INTERACTIVE COMMUNICATION IN VALUE MANAGEMENT WORKSHOPS

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ABSTRACT

In the Value Management (VM) workshops, VM team often composes of multidisciplinary members with different professional backgrounds (e.g., architects, structure engineers, etc.) from various companies. Sometimes, they may even come from different cities and regions. Therefore, it is hard to arrange all VM team members participating in a workshop at the same time in the same place, especially for the international mega projects. However, it is vital to ensure effective communication during the VM workshop for maintaining and enhancing the team spirit in the complicated decision process. This study aims at investigating the effects of three communication modes (i.e., face to face communication, online communication, and both face to face and online communication) between various team members on the performance of VM workshops (function analysis, creativity, and evaluation). An intervention study via the three communication modes was conducted, post-questionnaire surveys were adopted to collect data from the VM participants who joined the intervention study. Statistical analysis (i.e., ANOVA) was used to compare the level of satisfaction among the three groups. The results surprisingly reveal that team members using online communication tools by the computer can significantly improve the information sharing process and facilitate the VM workshop, particularly for overcoming the time limitation in a restricted location, but the totally independent environment is not fit for function analysis phase. Some recommendations such as the internet and computer-based systems (e.g., Google Sheet) will then be suggested for enhancing the communication in the VM workshop.

Keywords: Communication, Face to face, Online, Value Management

INTRODUCTION

Value management (VM) is a team decision-making process emphasizing participation among multi-stakeholders (Leung, et al. 2002), which has been applied in a huge number of construction projects for satisfying multi-stakeholders (Thiry, 2001). The traditional form of communication during VM studies is directly face to face. It includes data exporting and importing processes via different formats (e.g. Text, diagrams, etc.). Nowadays, communication has been extended from face to face to web-based approaches due to the development of the internet (Hatem et al., 2012). It is really hard to coordinate all VM team members' schedules at the same time in the same place for the VM workshop, especially for mega construction projects due to the long distance among their locations. All of those create obstacles in the VM practices.

VM encouraging positive communication among VM team members is beneficial in establishing team spirit and accelerating the arrival of consensus among stakeholders. All decisions and recommendations are made through communication. A suitable communication platform and communication environment are, thus, the basis for the smooth implementation of the workshop. This study investigates the effects of three communication modes (i.e., face to face communication, online communication, and both face to face and online communication) among the team members on the performance of VM workshops (information, function analysis, creativity, and evaluation).

ONLINE COMMUNICATION IN VALUE MANAGEMENT WORKSHOP

The application of computer techniques can improve the efficiency of VM exercises (Waterhouse, 1998). In fact, Microsoft Excel spreadsheet has widely been used to calculate the function indexes, identify the best ideas, and assess the life cycle costs of alternatives in different VM phases (Meng, 1996).

The virtual workshop has been defined as web-based discussions using groupware facilities when team members are geographically dispersed (Veen et al, 1998). To allow sufficient flexibility to the participants, a new web-based value management system named 'interactive value management internet' (*iv*mi) was developed in 2011 (Leung, 2011). The *iv*mi program allows participants to participate in the whole function analysis process without meeting together physically at the same place.

Google Sheet is a proper computer-based online spreadsheet allowing users to create and format spreadsheets and, simultaneously, work with other people. At first, a set of VM worksheets for various phases (information, analysis, creativity, evaluation, and development) has to be uploaded to the Google Drive under various folder (e.g., function, FAST and value mismatch worksheets under the Analysis phase; and champion, scoring, and pair comparison worksheets under the Evaluation phase; see Figures 1 and 2). Assigned team members must log into the Google account for specific projects.

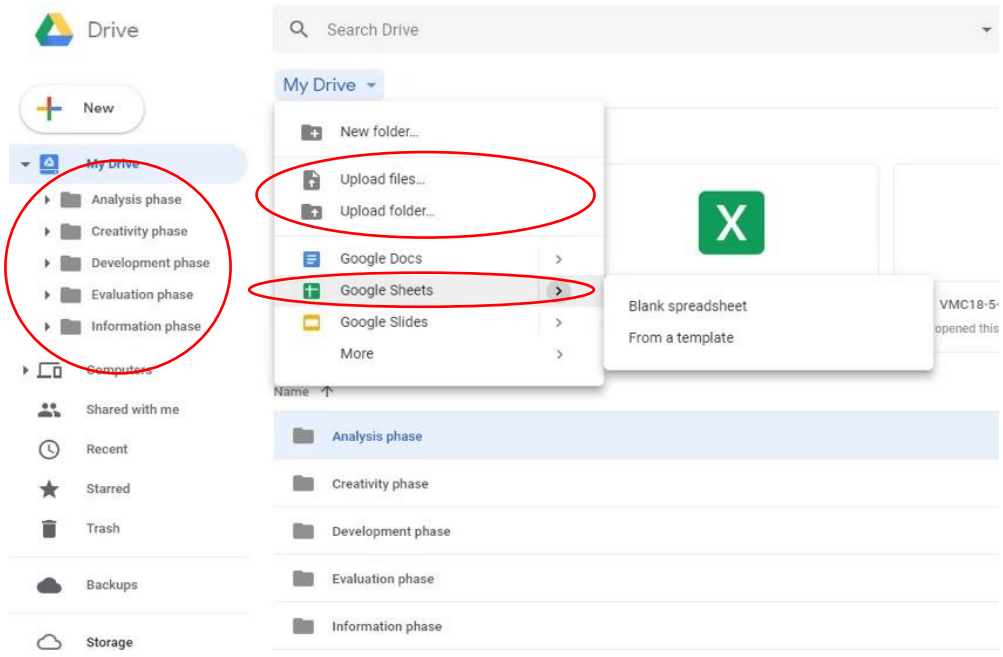


Figure 1 Uploaded/Created VM Worksheets into the Google Drive

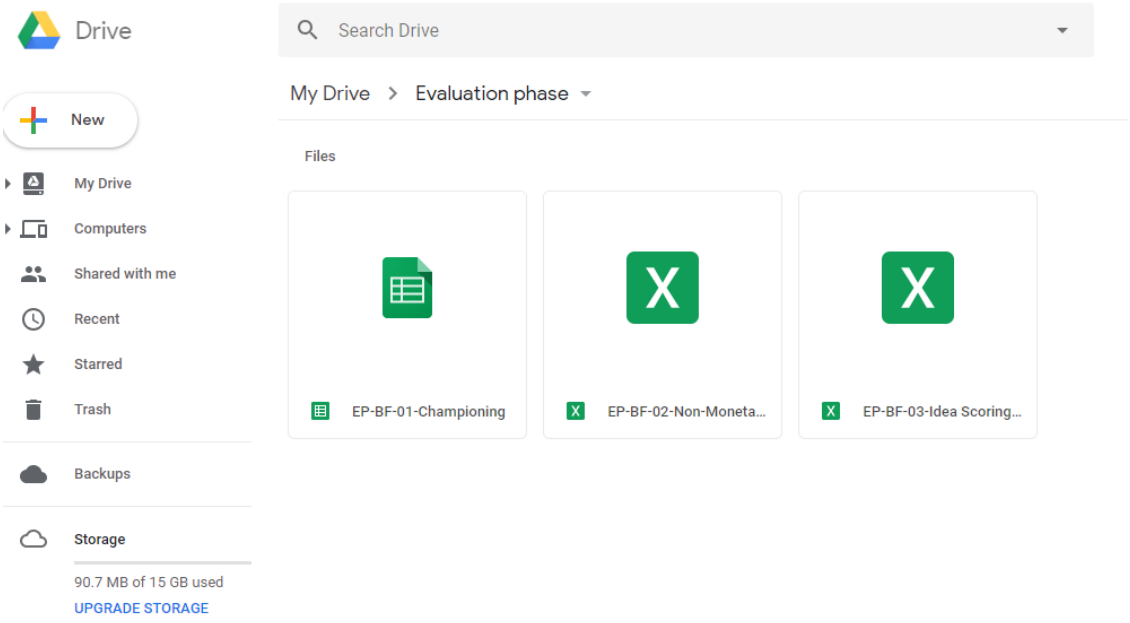
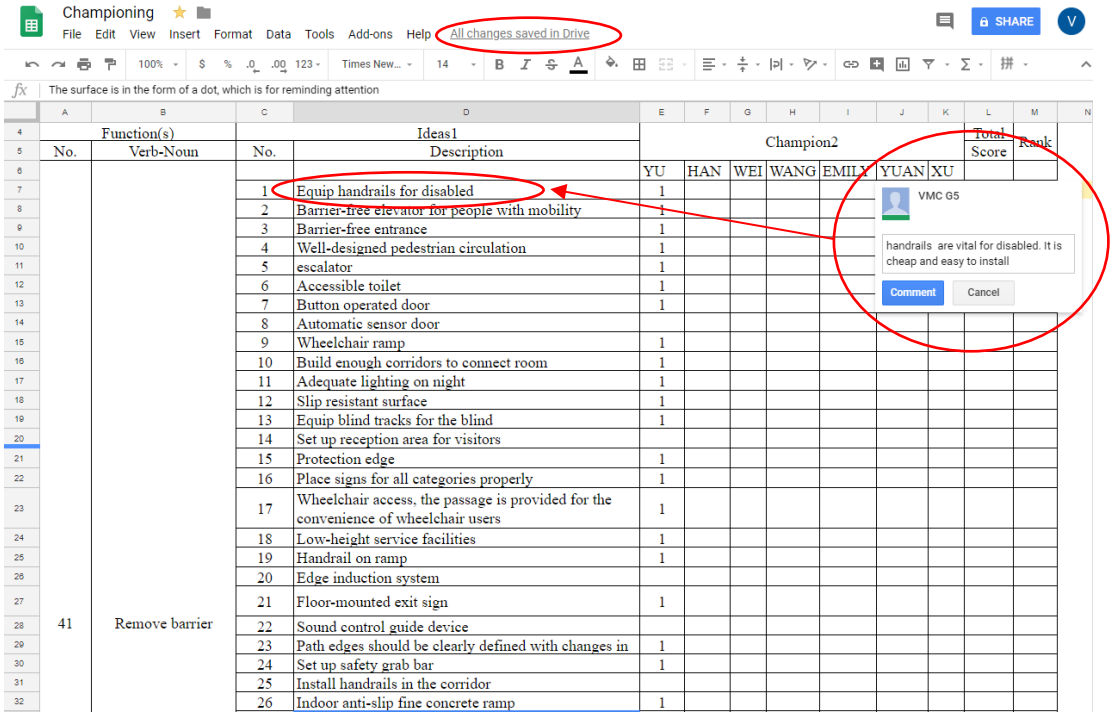


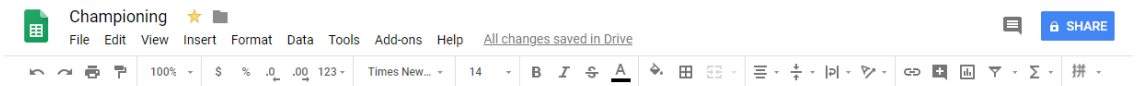
Figure 2 Pre-set VM Google Sheet for Evaluation Phase

Apart from the information (e.g., functions, ideas, etc.) saving and sharing, team members can also vote and write down any comments to convince other team members during the discussion (see Figure 3a). Finally, a champion Google sheet is accomplished (see Figure 3b).



Function(s)		Ideas1		Champion2							Total Score	Rank
No.	Verb-Noun	No.	Description	YU	HAN	WEI	WANG	EMILY	YUAN	XU		
		1	Equip handrails for disabled	1								
		2	Barrier-free elevator for people with mobility	1								
		3	Barrier-free entrance	1								
		4	Well-designed pedestrian circulation	1								
		5	escalator	1								
		6	Accessible toilet	1								
		7	Button operated door	1								
		8	Automatic sensor door									
		9	Wheelchair ramp	1								
		10	Build enough corridors to connect room	1								
		11	Adequate lighting on night	1								
		12	Slip resistant surface	1								
		13	Equip blind tracks for the blind	1								
		14	Set up reception area for visitors									
		15	Protection edge	1								
		16	Place signs for all categories properly	1								
		17	Wheelchair access, the passage is provided for the convenience of wheelchair users	1								
		18	Low-height service facilities	1								
		19	Handrail on ramp	1								
		20	Edge induction system									
		21	Floor-mounted exit sign	1								
41	Remove barrier	22	Sound control guide device									
		23	Path edges should be clearly defined with changes in	1								
		24	Set up safety grab bar	1								
		25	Install handrails in the corridor									
		26	Indoor anti-slip fine concrete ramp	1								

Figure 3a Information Sharing and Voting Individually in the Champion Google Sheet



Function(s)		Ideas1		Champion2							Total Score	Rank
No.	Verb-Noun	No.	Description	YU	HAN	WEI	WANG	EMILY	YUAN	XU		
		1	Equip handrails for disabled	1	1	1	1	1	1	1	5	**1**
		2	Barrier-free elevator for people with mobility	1	1	1	1	1	1	1	4	**2**
		3	Barrier-free entrance	1	1	1	1	1	1	1	4	**2**
		4	Well-designed pedestrian circulation	1	1	1	1	1	1	1	4	**2**
		5	escalator	1		1	1	1	1	1	4	**2**
		6	Accessible toilet	1	1	1	1	1	1	1	4	**2**
		7	Button operated door	1	1	1	1	1	1	1	4	**2**
		8	Automatic sensor door				1	1	1	1	4	**2**
		9	Wheelchair ramp	1	1	1	1	1	1	1	4	**2**
		10	Build enough corridors to connect room	1	1		1		1	1	4	**2**
		11	Adequate lighting on night	1	1	1	1	1		1	4	**2**
		12	Slip resistant surface	1	1	1	1	1	1	1	4	**2**
		13	Equip blind tracks for the blind	1	1	1	1	1	1	1	3	**13**
		14	Set up reception area for visitors		1	1	1	1	1	1	3	**13**
		15	Protection edge	1	1	1	1	1		1	3	**13**
		16	Place signs for all categories properly	1	1				1		3	**13**
		17	Wheelchair access, the passage is provided for the convenience of wheelchair users	1	1	1	1	1	1	1	3	**13**
		18	Low-height service facilities	1	1	1	1	1	1	1	3	**13**
41	Remove barrier	19	Handrail on ramp	1	1	1	1	1	1	1	3	**13**
		20	Edge induction system		1	1			1		3	**13**
		21	Floor-mounted exit sign	1	1		1		1		3	**13**
		22	Sound control guide device		1	1	1		1		2	**22**
		23	Path edges should be clearly defined with changes in	1	1	1	1	1			2	**22**
		24	Set up safety grab bar	1	1	1	1	1	1		2	**22**
		25	Install handrails in the corridor				1	1		1	2	**22**
		26	Indoor anti-slip fine concrete ramp	1	1	1	1	1			2	**22**

Figure 3b Finalized Champion Google Sheet after Voting

With the development of internet technologies, some networking software and hardware have witnessed a significant evolution during recent decades in the development of new collaboration methods (Halfway and Froese, 2007). Hence, the study aims at investigating the impact of the application of online Google Sheets on the team decision making process in the VM workshops.

RESEARCH METHODOLOGY

In this study, 90 respondents were invited to join three different groups with the application of three different communication methods in the VM workshop: (1) Face to Face group (FTF: all participants worked together with the traditional face to face communication way; (2) Face to Face and Online group (FTF and Online): all participants conducted the VM study with the traditional face to face communication way plus a pre-set of online Google Sheets; (3) Online group (Online): all participants conducted the VM study with a pre-set online Google Sheets text and used online chatting software to ensure instant communication (audio, video, text) in their own homes and offices.

A questionnaire survey was conducted to the workshop participants in all three groups. The questionnaire consisted of three main parts: (1) background information; (2) 16 items related to the information, function analysis, creativity, and evaluation phase; (3) 4 items related to the overall workshop satisfaction. A seven-point Likert-type scale, ranging from 1 (strongly dissatisfaction) to 7 (strongly satisfaction) was adopted for the measurement of all items.

The respondents were selected from different professional backgrounds, including 25 civil engineers (27.78%), 19 project managers (21.11%), 15 hydraulic engineers (16.67%), 11 quantity surveyors (12.22%), 6 architects (6.67%), and 14 others (15.56%). There are 42.22% and 32.22% of respondents had less than 5 years and 6 to 10 years work experience in the industry respectively. The respondents with over 10 years work experience are 25.56%. Over 79 respondents (89%) had a bachelor's degree or above, while male to female ratio is about 4 to 6. All of them participated in a certain kind of VM workshop before.

To compare the satisfaction of VM process (e.g. Information, function analysis, creativity and evaluation phase) with the three different communication methods (FTF, FTF&Online and Online), a one-way between-groups ANOVA and a post hoc test have been adopted in this study.

RESULTS

One- way ANOVA

One-way ANOVA is a method to compare the mean values of groups more than two (Pallant, 2011). The results of one-way ANOVA in the study revealed that significant differences among the three groups (see Table 1):

- Information phase: *Presented the design /product /process concept* (S1: F = 9.564, p = 0.000); *Seek out evidence to confirm opinions* (S2: F = 31.945, p = 0.000); and *A collective file of project information was created* (S3: F = 33.732, p = 0.000).
- Function Analysis phase: *Used function analysis or FAST diagram to identify functions* (S4: F = 3.235, p = 0.44); *Requested participants to define functions with verb-noun phases* (S5: F = 6.911, p = 0.02); *Asked "why" and "how" questions to identify functions of project* (S6: F = 8.142, p = 0.01); *Calculated function cost and find mismatch function* (S7: F = 22.377, p = 0.00); and *Red dots used to select mismatch functions and further mismatch analysis* (S8: F = 11.864, p = 0.00).
- Creativity phase: *Emphasized the quantity of ideas when generating ideas* (S9: F = 14.303, p = 0.000); *Exchanged ideas between different team members* (S10: F = 27.876, p = 0.000), *Anonymous ideas* (S11: F = 95.933, p = 0.000); and *Time limitation to stimulate creativity* (S12: F = 60.079, p = 0.000).
- Evaluation phase: *Requested participants to combine similar ideas within categories* (S13: F = 6.629, p = 0.002); *Requested participants to vote/score ideas for evaluation of the ideas.* (S14: F = 29.864, p = 0.000); *Each participant was encouraged to mark the idea individually at the same time* (S15: F = 105.737, p = 0.000); and *Individual work to score different ideas without persuasion influence* (S16: F = 45.071, p = 0.000).

The satisfaction levels of the Online group in the information, the creativity and the evaluation phases were the highest (means = 5.80 -6.60), while the Face to Face group got the lowest satisfaction levels

in all these phases (see Table 1). Out of five function analysis items, the satisfaction levels of four items (S4, S5, S6 and S8) revealed the highest scores in the FTF and Online group (6.05-6.60). However, the FTF group had the lowest satisfaction levels in terms of all 5 function analysis items, particularly item S7 for the calculation of function cost (4.23).

Table 1 One-way ANOVA for Workshop Items on Communication Groups

Item	Description	Group	Mean	SD	F	Sig
Information phase						
S1	Presented the design /product/process concept	FTF	4.97	.890	9.564	.000
		FTF and online	5.70	.837		
		Online	**5.83**	.847		
		Total	5.50	.903		
S2	Seek out evidence to confirm opinions	FTF	4.53	1.279	31.945	.000
		FTF and online	5.83	.834		
		Online	**6.40**	.498		
		Total	5.59	1.270		
S3	A collective file of project information was created	FTF	4.43	1.278	33.732	.000
		FTF and online	5.17	1.117		
		Online	**6.57**	.504		
		Total	5.39	1.347		
Function analysis phase						
S4	Used function analysis or FAST diagram to identify functions	FTF	6.20	.805	3.235	.044
		FTF and online	**6.60**	.498		
		Online	6.47	.507		
		Total	6.42	.636		
S5	Requested participants to define functions with verb-noun phases	FTF	5.93	.785	6.911	.002
		FTF and online	**6.50**	.509		
		Online	6.33	.479		
		Total	6.26	.646		
S6	Asked “why” and “how” questions to identify functions of the project	FTF	6.00	.830	8.142	.001
		FTF and online	**6.60**	.498		
		Online	6.53	.507		
		Total	6.38	.680		
S7	Function cost was easily calculated after we decided the weight of each function and each component performed	FTF	4.23	1.547	19.141	.000
		FTF and online	5.17	.913		
		Online	**6.03**	.765		
		Total	5.14	.337		
S8	Red dots used to select mismatch functions and further mismatch analysis	FTF	5.50	1.119	11.864	.000
		FTF and online	**6.57**	.504		
		Online	6.50	.509		
		Total	5.26	.855		
Creativity phase						
S9	Emphasized the number of ideas when generating ideas	FTF	4.60	1.003	14.303	.000
		FTF and online	5.30	.750		
		Online	**5.80**	.847		
		Total	5.23	.995		
S10	Exchanged ideas between different team members	FTF	3.73	1.760	27.876	.000
		FTF and online	5.03	.809		
		Online	**6.10**	.885		
		Total	4.96	1.557		
S11	Anonymous ideas	FTF	2.97	1.402	95.933	.000
		FTF and online	4.90	.809		
		Online	**6.50**	.885		
		Total	4.96	1.557		
S12	Time limitation to stimulate creativity	FTF	3.13	.147	60.079	.000
		FTF and online	6.07	.151		
		Online	**6.10**	.317		
		Total	5.10	.194		

Evaluation phase						
S13	Requested participants to combine similar ideas within categories	FTF	4.97	1.629	6.629	.002
		FTF and online	5.80	1.095		
		Online	**6.07**	.785		
		Total	5.61	1.203		
S14	Requested participants to vote/score ideas for evaluation of the ideas	FTF	4.50	1.548	29.864	.000
		FTF and online	5.93	.740		
		Online	**6.50**	.509		
		Total	5.64	1.327		
S15	Each participant was encouraged to mark the idea individually at the same time	FTF	2.90	1.398	105.737	.000
		FTF and online	4.97	.850		
		Online	**6.60**	.498		
		Total	4.82	1.809		
S16	Individual work to score different ideas without persuasion influence	FTF	3.07	1.53	45.471	.000
		FTF and online	4.53	1.167		
		Online	**6.03**	.809		
		Total	4.54	1.704		

Note: The mean difference is significant at the 0.05 level;
FTF is the abbreviation for face to face.

Post hoc test

Post hoc tests are used to explore the differences among the means of three or more groups to identify the significant differences between a group and others (Pallant, 2011). The results reveal that *the satisfaction levels of Specific information being exchanged were sufficien*t (D1), *Every participant's time is not different from other each other* (D2), *No location constrains for VM participants*(D3) and *Internet make communication much more convenient* (D4) in the FTF group were significantly lower than the two groups.

Table 2 Post test results for workshop satisfaction items between 3 communication groups

Item		X	Y	Mean Diff	SE	Sig.
D1	Specific information being exchanged were sufficient	FTF	FTF and Online	-1.800	.257	.000
			Online	-2.433	.217	.000
D2	Every participant's time is not different from other each other	FTF	FTF and Online	-1.033	.350	.007
			Online	-2.567	.356	.000
D3	No location constrains for VM participants	FTF	FTF and Online	-2.467	.245	.000
			Online	-3.967	.205	.000
D4	Internet makes communication much more convenient	FTF	FTF and Online	-.633	.250	.042
			Online	-2.067	.221	.000

Note: The mean difference is significant at the 0.05 level;
FTF is the abbreviation for face to face;

DISCUSSION

According to the results, online communication can significantly improve the satisfaction of information sharing (D1), remove the barriers of remote location and time (D2, D3), and facilitate the communication (D4). Satisfaction levels of the items in the information, creativity and evaluation phases in the Online group were all higher than the group used both face to face and online tools, while the Face to Face group shows the lowest level of satisfaction. The online communication can remove the barriers caused by time and location, so they can easily share the information like *Presenting the design /product /process concept* (S1), *Exchanging ideas between different team members* (S8) and *Requesting participants to vote/score ideas for evaluation of the ideas* (S10), and *Function cost was easily calculated after we decided the weight of each function and each component performed* (S7).

Google Sheet does not only record the data, but also an information sharing platform simplifying the whole VM study, especially, information, creativity, and evaluation phases, without delay. All VM

team members can update the information efficiently, get feedback and make comments simultaneously, while the end users do not need to maintain the software program with extra cost. It enables geographically remote users to interact and collaborate in the workshops without traveling (Hatem et al, 2012).

However, the satisfaction levels of function analysis items in FTF & Online group had the highest score among the three groups. It means that computer-based systems like Google Drive and pre-set Google Sheet can effectively facilitate the VM workshop process, but a totally separate environment is not fit for the process of function analysis especially for the *Function analysis or FAST diagram* (S3), *Function identification with verb-noun phases* (S4), *"why" and "how" logic* (S5). A computer-based system can provide a systematic program and instant response that can assist VM participants to identify key function, identify conflict, encourage participation, get commitment and receive feedback (Leung, 2011), but face to face communication is still necessary for the functions analysis.

RECOMMENDATION

Hence, the application of online Google Sheet surely enhances the information sharing and the team cohesiveness, while face to face communication is still required in the function analysis. To ensure that VM facilitators and all stakeholders fully utilize the online Google Sheets, proper internet training for VM facilitators and the team members is also required. Moreover, pre-set Google Sheets and specific Google account must be well prepared in the pre-workshop stage.

However, only online Google Sheet is not sufficient for the communication in the function analysis phase. VM facilitators have to group all team members physically together at the same time in the same place and apply the pre-set online Google worksheets to identify and analyze functions by the FAST diagram. The other members in remote distance can reverse the function table and the FAST diagram by Google sheet and express their opinion by online cheating. As Google Sheet does not have the function of instant communication, it is suggested to use the developed web-based 'interactive value management internet' (*i*vmi) (Leung, 2012) or the online chatting software to support the virtual workshops.

CONCLUSION

In this paper, the different communication methods (face to face and online) among team members in the information, function analysis, creativity and evaluation phases have been analyzed through an intervention study (3 groups). The result reveals that online communication software can significantly support communication in the whole VM process in terms of information sharing, flexible time, unconstraint location, and overall convenience. Apart from function analysis, the satisfaction levels of items related to the information, creativity and evaluation phases in the online group are all higher than those in the face to face group and the face to face plus online group. It is recommended to fully utilize the online Google Sheets *plus* the developed *i*vmi program and/or audio /video devices for virtual face to face communication in the function analysis.

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