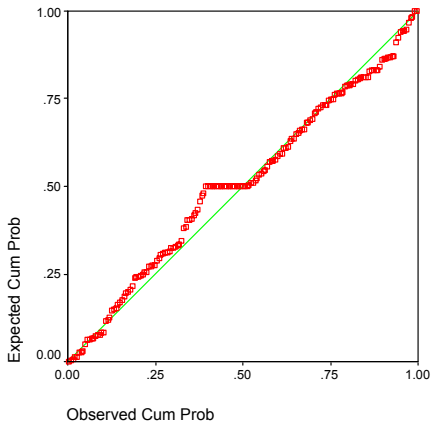


Figure 6. Probability Plot of regression standardised residual.

This confirms a significant relationship exists between perceived usefulness, perceived ease of use, shared understanding and efficiency with Satisfaction (all are highly significant at the p=0.05 level (see Table 6)). Thus these variables make a significant contribute to satisfaction. The scatter plot of the predicted and residual of satisfaction shows a random scatter indicating a degree of linearity of the data (see Figure 5), and the Probability Plot shows a linear relationship between the predicted and observed variables (See Figure 6).

To establish which variables contributed the most variance in the data a principal components analysis was conducted. Principal components analysis was selected because there are no limits to the number of variables, the number of analyses or the number of rotations that can be performed.

The result of this analysis appears in Table 6. which shows the variables and their associated eigenvalues, the percentage of variance explained and the cumulative percentage of variance explained. In reference to the eigenvalues if this value is greater than 1 then the factor is contributing significantly to the variance in the data. **Table 6** displays 3 variables with an eigenvalue greater than 1; shared understanding, perceived usefulness, and perceived ease of use.

A visual examination of the Scree plot (**Figure 7.)** suggests that one more variable may be of interest, information about the system before it was introduced. The 3 variables with an eigenvalue greater than 1 contribute 63.1% of the variance in the data.

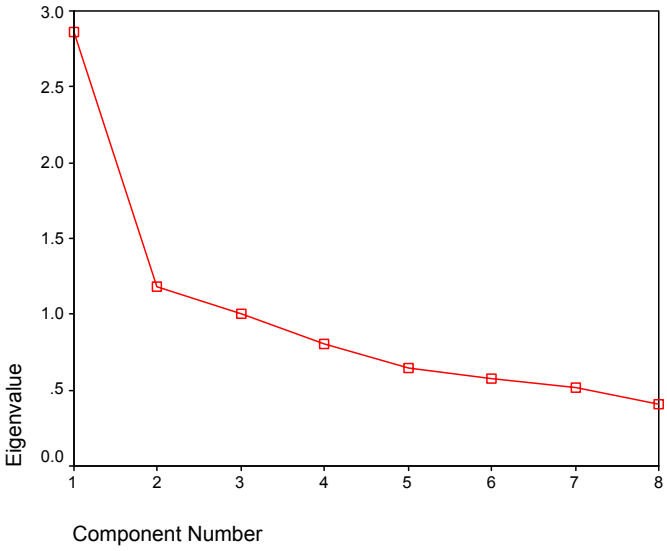


Figure 7. Scree plot of eigenvalues for components used. (1 = SU; 2 = PU; 3 = PEOU; 4 = Tasks and Roles; 5 = Work Systems; 6 = Management Practices; 7 = Task Requirements; 8 = Efficiency.)

The addition of the 'tasks and roles' variable adds a further 10% yielding a total of 73.2% of the variance in the data explained by 4 variables.

Discussion and Conclusions

The Organisation structure based upon the HQ is a relatively sound model for the HQ at certain stages in an operation. Nevertheless cultural differences, technology factors and a lack of personal contact all influenced the results obtained and have a clouding influence over issues associated with the organisational structure.

The boards centres & cells (BCC) structure needs to re-examined. This is complex in regards to the membership. There was a degree of conflict detected with regards to the membership of each BCC. There was also a lack of situational awareness of what was happening, which of the BCC's were sitting, who should be at what etc. Some of these factors need to be re –examined from the perspective of the experiment design and control during the execution period.

Working in a virtual environment is a challenge. This needs to be considered in the future staffing of experiments. Australia 'suffered' by not having participants engaged in the Knowledge Management and Information Superiority (although there was one SOSA) roles.

Initial analysis suggests that the process is a valid for planning EBO operations. However it does require further refinement. Specific issues relate to the mapping between the ONA and EBP processes: this has been noted as being disconnected in terms of the technology support provided and how they were used or focused during the event. The EBP process, as currently developed, does not include the non-military aspects of EBP.

On the technology side the CFBL VPN to support the MNE3 activity was a success. There was one small network outage of approximately 2 hours when communications problems in Hawaii disrupted the network. The tools however and IWS in particular were a problem particularly at the beginning of the experiment. Licensing issues, the need for a reboot of the IWS server and other technical issues detracted from the initial training periods.

Looking at the tools directly tested in MNE3 in support to the EBP process, a number of initial comments have been made. The key one being that there is a requirement to have greater integration between the EBP planning process and the tools that directly supports this activity. The UK Qinetiq tool (Qtool) which was tested had a number of specific problems including the limited ability to interface to the ONA process and aspects of the HCI, ie users quickly lost orientation of what steps in the process where completed etc using the tool. Relatively poor training may also have contributed to this fact.
Finally from an Experiment design perspective questions have been raised with regards to the size of the experiment, the number of supporting concepts being included influencing or potentially clouding the core aims of the experiment.
The results analysed so far indicate that there is support for the application of the Technology Uptake Model developed for assessing the level of acceptance for the Effects Based Planning Process. This also supports Reimenschneider's findings that this model is applicable to new methods and processes (Riemenschneider 2002). A large number of researchers have found that problems associated with the introduction of new systems are not just technological but social and managerial in nature (Clegg 1993; Shani 1994). New processes, organizational systems, and technologies can only improve organizational performance if they are accepted and used. The Successful management of human and behavioural factors during system design and implementation phases is vital to system acceptance. MNE3 has enabled further exploration of the factors critical to the success of new processes and systems.

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