出國報告（出國類別：國際會議）

赴新加坡參加
2017 IEEE 國際工業工程與工程管理研討會
2017 IEEE International Conference on Industrial Engineering and Engineering Management （IEEM 2017）
心得報告

服務機關：國防大學財務管理學系
姓名職稱：楊志豪副教授
派赴國家：新加坡
出國期間：106 年 12 月 9 日至 13 日
報告日期：107 年 1 月 3 日

摘要

為與國際「作業研究與數量方法」學術領域之先進議題接軌，並與領域學者進行有效交流，個人有幸獲得科技部經費補助，前往新加坡參加 2017 IEEE International Conference on Industrial Engineering and Engineering Management （IEEM 2017）國際研討會，並以論文名稱「**Development of Intelligent Building Management System Evaluation and Selection for Smart Factory: An Integrated MCDM Approach**」一題投稿接受口頭發表。此次 IEEM 2017 國際學術研討會與個人研究領域相關議題包括決策分析方法(Decision Analysis and Methods)、作業研究(Operations Research)、智慧系統(Intelligent Systems)、專案管理(Project Management)及工程經濟與成本分析(Engineering Economy and Cost Analysis)等新興議題領域。本次參加國際研討會，個人於國際研討會所發表的成果為個人申請通過科技部計畫「智慧能源產業發展之績效評估-最佳化能源組合決策模型建構研究」之部分成果發表，發表過程有幸與國外學者進行意見交流，有助於個人研究學術新知增進，期許個人將研究計畫之研究成果發表至高品質之國際期刊。

目次

壹、目的

為與國際「作業研究與數量方法」學術領域之先進議題接軌，並與領域學者進行有效交流，個人有幸獲得科技部經費補助，前往新加坡參加 2017 IEEE International Conference on Industrial Engineering and Engineering Management （IEEM 2017）國際研討會，並以論文名稱「**Development of Intelligent Building Management System Evaluation and Selection for Smart Factory: An Integrated MCDM Approach**」一題投稿接受口頭發表。此次 IEEM 2017 國際學術研討會與個人研究領域相關議題包括決策分析方法(Decision Analysis and Methods)、作業研究(Operations Research)、智慧系統(Intelligent Systems)、專案管理(Project Management)及工程經濟與成本分析(Engineering Economy and Cost Analysis)等新興議題領域。

本次參加 IEEM 2017 國際研討會主要目的為與國際學者進行學術交流，並擇選與個人研究相近之國際學者之口頭發表場次，吸取作業研究領域新興議題新知；同時今年 IEEM 2017 於新加坡 SUNTEC 會議中心舉行，個人亦深刻體驗新加坡多元文化共存及智慧城市推動之豐碩成果。

IEEM 2017 舉辦地點 新加坡 SUNTEC

貳、過程

2017 IEEE International Conference on Industrial Engineering and Engineering Management （IEEM 2017）國際研討會於 106 年 12 月 10~13 日於新加坡 SUNTEC 舉行，投稿件於 106 年 7 月 20 日經審查接受後，於 12 月 9 日啟程出發抵達新加坡，12 月 10~13 日為會議期間，並於 12 月 13 日搭機返國。

12 月 10 日下午開始註冊，當天開幕典禮後，由 Prof. Jianjun SHI 進行學術工作坊分享「How to Publish in Top Journals」，針對傑出期刊排序介紹、新興研究議題擇選及如何寫好一篇好的文章等，透過分享使個人於投稿國際學術期刊時具有參考價值。

發表人於會場與海報合影

12 月 11 日上午參加 Keynote 場次，由 Prof. Andy NEELY 進行專題講演，主題為「Rethinking Operations Strategy in an Age of Digital Manufacturing」，講演過程提及數位製造年代中競爭優先順序與決策問題，提及競爭標的為品質、速度、依賴性及成本下之不同思維，專題講演主題與個人研討會於發表之「智慧工廠」議題相呼應，亦提升個人研究後續延伸之可能性。

本人發表的論文安排於 12 月 12 日上午 1115 時開始，場次為 Decision Analysis and Methods，首先，主持人 Prof. MOKTAR 和 Prof. BELLINI 分別針對個人研究成果進行發表。

隨後由本人進行論文口頭發表及接受現場學者提問與討論。本人除表達研究成果分享外，亦結合研究主題分享「台灣」推動智慧化政策之決心。與會學者中哥倫比亞大學 Prof. CALIXTO 和 Prof. MANYOMA 對於本人發表研究發現富興趣，提問決策方法選擇與議題之相關性，也提出以不同方法進行解決，可能會有更顯著之研究發現等建議。同時，對於台灣智慧產業發展表達肯定之意。此外，會議期間亦前往與個人研究領域相關之的場次，聆聽新興的研究方法與研究發現，期許觸發新興研究議題，應用於作業研究與數量方法之學術領域。

發表人於會場內發表

發表人進行論文口頭發表

會場發放用品:會議摘要集、發表證明、會議紀念外套及環保購物袋

會議議程海報

參、心得與建議

IEEE 國際工業工程與工程管理研討會（IEEM）結合高品質理論與實務之學術論壇，歷年研討會論文均經過嚴格審查，始可進行發表。IEEM 2017 於新加坡舉辦，來自 50 個國家約 500 名學者專家共襄盛舉。

本人於此次研討會中所發表的論文為：『Development of Intelligent Building Management System Evaluation and Selection for Smart Factory: An Integrated MCDM Approach』(整合多準則決策分析應用於智慧工廠之智慧建築管理系統評選之研究)，其係探討工業 4.0 浪潮下，智慧工廠之智慧管理系統(IBMS)以提供良善之解決方法。管理系統對於智慧建築而言扮演重要的角色，以優化建築內部營運流程。考量 IBMS 的評估與規劃，本研究針對智慧工廠內之管理系統提出整合決策模型，分以技術整合、政府政策、產品應用及財務價值等構面進行分析，結合決策實驗室分析法、網路層級分析法與折衷分析法等進行決策分析。本研究有助於作業研究永續發展領域之文獻，尤以將智慧工廠特性評估置入 IBMS 並建構多準則決策分析評估模型。

本次研討會不乏許多與「永續環境」、「智慧化」相關之研究發表，顯見「永續」議題之國際重視程度。個人研究領域主以多準則決策分析及財務管理技術相結合，自永續公共建設、再生能源，延伸至智慧能源領域，透過國際研討會參與，更深化個人研究領域長期耕耘之決心。同時，政府刻正推動之前瞻基礎建設並鼓勵產業創新亦為國際新興政策，有效進行研究發展之結合，將有助於政策規劃推動。本次參加研討會乃難得寶貴經驗，透過研究成果之分享與同場次的學者相互交流、交換意見。感謝科技部經費補助國際研討會，使個人有機會將個人研究成果於國際會議場合分享，同時在多元文化融合之新加坡，感受智慧化城市之便利，有助於個人未來在新興議題之發想。同時，配合國家推動國防工業自主政策發展，建議國防部主管單位及國家級研發單位應將「智慧工廠」之相關研究成果納入後續建置規劃考量，並鼓勵所屬結合智慧產業發展趨勢，有效提供各項計畫之評估建議。

肆、附錄

1. IEEM2017 簡要議程與論文發表場次資料：

資料來源:IEEM 2017 官方網站(http://www.ieem.org/public.asp?page=home.htm)
(擷取日期:2017/11/01)

Program Overview

*Subject to change without notice

Sun-10 Dec	Session	Mon-11 Dec	Tue-12 Dec	Wed-13 Dec
Pre-conf Tour Singapore Ethnic Treasures 09:00-13:00	AM1	Opening & Keynotes	Technical Sessions	ARTC and ATMRI Technical Visit 08:30-13:00
		AM Break	AM Break	
	AM2	Technical Sessions / "Meet-the Editors" Panel Session	Technical Sessions	
		Lunch	Lunch	
Workshop 13:30- 15:30 / Registration 13:00-17:00	PM1	Technical Sessions	Technical Sessions	Conference Ends
Welcome Reception 15:30-17:00		PM Break	PM Break	
	PM2	Technical Sessions	Poster Sessions	
Delegates' Free Time	EVE	Delegates' Free Time	Conference Dinner	

All Day Registration (Mon-11 Dec)

All Day Registration (Tue-12 Dec)

Day 2 - Tuesday, December 12, 2017 / Room MR333 / 11:15 - 12:45			
Decision Analysis and Methods 3 / Chairs: Ainul Akmar MOKHTAR (Universiti Teknologi Petronas), Alberto BELLINI (University of Bologna)			
1	IEEM17-P-0556	Assessing Performance of Aging Air-Cooled Heat Exchangers Using Inspection and Performance Data	Ainul Akmar MOKHTAR, Masdi B. MUHAMMAD, Hilmi HUSSIN, Mohd Amin ABDUL MAJID
2	IEEM17-P-0244	Energy Balance of Waste Management Systems: A Case Study	Alberto BELLINI, Alessandra BONOLI
3	IEEM17-P-0506	Schools location through hybrid multi-criteria methodology to satisfy demand of extended school day program in Colombia	Jonathan CALIXTO, Nicolas TABARQUINO, Pablo MANYOMA
4	IEEM17-P-0507	Effect of Socioeconomic Status on Lung Cancer Survival: A Mediation Analysis Based on Bayesian Network Approach	Kartika Nur ANISA, Shi-Woei LIN
5	IEEM17-P-0261	Development of Intelligent Building Management System Evaluation and Selection for Smart Factory: An Integrated MCDM Approach	Chih-Hao YANG
6	IEEM17-P-0601	OPBI: An Open Pipeline for Biomarker Identification	Sugandima VIDANAGAMACHCHI, Mahesan NIRANJAN

2.研討會發表簡報

Development of Intelligent Building Management System Evaluation and Selection for Smart Factory :An Integrated MCDM Approach

Department of Financial Management,
National Defense University, Taiwan

Associate Professor
Chih-Hao Yang Ph.D.

chihhao.yang123@gmail.com

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I.INTRODUCTION

- The strategy of Industry 4.0 will be realized by smart factory which emphasis on the vertical process integration and networked manufacturing scheduling system.

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I.INTRODUCTION

- Due to the multidimensional characteristics of smart factory IBMS selection is complexity, it must be appropriately solved by multiple criteria decision-making (MCDM) method.

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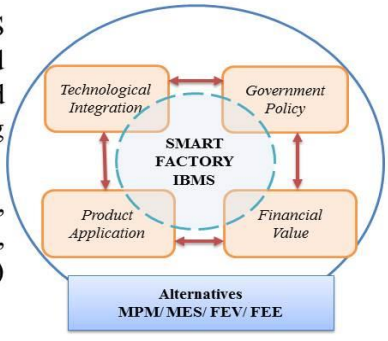
II.LITERATURE REVIEW

- This section presents the IBMS evaluation criteria as derived from the literature and categorized under the following four main perspectives:
- Technological Integration (TI), Government Policy (GP), Product Application (PA) Financial Value (FV).



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Technological Integration (TI)

- Advanced technological development must own the specific capability, including the compatibility between various technologies, the practicality and convenience for the user.

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Government Policy (GP)

- government's proactive policies can have a powerful impact on the strategy and diffusing of smart technology.

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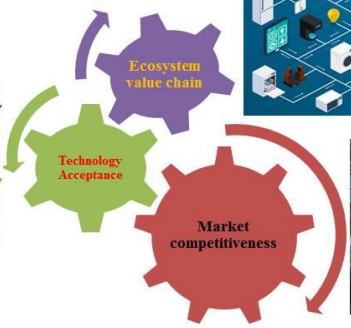
Product Application (PA)



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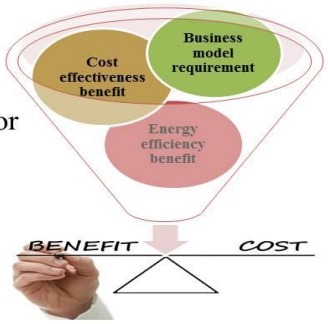
Financial Value (FV)

- Financial Value of intelligent building management system is necessary as a key driver for smart factory deployment.



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DEMATEL

III.METHODOLOGY

- The DEMATEL technique has been applied to various decision-making issues.
- Illustrating inter-relationships of criteria concerns and constructing network relationships.

3. Find the dispatcher and receiver groups and set the threshold values to obtain the impact-digraph-map.
4. Set a threshold value to clarify the influence level and to filter out smaller effects.

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ANP

III.METHODOLOGY

1. Establish the network structure and calculate the priorities of the criteria.
2. Analyze the pairwise comparisons with criteria for a priority weight matrix and conduct a consistency test.
3. the results of the comparisons are used to generate a supermatrix.→ weights of criteria

The weights of criteria incorporating into next decision method.

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VIKOR

III.METHODOLOGY

•VIKOR is a compromise ranking method is determining the best rating value and the worst rating value for all the criteria

1. Computing the values of "concordance" *(S)* and "discordance" *(R)*.
   - Computing the aggregate value *(Q)*.
2. Ranking the alternatives by sorting each *S*, *R* and *Q* values in an increasing order.
   - The decision makers can distinguish the best alternative by the minimum value of Q_i.
   - The best alternative have identified that a maximum "group utility" of the "majority" and a minimum of individual regret of the "opponents"

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CASE STUDY

Machine and Predictive Maintenance (MPM)

Manufacturing Execution System (MES)

Factory Environment Monitoring (FEV)

Factory Energy Monitoring (FEE)

- The research analysis was composed of six experts, who work in architectural engineering domain. The average experience of the panel is 12.5 years.

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Step 1: Process evaluation information

TABLE II

The relationship matrix of the perspectives for IBMS selection (p≥1.980)

	TI	GP	MA	FV	D	D+R	D-R
TI	***2.030***	***2.193***	***2.234***	1.962	8.419	16.774	0.064
GP	1.660	1.569	1.546	1.256	6.031	14.058	(1.997)
MA	***2.391***	***2.041***	***2.323***	***2.041***	8.796	16.867	0.725
FV	***2.274***	***2.226***	1.968	1.965	8.434	15.658	1.209
R	8.355	8.028	8.071	7.225			

Note: The bold values represent the relationship of perspectives over the threshold value.

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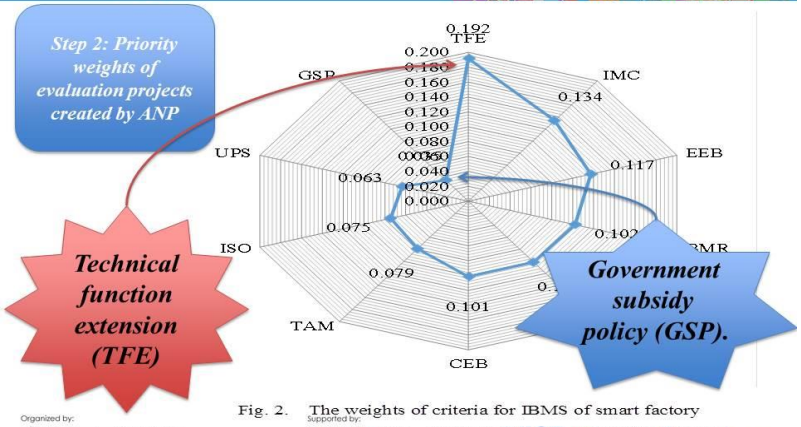

Fig. 2. The weights of criteria for IBMS of smart factory

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Step 3:Evaluate alternatives based on VIKOR approach and rank alternative.

TABLE III

The value S_i, R_i, and Q_i, of smart factory IBMS

	S_i	R_i	Q_i
MPM	0.397	0.875	0.636
MES	0.073	0.500	0.287
FEV	0.502	0.750	0.626
FEE	0.452	0.875	0.664

best option

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CONCLUSION

- Over the past decade, Taiwan has put abundant resources into smart technology in keeping with the international industry 4.0 trend, in order to make the industry a leading player on the ICT global stage.

CONCLUSION

- the significant factors Technical function extension (TFE) and Industry market competitiveness (IMC), indicates that it would be wiser for the government to focus more on resources input, proposing subsidy policy and providing user privacy and secrecy security for industry and society.

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CONCLUSION

- Manufacturing Execution System (MES) is considered as the best alternative, and MES provides information related production and factory operation that helps decision makers understand how current production capacity conditions under smart environment.

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CONCLUSION

- This study contributes to the sustainable development - operation research (OR) literature, especially concerning the incorporation of the smart industry characteristic measurement into intelligent building management system, by utilizing MCDM decision model for intelligent building management system projects.
- Further research can consider the resource constraints into Goal Programming (GP) to selecting the optimal portfolio.

ACKNOWLEDGMENT
I would like to thank the Ministry of Science and Technology of Taiwan for financially supporting this research under Grant MOST 105-2410-H-606-007-MY2 and 106-2914-I-606 -002 -A1.