UNIVERSITI PUTRA MALAYSIA

PROJECT RISK MANAGEMENT DECISION-MAKING METHOD FOR MANUFACTURING SYSTEM USING STATISTICAL APPROACHES

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By

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Manufacturing systems help in planning, controlling and monitoring throughout the manufacturing processes. Failure to perform reliable systems may cause problems through its lifecycle. Specifically, risk management is particularly pertinent for manufacturing projects, thus distinctive methods and education have been developed for such risk management. Fewer attempts have been undertaken in dealing with lean production risks during constructing of projects. On the other hand, lack of methodology in recognizing and minimizing lean production risks during developing manufacturing systems resulted in nothing, except wasting a lot of money and energy, dismissing of personnel, getting loans or bankruptcy. Consequently, for a more desirable management of risks associated with mass production of a manufacturing system, it seems necessary to develop an expanded image and a perspective of future horizons when constructing a manufacturing system. In this study, a review from the previous works were conducted on risk management, particularly risks in the decision-making method for scheduling and line of balance monitoring in manufacturing systems. In first hand, a questionnaire based survey approaches for risks identifying and analysing of the critical risk factors were developed and presented. The survey was adopted based on the previous researches and slightly altered, pre-tested and weighted for the validity and reliability. Three keys risk elements were adopted which are; organizational scope, business strategy risk and operational risk, with 82 specified questionnaires were considered in this study. Likert scales weighed as 1 to 5 were assessed by the correspondents. The collected survey were then has been analyse using SPSS. Results showed that the risk elements from the operational risk a highly influences to the overall outcomes of the organizations. A suggestion of a conceptual model and the

identification of the effective production factors was then has been discussed. Finally, a manufacturing software was developed. A validation test was successfully conducted without any error occurred. The developed software managed to perform a recommended values based on risks and will help in the success of the manufacturing scheduling.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

KAEDAH PEMBUATAN-PENGURUSAN RISIKO PROJEK UNTUK SISTEM PEMBUATAN MENGGUNAKAN PENDEKATAN STATISTIK

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Sistem pembuatan membantu dalam perancangan, kawalan dan pengawasan di sepanjang proses pembuatan. Kegagalan dalam melaksanakan sistem yang boleh dipercayai mungkin menyebabkan masalah melalui kitaran hayatnya. Khususnya, pengurusan risiko amat penting untuk projek perkilangan, oleh itu kaedah dan pendidikan yang tersendiri telah dibangunkan untuk pengurusan risiko tersebut. Hanya sedikit usaha yang telah dilakukan dalam menangani risiko pengeluaran bersandar semasa pelaksanaan sesebuah projek. Sebaliknya, kekurangan metodologi dalam mengiktiraf dan meminimumkan risiko pengeluaran bersandar semasa membangunkan sistem pembuatan tidak menghasilkan apa-apa, kecuali pembaziran wang dan tenaga yang banyak, membuang kakitangan, mendapatkan pinjaman atau muflis. Oleh itu, untuk pengurusan risiko yang lebih wajar, yang berkaitan dengan pengeluaran besar-besaran bagi sistem pembuatan, nampaknya perlu untuk menghasilkankan imej yang lebih luas dan perspektif horizon masa depan semasa membina sistem pembuatan. Dalam kajian ini, kajian literatur telah dijalankan ke atas pengurusan risiko terutamanya risiko dalam kaedah membuat keputusan untuk penjadualan dan pemantauan 'line balancing' dalam sistem pembuatan. Untuk permulaan, kajian soalan perantis berkenaan risiko dikenalpasti, dan setrusnya dianalisa untuk mengenalpasti factor-faktor penting yang berkait rapat. Tinjauan ini diterima pakai berdasarkan penyelidikan sebelumnya dan sedikit diubah, pra-diuji dan ditimbang untuk kesahihan dan kebolehpercayaan. Tiga elemen risiko utama diterima pakai; skop organisasi, risiko strategi perniagaan dan risiko operasi, dengan 82 soal selidik yang ditetapkan telah dipertimbangkan dalam kajian ini. Skala Likert sebanyak 1 hingga 5 dipertimbang dan dinilai oleh penemuduga. Jawapan kaji selidik kemudiannya dianalisa mengunakan perisian SPSS. Keputusan kajian menunjukkan bahawa elemen risiko daripada risiko

operasi sangat mempengaruhi hasil keseluruhan organisasi. Cadangan model konseptual telah dibincang dan dibentangkan. Pengenalpastian faktor pengeluaran yang berkesan juga dibincangkan. Akhirnya, perisian pembuatan telah dibangunkan. Ujian pengesahan berjaya dilakukan tanpa sebarang kesilapan. Perisian yang dibangunkan berjaya melaksanakan nilai yang disyorkan berdasarkan risiko dan akan membantu dalam kejayaan penjadualan pembuatan.

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This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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LIST OF ABBREVIATIONS

CRF	Critical Risk Factors
PRM	Project Risk Management
VAR	Value At Risk
HS	Historical Simulation
EVT	Extreme Value Theory
CAPM	Capital Asset Pricing Model
CRIMS	Cost/Risk Identification & Management System
ART	The Aggregate Risk Tool
PRA	Probabilistic Risk Assessment
AOA	Activity On Art
RCPSP	Resource-Constrained Project Scheduling Problem
MRCPSP	Multi-Mode Resource Constraint Project Scheduling Problems
GA	Genetic Algorithm
SA	Simulated Annealing
FLG-HGA	Fuzzy Logic Controller
HGA	Hybrid Genetic Algorithm
RC-MPSP	Resource-Constrained Multiple Project Scheduling Problem
PSO	Particle Swarm Optimization
NPV	Net Present Value
TS	Tabu Search Algorithm
DSS	Decision Support System
DBMS	Database Management System
MMS	Mail Management System
GDSS	Group Decision Support Systems
EIS	Executive Information Systems
CMCS	Computer-Mediated Communication Systems
OLAP	On-Line Analytical Processing

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Manufacturers are hunting down better approaches to address the developing requests of worldwide manufacturing. They need the most recent devices and advances to support execution in every perspective; tasks, providers, accomplices, and so forth. They additionally look for answers for help them deliver more for less, bring down their total cost of ownership (TCO) and enhance their return on investment (ROI).

Today's business condition is more dynamic yet additionally dubious than any time in recent memory. The dynamic impact can be ascribed to the globalization marvel that outcomes in a pattern towards worldwide market, worldwide generation and worldwide rivalry. In the event that this pattern offers chances to organizations, it stands up to them likewise with dangers in view of vulnerabilities and turbulences in the worldwide market. To benefit the chances and manage the dangers, organizations require a strong choice help instrument for sensible and educated basic leadership particularly at strategic and operational dimensions. There are many factors that contribute to the decision-making process including personality attributes, temperaments, past experiences, and external factors. Decision-making is the most complex human behavior. In order to improve the effectiveness of decision-making, a new model for characterizing the decision-making process and how sets of perceived risks affect the decision-making have to be developed.

The risk types are grouped according to their nature and examples such as hazard risk, financial risk, operational risk and strategic risk. Risk management has been defined as the act or practice of controlling risk that includes risk planning, assessing risk areas, developing risk-handling options, monitoring risks to determine how risks have changed, and documenting the overall risk management program. In managing risk, project managers must consider risk in their planning and scheduling practices. Risk management and scheduling are closely linked, where contemplations of one requires a reassessment of the other, e.g., in creating methodology and plans to deal with program risk, how the methodology influences the program plan must be considered. Thus, plan that adjusts risk, cost, schedules and performance should be produced (MacDaniel and Bahnmaier, 2001). The key parts of any risk management procedure would incorporate risk identification, assessment/analysis, evaluation, response, and monitoring. In order to perform adequate risk management, it is basic to connect recognizable proof/appraisal ventures with their administration activities through adequate comprehension (Hillson, 2002). There are

various methods for distinguishing project risks. Be that as it may, as a solidified rundown of ordered devices and risk identification, these techniques lack a definite organization of risks and do not help to structure identified risks in the most proper various leveled way (Hillson, 2002). That it will give a fundamental and standard methodology for risk presentation, comprehension, correspondence, and the management during project execution phases

Scheduling of jobs in the manufacturing environment is a crucial task to be executed during production planning. The execution of any production process cannot start before a feasible schedule has been created. It is common for an organization to create orders (jobs) which are going to be executed in near future in their facilities. These orders are usually created based on customer‘s request (made-to-order) or the need to balance stock levels (made-to-stock). Once a certain numbers of orders have been made, the next step is to schedule them. Tasks are usually orders or operations of an order. Complex orders are usually broken down into several operations and each of them is a job or task to be scheduled. Usually, those orders and operations have specific requirements, e.g. the sequence operations for an order. There are certain manufacturing environments, such as flow shops, where jobs have a pre-defined sequence of operations. This sequence is a constraint that must be satisfied by the schedule. A problem is considered not feasible if no solution can be found without violating the constraints. Jobs need resources in order to be executed. Resources are tools, machines, people, etc. They have limited availability and cannot be shared. They can be allocated to a single job at a certain point in time. In general, a project can be defined as a series of activities that are conducted to achieve one or more specific objectives at a specified cost and within a specified time (Hughes et al., 2004). Essentially, a management method is a set of processes used to run a project in a controlled and, therefore, predictable fashion. In the context of manufacturing systems, the management activities including: planning, coordinating, measuring, monitoring, controlling, and reporting, which collectively ensure that the development and maintenance of the system is systematic, disciplined, and quantified.

1.2 Problem Statement

The recent manufacturing situation is tremendously unsettled and unreliable, because of occurrences associated to market globalization and the swift developments attained in technology. Thus, a permanent adaptation of the manufacturing systems is required i.e. enterprises should overcome the old procedures and configure their organizations continuously. Moreover, in the production rivalry world nowadays, manufacturing frameworks need to plan and control the manufacturing procedure in subtleties from the requesting and getting crude material until conveyance and after deal administrations to clients. Each organization whether it is an assembling organization or furnishing administrations may experience with a lot of various issues through its lifecycle if not structured well to face and stand up to such issues.

More than $250 billion is spent yearly in the United States for office planning, booking and re-booking (Tompkins et al., 2003). Subsequently, it is essential to perceive unsafe factors and plan an adaptable assembling framework to adapt to such impacts amid its life cycle. While in Malaysia, according to SMIDEC (2002) the lack of knowledge and limited access to capital and finance as well as limited in technology management. In addition, limited in managerial capabilities and human resources are also some of major cost need to be tolerate by the manufacturer (Ismail, 2002)

Typically, organizations want to operate their manufacturing systems to minimize their costs, which usually mean minimizing make-span and late orders (lateness), maximizing resource utilization, and other types of optimization. The cost function to be optimized is called the objective function. Often, scheduling problems involve multiple objective functions. Complete minimization is not always possible. Therefore, a trade-off process is applied. The challenge of any scheduling planning is to best allocate the available resources in order to minimize as many objective functions as possible without violating any existing constraints. Moreover, achieving effective manufacturing system has become a goal for both academia and industry.

However, fewer efforts are made in dealing with lean production risks during constructing of project. Furthermore, due to lack of methodologies in recognizing and minimizing lean production risks during constructing a manufacturing system, nothing is obtained except wasting a lot of money and energy, firing employees, getting loans or bankruptcy. Risk management is therefore particularly pertinent for manufacturing projects, thus special methods and special education have been developed for such risk management. It is understandable, from the past literature search, less attempts are done in dealing with lean production risks during constructing of project. Also, there is a needs to find new ways to use concepts of line balance monitoring during the constructing of a manufacturing system to minimize future harmful effects.

Subsequently, for an increasingly alluring management of risks associated with large scale manufacturing of a manufacturing framework, it appears to be important to build up an extended picture and a viewpoint of future skyline during developing a manufacturing framework. These days, the procedure of Risk Management is pursued deliberately as a national need in numerous nations. In this way, in this research by proposing a comprehensive conceptual model, it will be tried out to identify the effective production factors that may cause system failures. The procedure contains risk identification, plan and control during constructing of a manufacturing system and control amid building of an assembling framework and furthermore to recognize compelling criteria also to identify effective criteria and sub-criteria in each of the identified agents to be able to evaluate, analyze and select the most proper technique.

Hence, a comprehensive decision-making method for designing manufacturing systems particularly to increase the system performance by line balance monitoring in order to minimize negative factors as job tardiness, work in process, bottleneck machines and over-allocated machines will be obtained.

1.3 Objectives

The main goal of this research is to improve a risk management conceptual framework for scheduling (or re-scheduling) of manufacturing projects throughout implementation of projects activities in order to minimize the impact of risk factors. Specifically, the research intentions to define a framework for risk management by identifying, categorizing and assessing risks faced by manufacturers from data survey. Furthermore, in modern developed countries, there must be policies in place to identify, analyze, plan, monitor and control the agents of the global crisis. The application of 'Risk Management' is one of the basic ways to obtain power to survive in critical environments. Based on the developed risk management framework, a comprehensive decision-making method will then be developed as an implementing tool for risk management.

The proposed framework is a combination of a manufacturing process model and a risk management process. The manufacturing model characterizes the generic manufacturing system forms and in addition an exercise utilized by the industry and identifies the risks related with every action. The multi-dimensional nature of the risk elements and losses will be reflected in the manufacturing model to cover both outer or obscure and uncontrollable occasions that influence the profit of the value-adding processes and the risk factors originating from individuals, procedures, processes, and systems that can be directly assigned to losses. Risk measures would then be able to be utilized to help the management choices to avoid, control, or mitigate losses in accordance with the selected risk strategy.

The main objectives of this research study are as follows:

1. To identify and analyze critical risk factors associated with production volume, with time factor, and material transferring during the process.
2. To identify other potentially unknown effective criteria of resources involved in lean production risks.
3. To model the decision-making process in order to select the right method by developing a risk management framework.
4. To develop a comprehensive decision making method for scheduling and line balance monitoring of manufacturing systems.
5. To verify and validate the develop software for decision making.

1.4 Significance of This Study

The study results or outcomes significantly contribute towards improvement in design of a comprehensive decision-making method for scheduling and line balance monitoring of manufacturing systems. Risk based questionnaires and surveys were conducted and survey‘s result was analyzed. A manufacturing production scheduling software was designed and developed based on survey‘s results. This software will benefits the manufacturers in assessing their risk associated in their processes and finally helps them to adjust or alter their planning of their production according to their risk.

1.5 Scope of Work

The scope of work of this study is limited to project‘s management in medium enterprise (SME) in Malaysia and Kuwait. The pilot test was conducted in Kuwait and Malaysia within the SME‘s companies. While the survey were conducted either in Kuwait or in Malaysia and highly concentrated in project management related manufacturing companies. The study will be accomplished in the following six major steps, the initial three steps are: 1) Data collection, literature search, development of risk based questionnaires, 2) Software development, 3) Process simulation and data analysis. Initially, the perceptions of risk and risk management in manufacturing business were examined using the data gathered from a survey. While the other three 3 major activities or steps are; risk identifying, risk analyzing and risk prioritizing. While conducting those three items, feedback from user or stakeholders is then necessary. In addition, external risk factors and the selection criterion also must be considered

1.6 Thesis Organization

This study has been conducted into six main steps: Data collection, literature research and development of survey‘s questionnaires, risk based survey‘s, survey‘s analyzing and survey‘s identifying and following with the development of production planning software based on the survey‘s results and finally the implementing a risk-ranking methodology to prioritize risks within and across projects and identify and analysis the effectiveness of the developed software.

Chapter 1 provides with overviews of the study and the objectives of the study. Chapter 2 represents a comprehensive literature review from the related issues, Chapter 3 provides the methodology used in this study, Chapter 4 represents the result and discussion from surveys and finally Chapter 5 consists of the summary or conclusion of this study. In this chapter a general conclusions are presented for each sections and lastly, a recommended for future research are presented.

REFERENCES

Alcaraz Bosca, N. (2012). Lean project management. Assessment of project risk management processes.

Alcaraz, J., Maroto, C., & Ruiz, R. (2003). Solving the multi-mode resource-constrained project scheduling problem with genetic algorithms. *Journal of the Operational Research Society*, *54*(6), 614-626.

Aldas-Manzano, J., Ruiz-Mafe, C., Sanz-Blas, S., & Lassala-Navarré, C. (2011). Internet banking loyalty: evaluating the role of trust, satisfaction, perceived risk and frequency of use. *The Service Industries Journal*, *31*(7), 1165-1190.

APM (1997). Project risk analysis and management, The APM group Ltd., Norwich Norfolk.

Ary, D., Jacobs, L.C. & Razavieh, A. (1996) Introduction to Research in Education. *Harcourt Brace College Publishers*, Fort Worth.

Ballestín, F., Valls, V., & Quintanilla, S. (2008). Pre-emption in resource-constrained project scheduling. *European Journal of Operational Research*, *189*(3), 1136-1152.

Baroum, S. M., & Patterson, J. H. (1999). An exact solution procedure for maximizing the net present value of cash flows in a network. In *Project Scheduling* (pp. 107-134). Springer, Boston, MA.

Berg, H. P. (2010). Risk management: procedures, methods and experiences. *Reliability: Theory & Applications*, *5*(2 (17)).

Buddhakulsomsiri, J., & Kim, D. S. (2006). Properties of multi-mode resource-constrained project scheduling problems with resource vacations and activity splitting.*European Journal of Operational Research*, *175*(1), 279-295.

Burell, K., & Kylén, J. A. (2003). *Metoder för undersökande arbete: Sju-stegsmodellen*. Bonnier utbildning.

Chahal, V. (2012). An advance lean production system in industry to improve flexibility and quality in manufacturing by implementation of FMS & green manufacturing. *International Journal of Emerging Technology and Advanced Engineering*, *2*(12), 406-408.

Chaovalitwongse, W., Furman, K. C., & Pardalos, P. M. (Eds.). (2009). *Optimization and logistics challenges in the enterprise*. Springer-Verlag.

Chen, J., & Askin, R. G. (2009). Project selection, scheduling and resource allocation with time dependent returns. *European Journal of Operational Research*, *193*(1), 23-34.

Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Routledge.

Cronbach, L. J., & Shavelson, R. J. (2004). My current thoughts on

coefficient alpha and successor procedures. *Educational and psychological measurement, 64*(3), 391-418.

Damay, J., Quilliot, A., & Sanlaville, E. (2007). Linear programming based algorithms for preemptive and non-preemptive RCPSP. *European Journal of Operational Research*, *182*(3), 1012-1022.

Dan Zhu & Rena Padman (1999). A metaheuristic scheduling procedure for resource-constrained projects with cash flows, *Naval Research Logistics (NRL),* 46(8), 912-927.

De Reyck, B. (1998). A branch-and-bound procedure for the resource-constrained project scheduling problem with generalized precedence relations. *European Journal of Operational Research*, *111*(1), 152-174.

Delgoshaei, A., Ariffin, M. K., Baharudin, B. H. T. B., & Leman, Z. (2014). A backward approach for maximizing net present value of multi-mode pre-emptive resource-constrained project scheduling problem with discounted cash flows using simulated annealing algorithm. *International Journal of Industrial Engineering and Management*, *5*(3), 151-158.

Demeulemeester E.L & and Herroelen W. S. (1996) An efficient optimal solution procedure for the preemptive resource-constrained project scheduling problem, *European Journal of Operational Research*, 90(2), 334-348.

Durand, T. (1993). Economy of scope, added value chain and cost dynamics: A tentative optimization model. *International journal of production economics*, *29*(3), 237-247.

Eduardo Yamasaki Sato, C., & de Freitas Chagas Jr, M. (2014). When do megaprojects start and finish? Redefining project lead time for megaproject success. *International Journal of Managing Projects in Business*, *7*(4), 624-637.

Elmaghraby, S. E., & Herroelen, W. S. (1990). The scheduling of activities to maximize the net present value of projects. *European Journal of Operational Research*, *49*(1), 35-49.

Etgar, R., Shtub, A., & LeBlanc, L. J. (1997). Scheduling projects to maximize net present value—the case of time-dependent, contingent cash flows. *European Journal of Operational Research*, *96*(1), 90-96.

Figueira, J., Greco, S., & Ehrgott, M. (Eds.). (2005). *Multiple criteria decision analysis: state of the art surveys* (Vol. 78). Springer Science & Business Media.

Flyvbjerg, B., Bruzelius, N., & Rothengatter, W. (2003). *Megaprojects and risk: An anatomy of ambition*. Cambridge University Press.

Gary C. F & Erik. W. Larson (2008). Project management: the managerial process 4e. *International edition: McGraw-Hill*.

Ghosh, S., & Jintanapakanont, J. (2004). Identifying and assessing the

critical risk factors in an underground rail project in Thailand: a factor analysis approach. *International Journal of Project Management*, *22*(8), 633-643.

Grinold, R. C (1972). The payment scheduling problem. *Naval Research Logistics Quarterly*, 19(1), 123-136.

Guo, Z. X., Wong, W. K., Li, Z., & Ren, P. (2013). Modeling and Pareto optimization of multi-objective order scheduling problems in production planning. *Computers & Industrial Engineering*, *64*(4), 972-986.

Hartmann, S. (2001). Project scheduling with multiple modes: a genetic algorithm. *Annals of Operations Research*, *102*(1-4), 111-135.

Hartmann, S., & Briskorn, D. (2010). A survey of variants and extensions of the resource-constrained project scheduling problem. *European Journal of operational research*, *207*(1), 1-14.

Herroelen, W., & Leus, R. (2004). The construction of stable project baseline schedules. *European Journal of Operational Research*, *156*(3), 550-565.

Hopkinson, M., Close, P., Hillson, D., & Ward, S. (2008). Prioritising Project Risks–A Short Guide to Useful Techniques. *Buckinghamshire: Association for Project Management*.

Icmeli, O., & Erenguc, S. S. (1994). A tabu search procedure for the resource constrained project scheduling problem with discounted cash flows. *Computers & operations research*, *21*(8), 841-853.

Icmeli, O., Selcuk Erenguc, S., & Zappe, C. J. (1993). Project scheduling problems: a survey. *International Journal of Operations & Production Management*, *13*(11), 80-91.

Ierapetritou, M., & Li, Z. (2009). Modeling and managing uncertainty in process planning and scheduling. In *Optimization and logistics challenges in the enterprise* (pp. 97-144). Springer, Boston, MA.

Ingemansson, A., Bolmsjö, G., & Harlin, U. (2002, October). A survey of the use of the discrete-event simulation in manufacturing industry. In *Proceedings of the 10th international manufacturing conference*.

Ismail, N.A., (2002). A framework for the study of accounting information systems in small businesses. *Akauntan Nasional* 15(5):32-33.

Jarboui, B., Damak, N., Siarry, P., & Rebai, A. (2008). A combinatorial particle swarm optimization for solving multi-mode resource-constrained project scheduling problems. *Applied Mathematics and Computation*, *195*(1), 299-308.

Joo, C. M., & Kim, B. S. (2015). Hybrid genetic algorithms with dispatching rules for unrelated parallel machine scheduling with setup time and production availability. *Computers & Industrial Engineering*, *85*, 102-109.

Junghare, G. M., & Deshmukh, M. J. (2015). Mathematical Modeling of

Production Scheduling Problem: A Case Study for Manufacturing Industry. *International Journal of Science Technology & Engineering (IJSTE)*, *1*(10), 224-226.

Kaya, İ., Kahraman, C., & Çebi, S. (2012). Computational Intelligence Techniques for Risk Management in Decision Making. In *Handbook on Decision Making* (pp. 9-38). Springer, Berlin, Heidelberg.

Ke, H., & Liu, B. (2010). Fuzzy project scheduling problem and its hybrid intelligent algorithm. *Applied Mathematical Modelling*, *34*(2), 301-308.

Kim, K., Yun, Y., Yoon, J., Gen, M., & Yamazaki, G. (2005). Hybrid genetic algorithm with adaptive abilities for resource-constrained multiple project scheduling.*Computers in industry*, *56*(2), 143-160.

Kolisch, R., & Drexl, A. (1997). Local search for nonpreemptive multi-mode resource-constrained project scheduling. *IIE transactions*, *29*(11), 987-999.

Laslo, Z. (2010). Project portfolio management: An integrated method for resource planning and scheduling to minimize planning/scheduling-dependent expenses. *International journal of project management*, *28*(6), 609-618.

Li, X., Gao, L., Shao, X., Zhang, C., & Wang, C. (2010). Mathematical modeling and evolutionary algorithm-based approach for integrated process planning and scheduling. *Computers & Operations Research*, *37*(4), 656-667.

Lin C. M. & Gen M (2008). Multi-criteria human resource allocation for solving multistage combinatorial optimization problems using multiobjective hybrid genetic algorithm. *Expert Systems with Applications*, 34, 2480-2490.

Lova, A., Tormos, P., & Barber, F. (2006). Multi-mode resource constrained project scheduling: Scheduling schemes, priority rules and mode selection rules. *Inteligencia Artificial. Revista Iberoamericana de Inteligencia Artificial*, *10*(30), 69-86.

McMahon, P. T., Acker, D. D., Baumgartner, J. S., Patterson, M. B., & Bahnmaier, W. W. (1994). *Scheduling Guide for Program Managers. Revision*. DEFENSE SYSTEMS MANAGEMENT COLL FORT BELVOIR VA.

Mika, M., Waligóra, G., & Węglarz, J. (2005). Simulated annealing and tabu search for multi-mode resource-constrained project scheduling with positive discounted cash flows and different payment models. *European Journal of Operational Research*, *164*(3), 639-668.

Mori, M., & Tseng, C. C. (1997). A genetic algorithm for multi-mode resource constrained project scheduling problem. *European Journal of Operational Research*, *100*(1), 134-141.

Naderi, B., & Azab, A. (2014). Modeling and heuristics for scheduling of

distributed job shops. *Expert Systems with Applications*, *41*(17), 7754-7763.

Negahban, A., & Smith, J. S. (2014). Simulation for manufacturing system design and operation: Literature review and analysis. *Journal of Manufacturing Systems*, *33*(2), 241-261.

Oliver, R. L. (1999). Whence consumer loyalty?. *Journal of marketing*, *63*(4_suppl1), 33-44.

Ozdamar, L. (1999). A genetic algorithm approach to a general category project scheduling problem. *IEEE Transactions on Systems, Man, and Cybernetics, Part C (Applications and Reviews)*, *29*(1), 44-59.

PMI, A. (2008). Guide to the project management body of knowledge Project Management Institute. *Newton Square, PA*.

PMI, A. (2013). Guide to the project management body of knowledge (PMBOK guide). In *Project Management Institute* (Vol. 5).

Project Management Institute. (2000). *A guide to the project management body of knowledge (PMBOK guide)* (Vol. 2). Project Management Inst.

Rao, R. V. (2011). Modeling and optimization of modern machining processes. In *Advanced modeling and optimization of manufacturing processes* (pp. 177-284). Springer, London.

Raz, T., & Michael, E. (2001). Use and benefits of tools for project risk management. *International journal of project management*, *19*(1), 9-17.

Razaque, A., Bach, C., & Alotaibi, A. (2012). Fostering project scheduling and controlling risk management. *arXiv preprint arXiv:1210.2021*.

Renuka, S. M., Umarani, C., & Kamal, S. (2014). A review on critical risk factors in the life cycle of construction projects. *Journal of Civil Engineering Research*, *4*(2A), 31-36.

Russell, A. H. (1970). Cash flows in networks. *Management Science*, *16*(5), 357-373.

Salant, P. (86). D. A. Dillman. 1994. How to conduct your own survey.

Shah, L. A., Etienne, A., Siadat, A., & Vernadat, F. (2016). Decision-making in the manufacturing environment using a value-risk graph. *Journal of Intelligent Manufacturing*, *27*(3), 617-630.

Shirazi, B., Mahdavi, I., & Solimanpur, M. (2012). Intelligent decision support system for the adaptive control of a flexible manufacturing system with machine and tool flexibility.*International Journal of Production Research*, *50*(12), 3288-3314.

SMIDEC (2008). Promoting Innovation – led and Technology – Driven SMEs. *Paper Presented in Asia Pacific Conference of Technology and Technology Entrepreneurship*.

Stevenson, W. J., & Sum, C. C. (2010). *Operations management: an Asian perspective*. McGraw-Hill Education (Asia).

Tah, J. H., Thorpe, A., & McCaffer, R. (1993). Contractor project risks

contingency allocation using linguistic approximation. *Computing systems in engineering*, *4*(2-3), 281-293.

Thomas, L., & Krebs, C. J. (1997). A review of statistical power analysis software. *Bulletin of the Ecological Society of America*, *78*(2), 126-138.

Tompkins, J. A., White, Y. A., Bozer, E.H., Frazelle, & Tanchoco, J. M. A. (2003). Facilities planning. 3rd Edition. John Wiley & Sons, Inc., Hoboken, NJ.

Toni D & Tonchia S (1998). Manufacturing flexibility: a literature review, International Journal of Production Research, 36(6), 1587-617.

Van Peteghem, V., & Vanhoucke, M. (2010). A genetic algorithm for the preemptive and non-preemptive multi-mode resource-constrained project scheduling problem. *European Journal of Operational Research*, *201*(2), 409-418.

Węglarz, J., Józefowska, J., Mika, M., & Waligóra, G. (2011). Project scheduling with finite or infinite number of activity processing modes–A survey. *European Journal of operational research*, *208*(3), 177-205.

Wiguna, I. P. A., & Scott, S. (2005, September). Nature of the critical risk factors affecting project performance in Indonesian building contracts. In *21st Annual ARCOM Conference* (pp. 225-235).

Williams, R. (1999). SRE Method Description & SRE Team Members Notebook Version 2.0. Software Engineering Institute.

Yan, L., Jinsong, B., Xiaofeng, H., & Ye, J. (2009). A heuristic project scheduling approach for quick response to maritime disaster rescue. *International Journal of Project Management*, *27*(6), 620-628.

Yang, K. K., Talbot, F. B., & Patterson, J. H. (1993). Scheduling a project to maximize its net present value: an integer programming approach. *European Journal of Operational Research*, *64*(2), 188-198.

Zare, Z., Naddaf, A., & Salehi, M. R. (2012). Proposing a model on preemptive multi-mode resource-constrained project scheduling problem. *International Journal of Business and Social Science*, *3*(4).

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LIST OF PUBLICATIONS

M. K. A Ariffin, Bader, A (2016), A Review of risk management and different resources in scheduling problems for mega Projects, *Journal of Scientific Research and Development* 3 (5): 157-163.

M. K. A. Ariffin, Bader Al-Adwani, Faieza A. Aziz, F. Mustapha and R. Mohammad, Development of Risk Assessment Software for Project Implementation, FICEER, November 2019, Accepted

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