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FOREWORD

Congratulation to IGS on the continuous effort to publish the 11th issue of the Doctoral Research Abstracts which highlights the research in various disciplines from science and technology, business and administration to social science and humanities. This research abstract issue features the abstracts from 91 PhD doctorates who will receive their scrolls in this 86th UiTM momentous convocation ceremony. This is a special year for the Institute of Graduate Studies where we are celebrating our 20th anniversary. The 20th anniversary is celebrated with pride with an increase in the number of PhD graduates.

In this 86th convocation, the number of PhD graduates has increased by 30% compared to the previous convocation. Each research produces an innovation and this year, 91 research innovations have been successfully recognized to have made contributions to the body of knowledge. This is in line with this year UiTM theme that is "Inovasi Melonjak Persaingan Global (*Innovation Soars Global Competition*)".

Embarking on PhD research may not have been an easy decision for many of you. It often comes at a point in life when the decision to further one's studies is challenged by the comfort of *status quo*. I would like it to be known that you have most certainly done UiTM proud by journeying through the scholarly world with its endless challenges and obstacles, and by persevering right till the very end.

Again, congratulations to all PhD graduates. As you leave the university as alumni we hope a new relationship will be fostered between you and UiTM to ensure UiTM soars to greater heights. I wish you all the best in your future endeavor. Keep UiTM close to your heart and be our ambassadors wherever you go.

Prof Emeritus Dato' Dr Hassan Said
Vice Chancellor
Universiti Teknologi MARA

EDITORIAL COMMITTEE

This newsletter was created to disseminate information on the research carried out by the doctoral graduates of UiTM by sharing the abstract of their thesis.

For more information do not hesitate to contact us at *http://ipsis.uitm.edu.my*

TABLE OF CONTENTS

FACULTY OF ARCHITECTURE, PLANNING & SURVEYING

1

Name : ABDUL BASIT ALI AHMED ALMHAFDY

Title : OPTIMIZATION OF COURTYARDS DESIGN FACTORS IN THE HOT HUMID CLIMATE: ENERGY AND THERMAL ASSESSMENT

Supervisor : ASSOC. PROF. AR. DR. NORHATI IBRAHIM **(MS)**
PROF. DR. SABARINAH SHEIKH AHMAD **(CS)**

Courtyards are regarded as a microclimate modifier, and their application has become popular in various forms of public buildings. This thesis reviews design factors of courtyards in hospitals in Malaysia, and assesses the resulting thermal performance of the courtyard space and energy performance of the attached built volume. The study took a sequential approach whereby knowledge gained from each phase of research,served to inform the direction for the next phase of the study. It began with the initialinquiry on what are the courtyard characteristics applied in hospitals in Malaysia. Data were gathered through field survey, followed by a typology analysis involving 34 courtyards in 19 government hospitals. The survey revealed extensive use of OEnclosure Courtyard (OEC) and U-Enclosure Courtyard (UEC), and that although the spaces inside the surveyed courtyards appeared as appealing, activities inside these courtyards were rather limited. This led to the next research inquiry on the thermal condition inside the courtyard and the adjacent rooms / built volumes. A field measurement was conducted on a case study hospital, where the thermal condition in the OEC and UEC were collected, analysed and compared. The findings indicate UEC as the better design option. Consequently, the UEC configuration was chosen for further investigation through a parametric analysis using the Integrated Environment Solution <Virtual Environment> (IES<VE>) simulation software. Mean radiant temperature (MRT) in the courtyard and the energy consumption of the attached built volume were the criteria of thermal performance. In the final phase of the research, the results from the parametric analysis were used for dual purposes -(1) to ascertain the thermal condition inside the courtyard through Computational Fluid Dynamic (CFD) analysis, and (2) formulation of an energy performance prediction equation, constructed using Structural Equation Modelling (SEM) technique. The structure model shows that eight predictors, i.e., Area, Length, Width, Height, Cantileveredroof, Orientation, Flow-in and Flow-out, can explain 97% of variations in energy. The significant finding of the thesis is the proposed preliminary Energy Estimation Formula (EEF) for UEC in the tropical climate that could benefit architects, designers and clients with deep concerns for a responsive design resolution.

2

Name : AHMADREZA SABERI

Title : CALLIGRAPHIC WOODCARVING ORNAMENTATIONS IN SELECTED PENINSULAR MALAYSIAN MOSQUES

Supervisor : ASSOC. PROF. DR. ESMAWEE ENDUT **(MS)**
ASSOC. PROF. DR. SABARINAH SH. AHMAD **(CS)**
DR. SALIM ABDUL TALIB **(CS)**

Woodcarving is a form of Malaysian traditional art. After the advent of Islam in the Malay Peninsula in the 13th century (Pasai) and 14th century (Malacca), Islamic motifs such as calligraphic woodcarvings are added to the local art forms, particularly to embellish Malaysian mosques. Although Malaysian mosques have been built using three architectural styles, namely the vernacular, colonial and modern, the designers did not distinguish between the styles when installing calligraphic woodcarving ornamentations in the prayer halls. Furthermore, although many studies have been conducted to investigate the characteristics of Malaysian woodcarvings, findings on the opinions of mosque users are lacking. Hence, this thesis aims to identify the various forms of calligraphic woodcarving ornamentations through the analysis of their writing styles and other characteristics of this ornamentation from the selected peninsular Malaysian mosques. The objectives are: i) to establish the judgments of mosque users about calligraphic woodcarving ornamentations based on types of scripts, legibility, locations, function, aesthetic, desirability and combination of patterns; ii) to analyse the current calligraphic woodcarving ornamentation (writing styles, locations and contents) of Malaysian mosques; and iii) to propose recommendations on the appropriate design of calligraphic woodcarving ornamentations for Malaysian mosques. This study employed quantitative and qualitative methodologies. Five scripts - *Thuluth, Kufi, Naskh, Nastaliq* and *Diwani* and eight mosques in the North East and South West regions of Peninsula Malaysia were selected for the case studies. Firstly, the field study documented existing decorative woodcarving inscriptions in the mosques. Then, from the total number of 408 respondents, the assessments of mosque users on wood-carved calligraphy are conducted. The qualitative data are discussed comprehensively while SPSS is used to analyse the quantitative data of the questionnaire survey. The investigated variables included the locations, readability, aesthetic, function, mixture with other motifs and preference of scripts. The findings showed that calligraphy not only functions as ornamentation in a spiritual atmosphere, but also for recitations. *Thuluth* and *Kufi* are the most preferred scripts as decoration of mosques as woodcarving ornamental inscriptions. The users of mosques preferred individual inscriptions in terms of legibility while they desire to observe Arabic inscriptions to decorate *Mihrab*, *Mimbar* and entrances respectively. The designers preferred *Thuluth* scripts, but the selected contents did not follow the principle of connection between location and content of inscription. The study summarised design recommendations which will assist calligraphers, woodcarvers and designers of mosques to provide more desirable calligraphic woodcarving ornamentations for Malaysian mosques based on the users' assessments and the existing decorative inscriptions.

3

Name : FAUDZI MUHAMMAD

Title : KNOWLEDGE SHARING FRAMEWORK FOR SUSTAINABLE VALUE PLANNING IN MALAYSIAN PUBLIC CONSTRUCTION PROJECTS

Supervisor : PROF. SR. DR. HJ. ABDUL HADI NAWAWI **(MS)**
ASSOC. PROF. DR. ROHANA MAHBUB **(CS)**
ASSOC. PROF. DR. NAZIRAH ZAINUL ABIDIN **(CS)**

Malaysia is pursuing the status of a high-income nation by the year 2020. In tight economic conditions, the government has to improve the value of public spending through increasing its sustainability with the lowest possible investment. Although construction projects contribute to the country's economic growth and fulfil social needs, they also contribute to environmental deterioration. Besides that, construction projects in Malaysia are criticised for low productivity and failure to achieve client satisfaction. Due to these reasons, the government has introduced the Green Growth concept to promote sustainable development for public projects and Value Management (VM) to improve the projects' value for money. Value Planning (VP) is the front end of VM, conducted during the early project planning stage. Due to various advantages of integrating sustainability considerations during the early stages, VP is the best platform to achieve value for money and project sustainability at the same time. Sustainable Value Planning (SVP) is a concept that integrates both value for money and sustainability targets in a single mechanism. Effective knowledge sharing is the key driver for SVP. Despite the recognition of the importance of effective knowledge sharing within VP, its contribution in nurturing sustainability integration into the practice remains unclear. Thus, this study is conducted with the aim of developing the Knowledge Sharing Framework For Sustainable Value Planning. This framework explains the constructs involved and their relationships during the SVP in the context of knowledge sharing for Malaysian public construction projects. This study was conducted based on the philosophy of pragmatism and adopted the abductive approach. A two-phase Exploratory-Explanatory research was conducted employing the Mixed-Method Research design. Both quantitative and qualitative data were collected and analysed using various data analysis techniques such as Template Analysis and Partial Least Square of Structured Equation Modelling. This study arrived at a few findings, including: (1) the sustainability themes to be used during SVP; (2) factors that influence knowledge sharing effectiveness during VP; (3) relationship between perceived project sustainability performance and knowledge sharing effectiveness; and (4) The Knowledge Sharing Framework for SVP. Seven constructs were identified that explain the knowledge sharing phenomenon during SVP: (1) individual attitudes towards knowledge sharing; (2) perceived complexity of the knowledge domains (3) subjective norms of sharing knowledge (4) dependency on online repositories; (5) knowledge sharing effectiveness; (6) team synergy; and (7) perceived project sustainability performance. Using questionnaire survey involving the Value Assessment Laboratory participants, the relationships amongst the constructs were tested. The response rate of the survey is 84% and 280 observations were finally analysed. Eight direct relationships and two mediating effects were identified that explain the relationships between these constructs. Based on the findings of this study, effective knowledge sharing significantly influences the sustainability considerations during VP. It also partially mediates the relationship between team synergy and the perceived project sustainability performance.

4

Name : IZATUL LAILI BINTI JABAR

Title : PROJECT MANAGER'S COMPETENCY FRAMEWORK IN MANAGING INDUSTRIALISED BUILDING SYSTEM (IBS) CONSTRUCTION PROJECT.

Supervisor : ASSOC. PROF. SR. DR. HJH. FARIDAH ISMAIL **(MS)**
PROF. DR. SR. ABDUL RASHID ABDUL AZIZ **(CS)**

Industrialised Building System (IBS) has been introduced to promote a systematic construction process. The application of IBS offers numerous benefits such as cost and time reduction and enhancing construction quality and safety. In the Malaysian construction industry, IBS application was also expected to minimise the dependency on unskilled foreign labour. There are various issues associated with IBS construction projects such as poor quality building and construction delay, and thus, a qualified and experienced organisation led by a competent project manager is required to overcome the issues. The project manager who possesses the necessary competencies may lead the project to success and achieve its objectives. The objectives of this research are to investigate the competencies required for a project manager in managing IBS construction project; to determine the competencies required within the project management phases; to analyse the most significant competencies within the project management phases and to develop a competency framework for a project manager in managing the IBS construction project. This research is adopting a mixed method approach. A qualitative approach of semistructured interviews was carried out to fourteen interviewees consisting of project managers of construction organisations, managers of installer companies and managers of manufacturing companies. Fifty competencies have been identified during the semi-structured interviews and categorised into project management phases. The identified competencies were then re-evaluated through a quantitative approach to determine the most significant competencies for a project manager. A questionnaire survey was used to measure the significant level of competencies for the project manager. SPSS version 20 was used to analyse the data from the questionnaire survey. The competencies were ranked by using Mean Analysis and Relative Importance Index (RII). Pareto Analysis was then used to cut-off the most significant competencies. Thirty-five competencies out of fifty listed competencies were identified as the most significant competencies formed the primary competencies section; meanwhile, another fifteen competencies established the secondary competencies section in the framework. The framework of project manager's competency in managing IBS construction project (PM-IBS Competency Framework) were validated by panels represented from the construction organisation, Association of Construction Project Manager (ACPM), Public Work Department (PWD), Malaysian Asset and Project Management Association (MAPMA), Construction Industry Development Board (CIDB) and project management trainer.

5

Name : HAFISZAH BINTI ISMAIL

Title : THE INFLUENCE OF GENERATIONAL DIFFERENCES ON THE MALAYSIAN HOUSING PREFERENCES

Supervisor : PROF. SR. DR. HJ. ABDUL HADI NAWAWI **(MS)**
PROF. DR. HJ. ZAINAL MAT SAAT **(CS)**

Literatures and models on property development evidences demographics as the long term trends especially the populations as one of the main factors that influence the property development process. Changes of demographics would influence the economic in general and the property market in specific besides the public policy implications that may also affects the behaviour of many actors of the property development sector. People live in households and households need housing and thus various demographic changing trends would contribute to dramatic change that affects the society and the generations. Changing demographic trends would give effects on the property market especially on the housing demand thus this give reason why more studies especially on the relationship between population and housing is greatly needed. Previous studies on demographic changes and housing demand show that focus were given mainly to the senior (elderly) generation namely the 'Baby Boom/Baby Boomers' Generation especially on the impacts toward the housing prices. As the numbers of this senior (elderly) population and their mean age currently continues to increase and projected to continually arise annually alongside with the other populations due to improvement of the health quality and lifestyle thus studies on current and future senior (elderly) housing preferences were relevant to guarantee better housing provisions of this specific population. In relevance, differences between generations have a large influence on our society, with younger generations continually being accompanied by new and different attitudes and values' (Roberts et. al., 2000). Therefore, there is also an imperative need to include different categories of generation namely Generation X (Gen-X), Generation Y (Gen-Y) and Generation Z (Gen-Z) in the discussions of housing particularly on the preferences. Despite on the importance, intense debate on how demographics drive the demand for housing reveals that empirical evidence is still not conclusive, especially in an international context. This is stressed by Mulder (2006) that, 'given the fundamental demographic change currently underway, it is surprising how few studies have researched the effect of demographics on housing market for Europe and Asia'. The aim of this study is to provide and in-depth overview on the influence of generational differences towards the Malaysian housing consumers' preferences. The main objective of this study is show that demographic/population changes do influence the housing preferences especially on the generations. This study employs mixed methods approaches. Seven (7) of the local authorities from the City Councils, Municipalities and District Councils along with two (2) housing developers in Selangor were interviewed for this study. The main purpose of the conducted interviews (semi-structured interview) is to determine the considerations and level of extend given on the demographic (population) changes in the planning for housing currently practised by these main actors. A total numbers of 678 housing consumers from different generations in Selangor, Malaysia were managed to be surveyed (questionnaires survey) to ascertain the current, future and senior (elderly) housing environment preferences. The questionnaires responses were analysed by using the SPSS, the Paired Comparisons/Pair-wise and the Analytic Hierarchy Process (AHP) methods of analysis. The main findings reveal that Safety, Health and Convenience were listed as the first three (3) important factors of the Residential Environment Preferences by the Malaysian generations, followed by the other two (2) factors namely Community and Amenity. As for the senior (elderly) housing, the findings reveal the acceptance of the generations with the introduction of the Age-Restricted Community Concept. Thus, this study will provide comprehensive findings on the housing preferences of the generations covering the current, future and elderly (senior) housing preferences. Detail findings derived from this study of housing, population and generations will provide beneficial information to various parties of the property development especially the policy makers and the involving main actors. Detail understanding on the matter would provide information that can be use as guidance to able and assist these concerning parties of property development for better planning and delivery of housing provisions that would benefit the current and future generations.

6

Name : MOHD RIZA BIN ISMAIL

Title : COURTYARD AS A PASSIVE COOLING DESIGN STRATEGY IN MALAYSIAN LINKED HOUSES

Supervisor : PROF. DR. AZNI ZANI AHMED **(MS)**
PROF. DR. SABARINAH SH. AHMAD **(CS)**
ASSOC. PROF. DR. ABDUL RAZAK SAPIAN **(CS)**

Sixty percent of Malaysians prefer to stay in linked houses for reasons of location, space and aesthetic. Most of these houses are installed with mechanical cooling and air circulating fans for thermal comfort instead of a more passive means. There are less demand for courtyard linked houses although the courtyard could hypothetically to be the answer for a passive cooling design strategy. Hence, the aim of this research is to explore the possibilities of enhancing indoor thermal comfort condition by determining the effectiveness of courtyard as a passive cooling building element. The objectives of this thesis are: i) to study the types of courtyard configuration in existing linked houses; ii) to investigate the environmental condition of the courtyard and its effect to the indoor thermal comfort; iii) to explore the importance of courtyard configuration in providing good natural ventilation and iv) to determine the best courtyard configuration that create best indoor thermal comfort of a linked house. This study investigated two similar urban linked houses (with and without internal courtyard) in terms of size and specifications in Shah Alam and Klang. Data based on two days of measurements and observations at both houses for outdoor, indoor temperature, relative humidity and air velocity revealed that the indoor thermal conditions for both houses exceeded the thermal comfort zone recommended by Givoni's Bio-Climatic chart and ASHRAE. However, through comparative analysis, the house with internal centre courtyard produced better results and maintained a more comfortable indoor condition due to its horizontal and vertical natural cross ventilation which occurred during the day time and night time. Further predictive investigations on the courtyard linked house, based on CFD simulations using Flovent 7.2 and AnSys were conducted. Three variations of design models were studied namely enlarged courtyard area, increased courtyard walls height and enlarged openings at the front and rear. Diurnal simulations concluded that the increased of courtyard surrounding wall height and enlarged openings at front and rear options were the most effective, whereas the enlarged courtyard area (footprint) type were less effective, regardless of which operation mode were applied. Hence, linked houses with courtyards are proven to be beneficial to the occupants by providing passive cooling through natural ventilation.

7

Name : JULAIDA BINTI KALIWON

Title : BIO-ROOF MATERIAL BASED ON OIL PALM FIBRE

Supervisor : PROF. DR. SABARINAH SH. AHMAD **(MS)**
DR. ASTIMAR ABDUL AZIZ **(CS)**

Nature of roof that covers the very top of the building, has encouraged related research, especially regarding the properties, types, problems and materials for roofs. In recent years, awareness about environmental pollution and sustainability, has driven the demand for roof coverings that are more sustainable. Currently, the use of local raw materials that are easily found, in addition to reducing waste, and reuse of materials is a key features of construction materials. The use of recycled materials based on palm oil can be profitable for the farmers and consumers in general. The objective of this research is to produce an advanced composite material from oil palm empty fruit bunch (EFB) at the same time exploring the mechanical and physical properties of this material as a preparation to develop a substitute's material for sustainable roofing material. The mechanical and physical properties of oil palm EFB as roofing material is originally tested as per American Standard (ASTM) and British Standard (BS). Materials are selected based on normal concrete mix with the addition of oil palm empty fruit bunch fibres in various batches. The oil palm empty fruit bunch (EFB) fibre is obtained from MPOB Research Centre and there is no treatment done to the selected fibre. The selected cement to sand ratio used is 1:2, with six different water to cement ratio (0.32, 0.37, 0.42, 0.47, 0.52 and 0.57). The thickness of the sample is 10mm and percentage of fibre used is 0.5%, 1.0&, 1.5% and 2.0%. Fibre sizes are divided into four categories; OS, LS, MS and SS. The sizes are range from 0.7mm -14.04mm length. The river sand is used as an aggregate with sizes ranging from 0.06 to 2mm which is passing a 2mm to 2.5 mm mesh size sieve. The sample is tested and the impact of the sample on the five different variables which are cement to sand ratio, water to cement ratio, fibre volume, size and weathering condition are analysed. The samples are tested based on the flexural strength, density and water tightness only. Fibre volume of 0.5% is found as the appropriate volume for this mixture design. The highest flexural strength recorded is 6.44N/mm² which exceed from the minimum requirement of ASTM for roofing slates. Flexural strength is increases when using the large size of fibre, it is found that the size of 6.4-14.04mm fibre length, 396-471µm width; achieve the highest flexural strength at 6.44N/mm² for sample C3-15-42. Fibre size is categorised as LS (Large Size) with 0.37 water cement ratio. Weathering condition gave a big effect to the sample as there is an increment in strength for samples mixed with oil palm fiber through the curing process from 7 to 28 days. The highest increment is 63.46% for sample C2-27-52 with 1.0% fibre content. Even though the highest strength is using 0.42 water cement ratio, but 0.47 water cement ratio gave constant result for other samples compares to other variables. The highest density recorded is from the LS fibre (water cement ratio 0.42) with 1.0% fibre volume and 28 days immersion in wet condition. The density of the sample is 2030.99kg/m³. The lowest reading of density is 1247.73kg/m³ with water cement ratio 0.32 (MS fibre), 2.0% of fibre volume and 28 days immersion in dry condition. An average density is also indicated which between 1562.51kg/m³ to 1997.19kg/m³. Unfortunately, all samples failed the water tightness test with 49g water retention which is 44g more compare to the minimum requirement.

8

Name : NORAZIAN MOHAMAD YUSUWAN

Title : A PROCEDURAL FRAMEWORK FOR EXTENSION OF TIME (EOT) CLAIM SETTLEMENT IN THE MALAYSIAN CONSTRUCTION INDUSTRY

Supervisor : ASSOC. PROF. DATIN DR. HJH. HAMIMAH ADNAN **(MS)**

The construction industry is often burdened by various problems associated with contractual claims that affect not only the administration and management of projects but also disrupt the smooth running of construction activities as well as contribute to the occurrence of disputes between the parties involved. Such disputes will affect harmonious relationships among industry players if they are not tackled in the best possible way. Despite the many studies that have been carried out with regard to improving the management of contract claims, yet very little research has been conducted to address the issue in relation to the extension of time (EoT) claim, specifically as to what constitutes a good EoT claim and the possible measures that can be taken by industry players towards the successful settlement of an EoT claim. Therefore, this study was undertaken with the aim of developing an appropriate framework that can help the parties involved in the construction industry to come up with EoT claims that can be resolved harmoniously without any unnecessary disputes. Prior to the development of such a framework, the practices of industry players in dealing with EoT claims were investigated, contentious issues in relation to EoT claims and the reasons for the rejection of such claims were revealed, and the success elements for EoT claims and initiatives to reduce the likelihood of failure of such claims were identified. The triangulation method comprised of a questionnaire survey, semi-structured interviews and a modified Delphi approach, was employed to achieve the research objectives. Such an approach will produce a robust and reliable data. The findings revealed that weaknesses in terms of the management and keeping of records as well as the lack of competency in handling claims which result in the submission of poor and incomplete claim documents are among the factors that disrupt the preparation and assessment of EoT claims, which may then lead to a rejection of such claims. On the other hand, issues associated with EoT claims that often create dissatisfaction and conflict between the parties involved are concurrent delays, eligibility of time extension claims, non-compliance with contract requirements, inadequate efforts to mitigate delays, and also the permissible time period for extensions. The conservation of harmonious business relationships, the preservation of reputation as well as continuity in the construction industry are seen as the major factors influencing the likelihood of industry practitioners opting for negotiations as a medium to resolve any problems and disputes in relation to EoT claims. The findings from the research were then used to develop a framework for a successful EoT claim which contained elements that contribute to the success of EoT claims and initiatives that can be implemented in order for claims to be successful, and to reduce the possibility of failure of such claims. Subsequently, a personal (face-to-face) questionnaire survey conducted with eleven (11) experts from the industry confirmed that the framework is appropriate and is viewed as having great potential for implementation in the construction industry in Malaysia. The findings of this research may offer valuable information, not only to industry players but also to students in the related fields, in preparing themselves to face the challenges of working in the construction industry.

9

Name : NUR MAIZURA BT AHMAD NOORHANI

Title : AN IMPROVED PROJECT MANAGEMENT COMPETENCY FOR INTERIOR DESIGN PRACTICE

Supervisor : ASSOC. PROF. DR. PADZIL@FADZIL HASSAN **(MS)**
ASSOC. PROF. DR. AINI JAAPAR **(CS)**

The competencies of interior designers managing construction projects, particularly in project management have frequently been questioned. Central to this argument is the claim that the interior designer competencies, which was developed through education and practice tend to be very biased on design skills and knowledge at the expanse of project management. To date, there has been little research to justify the validity of the argument. In seeking to address this argument, this research was undertaken to establish to what extent is project management neglected in the academic and practice of interior design, and if so, where are the gaps. A mixed method research method was employed for the research. A quantitative research method with seventy-eight respondents was first adopted to establish the validity and extent to which project management was lacking in interior design practice. This was followed with a qualitative research method to identify precisely where the gap in project management education and interior design practice exists. To identify the gaps, fourteen key respondents were selected for interviews during the data collection. This was triangulated with content analysis method, which critically analyses the interior design syllabus offered by four leading local higher institutions. Activities undertaken by the interior design professional associations were also analysed. The findings found significant gaps in learning project management in the interior design higher education and interior design practice. The most important solutions to bridge the gaps is to improve the project management competencies of interior designers through education and practice were identified and suggested. To aid a holistic conceptualization of the project management skills and knowledge for the developmement of their competencies which can be added to the interior design education and practice, a framework was proposed. Significant new knowledge relating to interior design competencies was identifed through this research. This encompases the identification of the actual project management skills and knowledge required to improve the current interior design education curriculum offered by higher education. The skills and knowledge required in practice which should be promoted by the interior design professional associations was also identified. Notwithstanding, more research is suggested to follow through with this framework to structure and improve interior design curriculum in higher education. Research on how the project management skills and knowledge can be incorporated into the interior design continuing professional development program (CPD) can also be introduced.

10

Name : NURLELAWATI BINTI AB. JALIL

Title : PSYCHOLOGICAL AND PHYSIOLOGICAL COLOUR IMPACTS ON MALAY STUDENTS IN THE UNIVERSITY HOSTEL ENVIRONMENT

Supervisor : ASSOC. PROF. RODZYAH HJ. MOHD YUNUS **(MS)**
ASSOC. PROF. DR. NORMADHIAH SHEIKH SAID **(CS)**

Colour is an environmental stimulus that exerts an influence on human beings in a multitude of ways. The colour effect has been abundantly unequivocally demonstrated in previous research on the integration of multimodal approaches, such as from the psychological, performance and non-performance and preferences assessments. Nevertheless, little research has been conducted locally on the university students with the integration of physiological assessment and consideration of subjects' living ecology, this being particularly true in the field of design. The fact that no specific colour scheme recommended for the interior of public buildings and double standard perceptions of the importance of visual stimulations are contributing to the monotonous looks at most hostel rooms in public universities. The condition becomes a norm to the students although numerous of research has posited the view that environmental stimuli are correlated with better performances and engagements while the existing white environment contributes to salient negative implications. Worse, inappropriate colours could cause low performances; indirectly affecting moods, *dysphoria* or depression and health problems among others. In this regards, physiology is another option in understanding the nature of human's responses to their environments and, in this context, the coloured environment. This is because studies have postulated that colours are detectable in other modality, such as through parasympathetic activities and sympathetic activities, in the human autonomic nervous system (ANS). The aim of this study was to propose an optimal colour for the hostel environment of female university students from their heart rate responses. The objectives of this study were to identify the colour effects of four coloured environments and its effect patterns in a specific duration of exposures across various lengths of exposures. It also intended to determine the appropriate colours for the hostel rooms that evidently significant in performance, physiologically as well as psychologically. The colours used were strong red, bluish-green, pink - as it is the most preferred colours among female students obtained from a conducted survey, and white as the existing students' environment. A test and re-test method of assignment were conducted to 24 female students in their coloured rooms or ecology, and changes in their performance, emotional responses and physiological responses were recorded. They were divided according to three types of exposures; short-term exposure, long-term exposure with one to two weeks of stay, and sustainable exposure, where subjects live in the coloured rooms for more than three weeks. The results showed that each colour has different effects with positive changes over time. In fact, some of the colours were capable of overturning adverse influences into positive responses. Based on the consistency patterns and their advantages points, the findings found that the bluish green colour is the most appropriate colour for longer to sustainable dwelling periods and therefore is the most suitable for the hostel room for this focused group. Based on the differences found in each colour, this study has suggested a few recommendations that can possibly contribute to a better stimulating coloured environment. Findings from the study may become the best practice for designers as well as universities' management themselves in designing conducive learning environment for better students' engagements and productivities.

11

Name : RASIDAH BINTI A. RAHMAN

Title : REGIONAL COMPETITIVENESS IN PENINSULAR MALAYSIA

Supervisor : ASSOC. PROF. DR. JAMALUNLAILI ABDULLAH **(MS)**
ASSOC. PROF. DR. HANIZA KHALID **(CS)**
ASSOC. PROF. DR. KAUSAR HJ. ALI **(CS)**

In recent years, competitiveness has become an important issue in the modern world as many cities have confronted a more precarious competition from cities of home or foreign countries. Kresl and Ietri (2012) believed if there were no competition, regions would not be as efficient and there would not be any pressure for improvements. Malaysia witnessed a change in development paradigm of the federal government with a strong emphasis on building towards a competitive region, thus, in 2006, the five economic corridors were introduced, three in Peninsular Malaysia; The Northern Corridor Economic Region (NCER), Iskandar Malaysia and East Coast Economic Region (ECER). The three economic corridors, with statutory bodies empowered to administer, have put so much effort to promote their own region and to lure national key projects for foreign direct investments. Whether these regions will be successful or not depends on their competitiveness. The main objective of this research is to evaluate competitiveness and factors influencing the competitiveness of regions in Peninsular Malaysia. Taking the three economic corridors and Klang Valley as the study area, two analyses were conducted, firstly, Shift-Share and Location Quotient (LQ) to evaluate competitiveness, and secondly Structural Equation Model (SEM) to evaluate factors. The findings from the Shift-Share analysis reveal that Klang Valley is the most competitive region in Peninsular Malaysia with services sector as a major contributor to its competitiveness. The share of the services sector in Klang Valley is three times the share of NCER and Iskandar. For the latter analysis, a survey was conducted to executives in mid and top management in Small and medium Enterprises (SMEs) and multinational companies in the four regions forming 337 samples. Using the SEM as a tool, two major analyses were conducted; firstly, examination of the degree of influence carried by competitiveness factors, and secondly, examination of the degree of influence carried by institutions (government) after they intervene as a mediator to other factors. Surprisingly, education was found as the most influential factor contributing to the competitiveness of Klang Valley from the latter analysis. Similarly, education was also found as the most influential factor for Peninsular Malaysia. Iskandar and NCER have strength in technology. Klang Valley as the most competitive region is independent of the government to be competitive whilst ECER as the weakest region in Peninsular Malaysia has to depend on the government. The findings of this study provide a better insight to the Federal Government policy makers, in particular, the Economic Planning Unit (EPU) of the Prime Minister's Department, in their effort to formulate a more effective strategy for enhancing economic growth and competitiveness in the country. The Town and Country Planning Department (JPBD) may consider taking into account on the study findings when preparing various physical planning plan; National Physical Plan, Regional Plan, State Structure Plan and District Local Plan by concentrating on development actions that are capable of creating a competitive advantage for the regions.

FACULTY OF APPLIED SCIENCES

12

Name : AHMAD FAIZA BIN MOHD

Title : SYNTHESIS AND CHARACTERIZATION OF ULTRA VIOLET (UV) CURING ADHESIVE FROM NATURAL OILS

Supervisor : ASSOC. PROF. DR. RAHMAH MOHAMED **(MS)**
MRS. AZIZAH AHMAD **(CS)**

Bio-Adhesive from natural oil is expected to become important sources of renewable raw material in the resin industry. The synthesis and modification process of abundant natural oil such as sunflower, vegetable, palm oil, jatropha oil are the strategy to study the potential of green resin in various applications. In this study, natural oil from sunflower, rapseed and vegetable oils were chosen to be synthesized and modified to new natural modified resin which could be exploited as adhesive and coatings resin. Oils had been chosen according to their unsaturation in glyceride. The starting materials are in the form of fatty acids and triglyceride to produce bioadhesive resin. Fatty acid or triglyceride had been synthesized to produced modified oil via various routes of synthesize method, consist of amide prepolymer, urethane oil prepolymer and fatty acid dimers. A stoichiometry and reaction temperature was studied to explore the kinetic of reactions in each of synthesize route. Gel permeation chromatography, wet chemistry and spectroscopy techniques; Fourier transform infrared (FTIR), Nuclear Magnetic Resonance (NMR) were used as characterization method to identify the functional group and chemical properties of prepolymers. Then, functional groups in these three prepolymers were activated using epoxidation and acrylation process. Epoxidation process was done via in-situ epoxidation by peroxoformic acid. This process had been optimized with the study of the effects of formic acid and hydrogen peroxide, temperature and solvents in different type of prepolymers. Grafting of Ultra violet reactive functional group were performed via acrylation. It was found that, amide polymer from isophorone diisocyanate backbone produce low viscosity pre-polymer and appropriate molecular weight for epoxidation process. Prepolymer from sunflower contain highest acrylated functional group and followed by rapseed and vegetable oil. After synthesize and modification process, ultra-violet curing (UV) resin was studied by formulating the resin with appropriate photoiniators and the intensity of UV in curing process. Co-initiator in UV curing polymerization was studied in this research due to the weakness of photoinitiator used in adhesive. The UV filtration by plastic substrate when used as UV adhesive shows the requirement of co-initiator. The performance of cured resin was evaluated by hardness, adhesion, tensile, shear strength, shrinkage, thermal resistance, chemical resistance, transition of glass, gel fraction and water adsorption. The result shows that, high crosslink network in the resin provide better physical and chemical properties. However, the density of crosslink network had reduced the adhesion properties due to the shrinkage phenomenon. To overcome this critical factor, resins from different routes of synthesis were formulated with monofunctional dan multifunctional monomers to reduce shrinkage and increase the adhesion properties. Monomers consist of mono acrylate, di acrylate, triacrylate, and teatraacrylate. The optimum formulation provides a better performance of ultraviolet curing bio-polymer.

13

Name : AJIS BIN LEPIT

Title : PROPERTIES OF POLY (VINYLIDENE FLUORIDE)-CO-POLY (VINYLIMIDAZOLE) SOLID POLYMER ELECTROLYTES PREPARED BY RADIATION-INDUCED GRAFTING METHOD FOR PROTON EXCHANGE MEMBRANE FUEL CELL

Supervisor : ASSOC. PROF. DR. AB MALIK MARWAN ALI **(MS)**
PROF. DR. MUHD ZU AZHAN YAHYA **(CS)**
DR. KHAIRUL ZAMAN HJ. MOHD DAHLAN **(CS)**

Solid polymer membranes based on graft copolymerization of 1-Vinylimidazole (VIm) onto polyvinylidene fluoride (PVDF) were synthesized. The graft copolymerization process was carried out under nitrogen atmosphere by a radiationinduced grafting (RiG) in aqueous medium. Ferrous ions were used as a redox initiator system. Radiation effects onto PVDF and VIm were investigated with the aim to develope a highly-stable grafted solid polymer membrane for potential use in proton exchange membrane fuel cells. Polymer membranes consist of PVDF as a polymer host and VIm as a monomer were prepared by solution casting technique. Prior to that, PVDF was exposed to ©-rays ranging from 20 to 100 kGy using RiG method to form free radicals that capable to initiate graft copolymerization of VIm onto PVDF backbone as a side chain.Various grafting conditions such as absorbtion dose, effects of different solvents and addition of Iron (II) sulfate heptahydrate were determined. Results showed that the degree of grafting (DG) was strongly influenced by the type of solvent used to dissolve the VIm. The grafted polyvinylimidazole (PVIm) onto PVDF was estimated using gravimetric analysis. DG of the VIm onto PVDF was also found to be dependent on the absorbtion dose exposed to the samples. The best absorbtion dose where the sufficent grafting occured between polymer based and monomer was at 60 kGy. Concentration of ferrous ions was observed to play a major role to initiate grafted VIm onto PVDF samples namely PVDF-co-PVIm membranes during induction of radiation. Samples were then complexed in acid sulfuric to prepare functional solid polymer electrolyte membranes as well as to enhance their ionic conductivity. The PVDF-co-PVIm solid polymer electrolyte membranes were then characterized by degree of swelling, water uptake, ion exchange capacity and degree of protonation. The PVDF, PVDF-co-PVIm, protonated PVDF-co-PVIm, and silicon dioxide composited PVDF-co-PVIm membranes also were: (a) morphology structurally characterized by Field Emission Scanning Electron Microscopy (FESEM) as well as X-ray Diffraction (XRD) (b) thermally characterized by Differential Scanning Calorimetry (DSC)/Thermogrametric Analysis (TGA) studies for phase transition & thermal stability (c) electrically/electrochemically characterized by Electrochemistry impedance spectrocopy (EIS) and transference number (d) optically characterized by Fourier Transform Infrared spectroscopy (FTIR) studies (e) mechanically characterized by Dynamic Mechanical Analysis (DMA). FTIR analysis demonstrated the occurence of scission in the C-H bond of PVDF main chain when exposed to ©-rays. The C-H bonds were observed to reduce in peak intensities and shift in peak position. FESEM reveals that the surface of the pure PVDF becomes rough containing chain grooves, nanopores and the crystal surface was homogenously covered by PVIm after grafted copolymerization. The storage modulus and loss modulus of PVDF-co-PVIm membrane show high mechanical strength at temperature up to 150 oC. However, the addition of silicon dioxide onto PVDF-co-PVIm reduced the storage modulus and loss modulus of membrane. The protonation of PVDF-co- PVIm membrane enhanced ionic conductivity after complexation in sulfuric acid up to 10_{-4} Scm_{-1} at room temperature and up to 10_{-3} Scm_{-1} at 100oC temperature. The protonated PVDF-co-PVIm could be a good potential candidate as a proton conducting membrane for fuel cells application.

14

Name : NOORAZMI BIN HASSAN

Title : PREPARATION AND CHARACTERIZATION OF NaI-Na_3PO_4 SODIUM ION CONDUCTING SOLID ELECTROLYTE WITH PLLTMEDA AS AN ADDITIVE FOR SODIUM BATTERIES

Supervisor : PROF. DR. HJH. AZIZAH HANOM AHMAD **(MS)**
DR. AZLIN SANUSI **(CS)**

New binary inorganic salt sodium iodide (NaI)–sodium phosphate (Na_3PO_4) prepared by mechanical milling for 3 hours and low sintering temperature method at 50 ºC exhibits maximum ionic conductivity of $(1.02\pm0.19) \times 10_{-4}$ S cm_{-1} at room temperature for the composition 0.50 NaI : 0.50 Na_3PO_4. The increase in conductivity is due to the increase in number of mobile Na_+ charge carriers through the conducting pathway provided by tetrahedral structures of Na_3PO_4. The presence of P–O at wavenumber 580 cm_{-1} and $PO_{4\ 3-}$ bands at wavenumber 1012 cm_{-1} respectively were detected by the infrared technique. Fourier transform infrared spectroscopy had been shifted indicating changes in polyhedral structure which in turn led to the formation of conducting channel by corner sharing or through edges. The spectra also implies that chelation of iodide anion gave rise to high mobility and elevations of the charge carriers to traverse along the conducting pathway created from tetrahedral phosphate thus giving rise to the conductivity of the sample. However the ionic conductivity value is still not high enough for application in electrochemical devices. Improve conductivity can be achieved by incorporation of an additive to the binary system. Poly(L-Leucine)1,3-diamino propane (PLLTMEDA) has been chosen as an additive due to its unique properties that able to further increase the ionic conductivity. The electrical conductivity of NaI–Na_3PO_4 and NaI–Na_3PO_4–PLLTMEDA were obtained by employing impedance spectroscopy (IS) technique. It was found the addition of PLLTMEDA resulted in an increase of electrical conductivity. The maximum conductivity of the new system NaI-Na_3PO_4 with 4 wt. % of PLLTMEDA shows maximum conductivity of $(1.12\pm0.68) \times 10_{-3}$ S cm_{-1}. The temperature dependence conductivity studies show that both systems are Arrhenius in nature and the transport properties can be descript by the hopping mechanism. The activation energy obtained for NaI–Na_3PO_4 is 0.34 eV and NaI– Na_3PO_4 with PLLTMEDA is 0.26 eV. The collected data from IS studies were analyzed in various complex planes such as impedance, admittance and permittivity for dielectric studies. Ac conductivity is analyzed using the Johscher's universal power law and the hopping mechanism of the charge carriers for both systems follow quantum mechanical tunneling (QMT) model. Ionic transference number was found to be 0.92 and 0.96 for the optimum composition of binary system and binary with additives respectively. This implies that the samples are ionic in nature. The FTIR spectra of NaI–Na_3PO_4–PLLTMEDA also verify the chelation of I- resulted in the immobilization of anion to give rise to high mobility and elevations of the charge carriers to traverse along the conducting pathway created from tetrahedral phosphate thus giving rise to the conductivity of the sample. Result obtained from NMR revealed the narrowing of the line width $_{23}Na$ spectra in the optimum composition of the binary NaI–Na_3PO_4–PLLTMEDA system can be assigned to Na population with higher ion mobility. The X-ray diffractogram of the binary with PLLTMEDA shows that the system has become semi-crystalline in nature. Field emission scanning electron microscopy micrographs revealed finer microstructure of the milling samples with grains growth formation and densification upon sintering. The fabricated cell using 50 wt. % of NaI and 4 wt. % of PLLTMEDA showed better performance with discharge time of 173 hours at 1.0 µA current and the value of open circuit voltage is 3.0 V at room temperature.

15

Name : NURAIN BINTI AZIMAN

Title : ANTIOXIDANT CAPACITY AND ANTIMICROBIAL ACTIVITY OF SELECTED AROMATIC MALAYSIAN HERBS AND THEIR EFFECTS ON THE STORAGE STABILITY OF MECHANICALLY DEBONED CHICKEN MEAT SAUSAGE

Supervisor : PROF. DR. NORIHAM ABDULLAH **(MS)**
ASSOC. PROF. DR. ZAINON MOHD NOOR **(CS)**

Mechanically deboned chicken meat (MDCM) is widely used due to the lower price however it is very susceptible to oxidative rancidity and microbial growth. Hence, this study was conducted to produce a quality MDCM sausage with added nutritional values by diversify the usage of six aromatic Malaysian herbs; Persicaria hydropiper (L.) H. Gross, Citrus hystrix DC, Murraya koenigii Spreng., Etlingera elatior (Jack) R.M. Sm., Cymbopogon citratus Stapf and Kaempferia galanga L. as functional food ingredients. Spectrophotometric method and RP-HPLC were used to identify and determine phenolic acid and flavonoid compounds of aromatic Malaysian herbs. DPPH radical scavenging, ferric reducing antioxidant power (FRAP), β-carotene bleaching and oxygen radical absorbance capacity (ORAC) assays were used to determine antioxidant capacity, and the antimicrobial activity was determined using disc diffusion assay. An optimum formulation of MDCM sausage incorporated with selected aromatic Malaysian herbs was obtained using a mixture design (Design Expert 8.0.1) software. The synergistic effect of these herbs on the storage stability of MDCM sausage was also determined throughout the nine months of frozen storage (-18°C), and was compared with the formulation without any incorporation herb (control) and formulation incorporated with BHA/BHT combination. Results showed gallic acid, (-)-epicatechin and myricetin were the major bioactive compounds detected in six aromatic Malaysian herbs. However, only P. hydropiper, M. koenigii and E. elatior exhibited strong and moderate antioxidant and antimicrobial activities, and they were used in MDCM sausage formulations. MDCM sausage which consists of P. hydropiper and E. elatior (59.46%, 40.54%) was optimised with the highest desirability of 0.93. The other two formulations also obtained from the mixture design consist of P. hydropiper and M. koenigii at two proportions (53.32%, 46.68%) and (50.00%, 50.00%) with 0.795 and 0.793 of desirability, respectively. The incorporation of dried P. hydropiper, M. koenigii and E. elatior into MDCM sausage formulation as suggested by mixture design was found to exhibit synergistic effects which include improvement in the water-holding capacity (WHC), cooking yield, texture and sensory properties. Besides that, the incorporation of these herbs was also found to reduce the cooking loss, rates of darkening in colour, rates of lipid oxidation, and decrease microbiological spoilage which comparable with formulation incorporated with BHA/BHT combination. However, the combination of P. hydropiper and E. elatior (59.46%, 40.54%) in MDCM sausage formulation had a lower shelf life compared to the combination of P. hydropiper and M. koenigii (53.32%, 46.68%), P. hydropiper and M. koenigii (50.00%, 50.00%) and also BHA/BHT, where their shelf life can be extended up to nine month of frozen storage period. Hence, from this study it can be concluded that combinations of P. hydropiper and M. koenigii at two different proportions (i.e. 53.32%, 46.68% and 50.00%, 50.00%) can be used in the development of quality and nutritious MDCM sausage.

16

Name : SITI NORATIQAH MOHAMAD DEROS

Title : MODELING SEASONAL WIND PATTERN FROM IMAGING AND NON-IMAGING DATA

Supervisor : ASSOC. PROF. DR. ARNIS ASMAT **(MS)**
PROF. DR. SHATTRI MANSOR **(CS)**

Wind speed in Malaysia is categorized as low with annual mean of 3-5 m/s and influenced primarily by four monsoon season; Northeast and Southwest monsoon with two transition period; April and October inter monsoon. Monsoon seasons were classified based on the origin of wind blows that brings unique character of wind speed and direction. Current wind study utilized limited wind data to projects wind behavior in wind pattern model generation. Short-term wind data insufficient to explain wind criteria by neglects the seasonality behavior of wind caused by different monsoon season. Wind observation using ground measurement devices such as anemometer and wind vane produced limited spatial resolution data that initiated the used of imagery data with 100-150 km_2 swath width. Wind direction extraction using wavelet transform (WT) technique is an example of wind study using imagery data. However, the study focused on high wind speed area due to the limitations of wavelet coefficient derivation that requires minimum 7 m/s wind speed and underestimates streak produced by lower speed. This study attempts to develop wind pattern model by forecasting the seasonal wind speed, determine the seasonal wind speed distribution model and extract wind direction from SAR images acquired at low wind speed area. The study site represents the seasonal and low wind speed condition in Pulau Langkawi, Malaysia. The timely wind speed data used for year 2000-2010. The imagery data used is Standard-2 (100 km_2) and Wide-3 (150 km_2) RADARSAT-1 SAR images to picture high spatial resolution wind direction in Langkawi. Autoregressive and Moving Average (ARMA) model was used to combine the seasonal and non-seasonal component of wind speed that will be used in wind speed forecast. The seasonal wind speed distribution model was determined among Lognormal, Weibull and Gamma distribution model; evaluated using goodness-of-fit test with the lowest error value is the most fit distribution model. Introduction of new WT technique to extract low wind speed wind direction was performed on Standard-2 and Wide-3 RADARSAT-1 SAR images. Enhancement involved the derivation of wavelet coefficient of low wind-induced streak on SAR data that then was transformed by using Fast Fourier Transform (FFT), Short Time Fourier Transform (STFT) and Mexican-Hat wavelet transform technique. Finally, the wind pattern model used is the Multi-Layer Conveyor (MLC) model simulated from wind speed, direction and the day in monsoon as the time unit, and the wind speed distribution as wind capacity measure. SARIMA $(1,1,1)\times(1,1,3)$ model is the ARMA model that best represents the seasonal wind speed with high r-squared value (>0.9) in each monsoon season. This showed that the coefficient of determination between sample data and forecasted data is relatively high. Lognormal distribution model is the best model used to describe the seasonal distribution of wind with goodness-of-fit test showed lowest error (0.07-0.14) between the model performance and data. The introduction of new wavelet transform technique using FFT domain spectrum is the most suitable technique to extract wind direction at low wind speed area with r-squared value of 0.71 for Standard-2 and 0.99 for Wide-3 image. Wind pattern model developed showed high r_2 (0.94) and correlation (0.97) with actual wind data. As a conclusion, the seasonal wind pattern model developed using MLC model by using derived parameters successfully described the wind behavior of distinct monsoon season and able to projects the long-term scenario of low wind.

17

Name : WAN NOR RAIHAN BINTI WAN JAAFAR

Title : MECHANICAL AND THERMAL PROPERTIES OF BIODEGRADABLE COMPOSITE FROM KENAF FIBRE AND POLYLACTIC ACID POLYMER

Supervisor : DR. SITI NORASMAH HJ. SURIP **(MS)**
ASSOC. PROF. DR. MANSUR AHMAD **(CS)**
DR. MOHD KHAIRUN ANWAR UYUP **(CS)**

Natural fibre (kenaf fibre) reinforced natural polymer, polylactic acid (PLA) was used for production of composites, where end life disposal is harmful to human and environment and able to self degraded. It is due to abundance of solid waste accumulation especially from plastic materials that seriously has taken numerous attentions. Kenaf bast and core fibre was separated and treated similarly to reinforce PLA. The effect of preparation condition such as acid hydrochloric concentration, extrusion rotation speed and amount of fibre loading was used to investigate composites properties. While the effect of natural weathering and landfill burial on composites properties was investigated for its degradation. Kenaf fibre was treated at 6% w/w NaOH followed by various HCl concentrations (0.5 M, 1.0 M, and 1.5 M). Fibres were then cryo-crushed to reduce size and compounded with PLA at various rotation speed (60, 70, and 80 rpm) and fibre loading (2, 4, and 6%) to determine the optimum parameter. Mechanical properties (flexural and impact), thermal properties (TGA and DSC), microscopic observation (SEM and TEM), Fourier Transform Infra-Red (FTIR), X-Ray Diffraction (XRD) were done for the investigation of the composites properties. Results reveal that treatment at 1.0 M HCl, with 60 rpm extrusion speed and 2% fibre loading has optimum properties for both KBC and KCC. Interestingly, KCC has comparable strength with KBC where statistical analysis shows no significant difference in the value of most mechanical properties. Although KCC present slightly lower thermal stability than KBC, temperature difference was in smaller range. It is proved that reinforcing ability of kenaf core fibre is as similar as kenaf bast fibre. In addition, reinforced composites (KBC and KCC) have shown positive self-degradation compared to neat PLA and more degradation was visible using landfill burial than natural weathering condition with almost 15 – 19% and 2 – 4% weight loss respectively after 6 month exposure. Due to slow degradation on natural weathering condition, KBC and KCC are useful for self-degraded materials for outdoor application against Malaysian weather.

FACULTY OF COMPUTER & MATHEMATICAL SCIENCES

18

Name : AHMAD SALAH MAHMOUD AL-AHMAD

Title : PENETRATION TESTING MODEL FOR MOBILE CLOUD COMPUTING APPLICATIONS

Supervisor : ASSOC. PROF. DR. HJ. SYED AHMAD SHEIKH ALJUNID **(MS)**
DR. NORMALY KAMAL ISMAIL **(CS)**

Mobile cloud computing (MCC) technology possess features mitigating mobile limitations and enhancing cloud services. MCC application penetration testing issues are complex and unique which make the testing difficult for junior penetration testers. It is complex as MCC applications have three intersecting vulnerability domains, namely mobile, web, and cloud. The offloading process adds uniqueness and complexity to the MCC application penetration testing in terms of generating, selecting and executing test cases. To solve these issues, this thesis constructs a model for MCC application penetration testing that reduces the complexity, tackles the uniqueness and assists junior testers in conducting penetration tests on MCC applications more effectively and efficiently. The main objectives of this thesis are to discover the issues in conducting penetration testing on MCC applications and to construct and evaluate MCC application penetration testing model. Design science research methodology is applied with four phases: (i) Theoretical framework construction phase (ii) Model construction phase entails designing the components and processes of MCC application penetration to reduce the complexity and address offloading; (iii) Model implementation phase implements the components and processes of the model into model guidelines and integrated tool called PT2-MCC. This tool manages the repositories, generates and selects test cases, and implements the mobile agent component; (iv) Model evaluation phase applies case study approach and uses an evaluation framework to evaluate the model against selected testing quality and performance attributes. In model evaluation phase, a junior penetration tester conducted two case studies on two MCC applications built by extending two open source native mobile applications. The tester uncovered more vulnerabilities using the constructed model and in less time compared to using the benchmark OWASP Security Testing Guidelines for mobile Apps model, i.e. it uncovered twenty and eight security vulnerabilities in the MCC HerdFinancial and MCC FourGoats applications respectively. The constructed test case selection technique selects a set of test cases that cover the designated entry points and fit with the user requirements. The results analysis showed that the constructed model has successfully tackled both the complexity and uniqueness of MCC application penetration testing by encompassing these multiple vulnerabilities' domains and MCC offloading. This model can significantly increase the efficiency and effectiveness of the penetration test on MCC applications as the evaluation has shown it has helped the junior tester to uncover 65% more security vulnerabilities within 11% less time compared to the benchmark model. The model evaluation is however limited to SQL injections and XSS vulnerabilities only; nevertheless, these two are the most common vulnerabilities for MCC. The main theoretical contribution is the MCC application penetrating testing model. Likewise, this thesis has two practical contributions, namely the PT2-MCC integrated tool that represents the model implementation and the two MCC test bed applications that can be applied as benchmark MCC penetration testing applications. This thesis is significant because it moderates the lack of testing models to detect security vulnerabilities in the MCC applications and help junior penetration testers to be more effective and efficient when testing MCC applications.

19

Name : AMAL ABDULGHANY QASSEM AL-SHARGABI

Title : A TASK-BASED PROGRAM COMPREHENSION FRAMEWORK FOR NOVICES

Supervisor : ASSOC. PROF. DR. HJ. SYED AHMAD SHEIKH ALJUNID **(MS)**
ASSOC. PROF. DR. MUTHUKARUPPAN ANNAMALAI **(CS)**
DR. MARINA ISMAIL **(CS)**
PROF. DR. ABDULLAH MOHD ZIN **(CS)**

Novices face much difficulty in comprehending even small computer programs. A framework is needed to help novices' attain sufficient program comprehension skills. To develop such framework, this research re-examines the three main factors that influence the novices' program comprehension; the programmer, the program code, and the task. Most studies so far focused on the first two especially programmer, with tasks traditionally applied only as a measure for program comprehension. Very few studies have inverted this supplementary role of task and instead examined the task factor itself. There is a research gap on the effects of tasks on novices' program comprehension. Moreover, current program comprehension mental models (PCMMs) have been mostly constructed for expert programmers, which do not match the novices' mental model. To solve these two problems, the research proposes a task-based program comprehension framework for novices. Employing empirical software engineering research design approach, 1) fourteen effective programming tasks for novices have been identified, 2) a novices' PCMM has been constructed, and 3) the effects of the tasks on the PCMM have been investigated. Consequently, the tasks were classified according to the cognitive domain of Revised Bloom's Taxonomy. The tasks in each cognitive category were then ranked based on their effectiveness on novices' program comprehension using a survey of instructors. Subsequently, novices' PCMM with four core abstraction levels, i.e. Statement, Block, Module, and Program, and an extended level, i.e. Domain, was developed, and validated by experts. The effects of eight tasks on the novices' PCMM were investigated through an experiment involving 69 novices, and six tasks were validated through another experiment involving 178 novices in three universities. Both experiments also validated the ranking of these tasks on the novices' PCMM. The first experiment demonstrated that all the tested tasks were able to significantly improve novices' PCMM. The first and second ranked tasks were studied more closely, where the first ranked tasks consistently showed higher improvements than the second ranked tasks in each of the four tested Bloom's categories of Remember, Understand, Analyze, and Create. The second experiment demonstrated that different tasks improved the abstraction levels and the information categories differently. It also indicated that higher cognitive category tasks improve PCMM at higher abstraction levels. The general implication is that the framework can be an effective tool for computing educators to incorporate program comprehension in programming, and thus shift from merely teaching tracing and debugging tasks only. These tasks need to be introduced in stages in the teaching of programming, starting initially from the lower cognitive categories' tasks such as Recall and culminating at the higher cognitive categories' tasks such as Modification in possibly team project assessments. However, these tasks should be applied with taking the consideration of the novices' programming levels and the information categories need to be improved. The key contribution of this thesis is a new developed framework, which includes novices' PCMM, and a set of classified and ranked effective tasks that can improve novices' PCMM.

20

Name : HAMAM M.IBRAHIM MOKAYED

Title : ROBUST GENERIC STRUCTURED DOCUMENT CLASSIFICATION SYSTEM

Supervisor : PROF. DR. HJH. AZLINAH HJ. MOHAMED **(MS)**

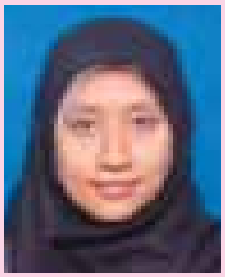
The Structured Document Classification System (SDCS) is an industrial-driven technology that has the ability to classify piles of structured documents collected everyday efficiently in different places. Although the SDCS technology has advanced tremendously, one of the most challenging tasks is to propose a classifier that supports various layouts for different categories and different script languages in a high accuracy and efficient time. To solve the issue of supporting various layouts for different categories and different script languages, a Robust Generic Structured Document Classifier has been proposed (RGSDC). RGSDS starts with finding the best objects that can be used to fit the target and solve the issue. Detailed study for all the previous thresholding techniques is conducted to introduce a new categorization method based on the transformation value of input images. This study is a good base for finding reliable thresholding algorithm. A new thresholding technique based on ordinal structure fuzzy logic (OSFM) is proposed to provide a robust generic image thresholding technique (RGT) that is able to extract clear mixed predefined objects for different languages and multi layouts problems. Two different set of features that distinguish different languages and multi layouts structured documents are proposed. Lines-based features are totally relying on dimensions, locations, and slanting properties. On the other hand, blob-based features represent the shape, appearance, and distribution of the nominated objects. All the collected features are used to build a statistical feature vector for the classification stage. Based upon the need of a fast and accurate process to propose a practical structured document classification, a creative and fast skewing process based on nominated referencing lines out of the group of lines in the object selection process is created as the first stage. An algorithm focused on evaluating performance of different pattern classification techniques namely; neural network, support vector machine, Pearson correlation, and dynamic time wrapping (DTW) is used. At the end, computational calculations to prove the accuracy of the proposed algorithms are performed in four different stages. The results of experiments demonstrate that the proposed RGSDC is capable of performing classification of 3.5 forms per second with a 4.9% misclassification error rate (ME). Reliability of the research is verified by benchmarking the results of RGSDS with another well-known SDCS developed by Austrian banking solution company (xyzmo).

21

Name : JULIANA BINTI WAHID

Title : HYBRIDIZING HARMONY SEARCH WITH LOCAL SEARCH BASED METAHEURISTIC FOR SOLVING CURRICULUM BASED UNIVERSITY COURSE TIMETABLING

Supervisor : ASSOC. PROF. DR. NAIMAH MOHD HUSSIN **(MS)**



Harmony search algorithm (HSA) is a population-based metaheuristic optimization algorithm that imitates the music improvisation process where musicians improvise their instruments' pitch by searching for a perfect state of harmony. Previous studies have shown that HSA has been successfully adapted for solving combinatorial optimization problems such as university course timetabling problem (UCTP). However, HSA encountered a setback in which the convergence rate and accuracy of the obtained results are reduced because of the solutions in the population are eventually about the same during the final iterations. Thus, this thesis proposed hybrid algorithms between HSA and local search based methods (simulated annealing (SA) and/or great deluge (GD)) to enhance the HSA performance for solving curriculum-based course timetabling (CBCTT) problem which is the variant of UCTP. SA is chosen to be hybridize with HSA for solving CBCTT because in literature, SA was successfully hybridize with HSA to solve other domain of problems. GD is chosen to be hybridize with HSA for solving CBCTT because GD has the related procedure with SA. The result of this approach was compared to other approaches in the literature applied to the same domain and best known solution available in the CBCTT website. The approach produced solutions that are at par quality with the previous published results. Moreover, this approach is able to obtain optimal penalty cost for two problem instances. In this thesis, a CBCTT problem from College of Art and Sciences, Universiti Utara Malaysia (UUM CAS) is also introduced and solved. The real data of UUM CAS timetable was analyzed and processed using the proposed algorithms. The result shows that the quality cost of UUM CAS course timetabling produced by the proposed algorithms is better compared to the course timetable produced by the ready-made software package. The main contributions of this thesis are: a well-defined lecture assignment procedures, with comprehensive comparison of heuristic orderings (with single or combinations) that are able to produce a diverse population of feasible solutions for all problem instances, a comprehensive hybridization settings between population and local search based framework, as well as the formulation and solution of a new curriculum based course timetabling dataset.

22

Name : NORHAYATI BINTI SHUJA'

Title : PROJECTING INPUT-OUTPUT TABLE FOR MALAYSIA

Supervisor : PROF. DR. MOHD ALIAS LAZIM **(MS)**
PROF. DR. YAP BEE WAH **(CS)**

Input-output tables provide detailed accounts of the flow of production and consumption of goods and services from producers to consumers. It serves as a dataset for input-output analysis which provide the tools to perform economic modelling. The construction of the input-output tables based on detailed census or surveys is a complex procedure that requires substantial financial expenditures, large human capital and time. This is the main reason why Malaysia Input-Output Table (MIOT) is produced and published on average every five years. However, for policy makers, the time lag that reflects data from much earlier years is not appropriate to be used for planning and formulating economic policies. Hence, the availability of timely and updated input-output tables is critical for effective assessment of the contribution of industries to the economy. Therefore, projecting input-output table for Malaysia is important as it can provide the latest information for policy makers in national development and budget allocation. The aim of this study is to compare two projection methods for projecting input-output tables for Malaysia. The data for the study are Gross Domestic Product and MIOT for 2000, 2005 and 2010. This study involved three phases. In the first phase of the study, two projection methods, the RAS and EURO method were used to project the MIOT 2005 and MIOT 2010 using the actual MIOT 2000 and MIOT 2005 respectively. The RAS is a bivariate method while the EURO is a stochastic method. The projection of input-output tables involved an intensive iterative procedure using MS-Excel Visual Basic programming. In the second phase of the study, the projection performance of RAS and EURO methods were assessed based on statistical measures and input-output analysis. The three error measures are Mean Absolute Deviation (MAD), Root Mean Squared Error (RMSE) and Dissimilarity Index (DI). The input-output analyses are based on the forward and backward linkages using Rasmussen and Hypothetical Extraction Method (HEM). The projected MIOT 2005 and MIOT 2010 were compared with the actual MIOT 2005 and MIOT 2010. The actual MIOT is considered as "benchmark". The deviation of the forward and backward indices between the actual and the projected MIOT is calculated. The results show that EURO performs better than the RAS method in projection of MIOT. In the last phase, the EURO method was used to project MIOT 2015 and linkages and key sectors were then identified. The Transport & Communication and the Finance & Insurance sectors were identified as a key sector of the Malaysian economy in 2015.

23

Name : ROGAYAH ABDUL MAJID

Title : MODELING THE HUMAN CENTERED DESIGN ADOPTION THROUGH HCI CAPABILITY

Supervisor : PROF. DR. NOR LAILA MD NOR **(MS)**
ASSOC. PROF. DR. WAN ADILAH WAN ADNAN **(CS)**

The Human Centered Design (HCD) approach rooted in the semi-scientific field of ergonomics was introduced into the software development process to increase the software usability and quality by focusing on the software use and applying human factors/ergonomics and usability knowledge and techniques. In the progress the Human Centered Software Engineering (HCSE) was developed more than a decade ago. HCSE is the framework for integrating the human centered design philosophy and usability engineering into traditional systems development method. Despite its importance, HCD adoption among software practitioners remains low, as reflected in the result of the preliminary study conducted among the Malaysian software development organizations. This research argues that to encourage the HCD adoption among software practitioners a path for HCD adoption needs to be prescribed. This research also argues that an organizational approach and not individual advocates of human-centered design must be used to facilitate the adoption of HCD in systems development. Following this argument of this research embarks on the strategizing of HCD adoption through the development of an adoption model that can inform the readiness of adopting HCD based on technological and organizational capability. The research was carried out in three phases. In the first phase a comprehensive literature analysis on HCD was conducted and the conceptual model has been developed. By integrating HCD from management perspectives into the conceptual model has contributed to the development of an initial model for HCD adoption. This initial model was used as a probe to elicit knowledge of its correctness and suitability with two renown academic experts in HCI. In the next phase the initial model was revised. The integration of the feedback obtained from the first phase with the constructs obtained from adoption and capability maturity models, the HCD Adoption Model has been developed. The HCD Adoption Model prescribes five levels of adoption and the related key processes of each level. This new adoption model later verified through expert reviews with two HCI academic experts and five software development practitioners in the last phase. The novelty of this research lies on its strategy of taking an organizational and managerial perspective of HCD. The main contribution of this research is a new HCD Adoption Model. This new model contributes to the theoretical knowledge of the managerial aspects of HCI. In terms of practical contribution, the HCD Adoption Model will be a useful tool to inform the readiness for adopting HCD in the software development organization.

24

Name : WAN ISNI SOFIAH BINTI WAN DIN

Title : CLUSTER HEAD SELECTION ALGORITHM USING FUZZY LOGIC IN MULTI-TIER WIRELESS SENSOR NETWORK FOR ENERGY EFFICIENCY

Supervisor : PROF. DR. SAADIAH YAHYA **(MS)**
PROF. DR. MOHD NASIR TAIB **(CS)**

Energy deficiency is one of the most critical aspects of Wireless Sensor Network (WSN). The network performance can be affected when a small network grows larger, and this is related to the energy deficiency of WSN. Therefore, it is essential to manage sensor node energy efficiently, so as to ensure that it would be sufficient to complete WSN applications. Clustering is an established approach which emphasized on cluster head to prolong the lifetime of WSN. However, there is still a lack of effective techniques to determine and select the cluster head. Currently, the selection of cluster head is based on residual energy and several parameters. The data routing to the based station is solely relying on cluster head. These have resulted ineffective of energy usage of sensor node which causes restrict on a lifetime of the sensor network. Hence, this study proposes a new algorithm called Multi-Tier Protocol (MAP). MAP introduced clustering scheme to reduce the energy consumption of wireless sensor network in which, Fuzzy Logic used as tools to select the cluster head and multi-hop communication is used to route the data from the cluster head to the base station. Initially, the combinations of parameters which are residual energy, centrality and communication cost are determined for cluster head selection and utilized in MAP. Also, two types of principle nodes applied which called cluster head and primary node. The cluster head (CH) is responsible to gathered and compressed the data send by the sensor node, while primary node acts as a relay node for the respective cluster head at each tier to execute the routing process and sent the data to the base station. Two simulations based on 100 sensor nodes with 1 Joule and random energy are carried out. Simulation based on 200 sensor nodes with 1 Joule energy deployed for testing the reliability of MAP. The performances of MAP are evaluated through comparing its energy usage for data transmission against Low Energy Adaptive Clustering Hierarchy (LEACH) and Stable Election Protocol (SEP). It found that the three parameters' combination gave the most promising results in improving the lifetime of a network. The results indicated that MAP significantly extends the lifetime of wireless sensor network 48.25% longer than LEACH and SEP. This thesis concludes that the proposed protocol MAP with effective combinations of parameters for selecting cluster heads and cluster primary nodes as a relay node for data routing can effectively improve the efficiency of WSN network.

25

Name : SAFAWI ABDUL RAHMAN

Title : IDENTIFICATION OF THE ESSENCE OF INTELLIGENCE IN PROBLEM SOLVING BASED ON PRAGMATICISM'S THEORY OF INQUIRY

Supervisor : ASSOC. PROF. DR. HARYANI HARON **(MS)**
DR. SHARIFALILLAH NORDIN **(CS)**

In Artificial Intelligence (AI), the issue of the essence of intelligence is disputable in which this issue leads to the difficulty in understanding the intelligence. This research enters the challenge of identifying the essence of intelligence by re-visiting the tenet of intelligent behavior due to that intelligent behavior is amenable to reflect intelligence. The investigation into the intelligent behavior leads to the finding that the process and intelligent process are the underpinning principle of behavior. The research progresses to identify the intelligent processes that are said to be truly intelligent. As a result, the problem solving processes are found to be essential source for intelligent processes because problem solving is the key for intelligence. By disregarding the existing problem solving frameworks, this study explores the Pragmaticism's theory of inquiry, a general philosophical idea that penetrated many academic realms such as in AI since 1950s. The re-exploration of Pragmaticims's abduction, deduction and induction yields seven intelligent processes namely invention, selection, entertainment, analysis, demonstration, operation and justification. These intelligent processes are represented using common terminologies of intelligent behaviors namely reasoning, inventing, selecting, adapting, planning, acting and learning in which these processes are identified as the repertoire of intelligent behaviors. The research progresses to examine and validate these intelligent processes or behaviors into actual problem solving domain of fern identification. This kind of examination has made this research fall into qualitative method. The respondents are semi-expert group of which the fern's identification is a challenging subject to them. The think-aloud and structured questions that consist of closed and open-ended has been used for data collection. The Atlas.ti has been used to produce quotations and codes of transcripts of think-aloud and structured questions. The interpretive method of Productive Hermeneutic Analysis (PHA) is used in the data analysis. The analysis and discussion are made based on the magnitude of respondent's conducts exhibited in the think-aloud and their explanations about the present of intelligent processes in the fern's identification exercise coded into the Atlas.ti. By the respondent's validation and acknowledgement of the presence of intelligent processes, this study suggests the repertoire of eight intelligent behaviors as adequately represent the essence of intelligence.

FACULTY OF CIVIL ENGINEERING

26

Name : AFZAN AHMAD ZAINI

Title : A MODEL FOR IMPLEMENTATION OF GREEN CONSTRUCTION

Supervisor : DR. INTAN ROHANI ENDUT **(MS)**
ASSOC. PROF. DR. AHMAD RUSLAN MOHD RIDZUAN **(CS)**
DR. ZAYYANA SHEHU **(CS)**

The recent shift from conventional construction to green construction has brought about efficiency and improvement to the construction industry. However, the construction industry is still reluctant to embrace this new development. This circumstance is primarily due to a fundamental problem of the lack of clarity in grasping the concept of green construction. Consequently, it has called for a need to explore the current practice of green construction in the construction industry with which this research has attempted to deal. In this research, a considerable effort was made towards identifying the solution to the problem through the establishment of a green construction model. In the process of establishing the model, four objectives were outlined; (1) To identify the current practice of green construction, (2) To investigate the level of awareness and understanding of the benefits and disadvantages of green construction, (3) To investigate factors of green construction innovation, and (4) To determine the major challenges for the implementation of green construction. The findings used for the establishment of the model were structured and analysed based on the data from 346 usable questionnaires and 25 semi-structured interviews with the aid of SPSS19 and NVivo-9 respectively. The datasets from the questionnaire survey were analysed using several statistical analyses; exploratory factor analysis, reliability analysis, assessment of normality, descriptive analysis (mean and ranking), and analysis of variance (ANOVA), while the datasets from the semi-structured interview were analysed using content analysis. A structural equation modelling (SEM-AMOS) was further employed in order to establish and validate the statistical model analyses that involved pooled-confirmatory factor analysis, structural equation modelling, and moderation effect for the latent constructs. From the findings, it was found that the implementation of ISO 14001: Environmental Management System attained the highest mean score for the current practices. The mean scores for the level of awareness and understanding in green construction were almost equal; the highest mean score for benefits was ―Improve customer satisfaction and the highest mean score for disadvantages was ―High cost of green construction material.Subsequently, the highest mean scores for green construction innovation and challenges were ―Environmental Policies and Procedures in Green Construction and ―Lack of Awareness of the Environmental Preservation respectively. Based on the overall establishment and validation of the model, it was found that the model performed well and all five hypotheses of the model establishment were supported. From the practical perspective, the model should be able to encourage construction stakeholders to be more attentive in the area of green construction. Hence, it can be used as a diagnostic tool for the continuous improvement of green construction in the Malaysian construction industry.

27

Name : KAMRAN SHAVAREBI

Title : TECHNICAL VIABILITY STUDY OF STEEL SLAG AS NON -CONVENTIONAL MATERIAL IN CONCRETE

Supervisor : ASSOC. PROF. DR. AHMAD RUSLAN MOHD RIDZUAN **(MS)**
PROF. DATUK DR. ABU BAKAR MOHD DIAH **(CS)**

Although recycling of waste material has started since the last few decades, recycling as a means of sustainable use of Non-Conventional material did not actually start until fairly recently. Recycling of industrial waste and by-product material which is an environmentally sensitive problem faced by waste manager throughout the world is no exception. Specifically steelmaking operations are concerned by this problem because of the generation of a huge quantity of by - products such as Electric Arc Furnace Slag (EAFS). Basically, there are two reasons to the rationale underlying the usage of slag as a source of aggregate; the need to conserve natural resources and the need to manage waste amicably. However, to make the feasible acceptance of slag as aggregate in concrete, its strength, deformation and durability must also be assured. This research attempts to provide that assurance by conducting a comprehensive investigation on the strength, deformation and durability performance. This study is divided into four (4) main phases: (i) chemical and physical properties of slag and its suitability as aggregate for concrete production (ii) design of mix proportions of SSA using replacement level of 0%, 10%, 50% and 100%. Six (6) series of concrete specimen were cast. The series refer to the difference of w/c ratios between the ranges 0.47 – 0.7. The specimens were tested from 3 days until 365 days (iii) the engineering properties considered include compressive, tensile and flexural strength, modulus of elasticity and drying shrinkage. These properties are important in evaluating the performances of the SSA concrete compared to the corresponding NA concrete (iv) in order to access the durability performance of SSA concrete, resistance to carbonation, sulphate attack and gas permeability were conducted. Gradation of the aggregates shows that the slag aggregates is suitable for concrete and complied to existing BS EN 12620:2002. Tests on the aggregate have shown that the resistance to mechanical action such as the impact and crushing value for slag aggregate is lower but higher in specific gravity and water absorption capacity than the natural aggregates. From the strength point of view with various w/c, the slag aggregate concrete compared well with the natural aggregate concrete. The mechanical properties steel slag aggregate concrete increased with the proportion of coarse aggregate. The results indicated that the higher concrete strength was obtained for the mixtures possessed a percentage of 100% SSA as a replacement of the coarse aggregate for all various w/c used. The static modulus of elasticity of the SSA concrete is found to be higher than NA concrete which is the higher the w/c ratio, the lower the static modulus of elasticity. With respect to deformation, SSA concrete produces lower drying shrinkage, at low w/c ratio. The drying shrinkage of the concrete mixtures incorporating with 10 and 100% SSA were approximately 33% and 51% less than of NA concrete respectively. The SSA concrete exhibited good durability performance compared to NA concrete. Using regression analysis, the correlation between the compressive and other mechanical properties and durability performance of control NA and SSA concrete have also been established.

28

Name : MOHD SUHELMIEY BIN SOBRI

Title : STRUCTURAL PERFORMANCE OF MALE-FEMALE INTERLOCKING PANEL (M-FiP) CONNECTION USING CRUSHED CONCRETE WASTE AGGREGATE (CCwA)

Supervisor : PROF. DR. IR. SITI HAWA HAMZAH **(MS)**
ASSOC. PROF. DR. AHMAD RUSLAN MOHD RIDZUAN **(CS)**

This research investigates the performance of male-female interlocking panel joint connection for precast panel applications. The research involved experimental laboratory work testing of twenty four (24) set of male-female interlocking panel (M-FiP) with and without bar as connector mechanism and used cement grout as wet joint binder. The dimensions size of the panel are 900 mm x 500 mm x 75 mm, was prepared using Grade 30 of concrete strength by used Crushed Concrete waste Aggregate (CCwA) size 10 mm and 20 mm as a major component material in concrete mix production. The concrete mix has been designed with water cement ratio of 0.50 and reinforced with B7 rectangular steel fabric type. Due to use recycled aggregate material in production new concrete mix, the fresh and hardened test was conducted to confirm the properties as satisfy according to the standard. The aspect (H/L) and slenderness ratio (H/t) of the panel are 0.55 and 6.67 respectively. In order to investigate the male and female performance the two pilot tests has been conducted in studied the bonding strength and ductility behavior of this joint connection. A total of twelve (12) set of male and female specimens with size dimension of 75 mm x 500 mm x 200 mm were cast and tested for two types of testing. Eight (8) set were prepared for pullout testing and another four set were prepared for flexural beam testing. Based on the result in bonding strength analysis due to hardened cement grout strength was showed satisfactory bonding between bar connector and cement grout in M-FiP specimens. The bond strength was increased linearly with the age of cement grout strength. For bending test on M-FiP specimen results was indicated that the specimens with bar connector resulted in better performance in term of ductility behavior and pre-cracked controlled compared to specimen without bar connector under bending condition. In all M-FiP samples that have been constructed, it was divided into two experimental setup conditions which are under vertical and horizontal setup condition. These conditions were conducted due to investigate the performance and ductility behavior of M-FiP at joint connection under vertical and horizontal loading respectively. The influence of bar connector and loading distribution types was studied and discussed. The success of this research were provided a new method in jointing system of precast panel due to simple and fast installation process.

29

Name : MUHD NORHASRI MUHD SIDEK

Title : UTILISATION OF NANO MATERIALS IN ENHANCING STRENGTH AND DURABILITY PROPERTIES OF ULTRA HIGH PERFORMANCE CONCRETE (UHPC)

Supervisor : PROF. DR. HAMIDAH MOHD SAMAN @ HJ. MOHAMED **(MS)**
DR. MOHD FADZIL ARSHAD **(CS)**

Hydration gel (C-S-H) is major component in binding of concrete and refining of the C-S-H gel is difficult to be done by using micro based materials. For this research, inclusion of nano materials in UHPC is expected to overcome the problem by providing ultra filler effect. In this study, the utilisation of nano material in UHPC was done by using additive or replacement method for cement and UHPC mix and generated based on a series of trial modified mixes originally formulated by previous researchers. For this research, two types of nano materials were selected. Firstly, nano kaolin samples were prepared from kaolin using milling and then underwent calcination process to produce nano metakaolin. Secondly, nano clay was provided by Sigma (M) and underwent calcination process to convert to nano metaclay. Characterisation of cementitious materials were confirmed by its particle size, chemical composition and morphology properties and evaluated using Laser particle Analyser, X-Ray Fluorescence (XRF), X-Ray Diffraction (XRD) and Scanning Electron Microscope (SEM). UHPC mixes were developed by incorporating nano materials with (addition) and without (replacement) addition of metakaolin. The inclusion of nano materials as an additive and cement replacement material (without metakaolin) based on percentage of increment from 1, 3, 5, 7 and 9 %. For additive approach, addition of metakaolin was fixed to 10%. The utilisation of nano materials was assessed in terms of its cementitious, microstructures and chemical phases, strength and durability properties. In cementitious properties, cement paste were determined in terms of setting time and compressive strength. In fresh state, workability of UHPC was determined by using slump test. For strength properties compressive and flexural strength were tested. Finally, durability properties were assessed based on porosity and water absorption characteristics. UHPC specimens, containing nano materials were assessed its chemical phases and microstructure using XRD and SEM examination. Moreover, data from strength and durability properties was optimise by using Design Expert Software and mathematical equation generated. It was found that, particles of nano materials performed different morphology as compared to the OPC, kaolin and metakaolin. For cement paste, inclusion of nano materials as addition or replacement increase the water demand but also increase compressive strength as compared to the OPC and metakaolin pastes. Strength and durability properties of nano materials enhances the UHPC performance by refining microstructure, promoting pozzolanic reaction and creating nucleation process and proves from the result provided by XRD pattern and SEM micrograph analysis.

30

Name : SHAMILAH BT ANUDAI@ANUAR

Title : SEISMIC PERFORMANCE BETWEEN UNREPAIRED AND REPAIRED OF TUNNEL FORM BUILDING UNDER LATERAL CYCLIC LOADING

Supervisor : ASSOC. PROF DR. NORHAYATI ABD HAMID @ ZULKURNAIL **(MS)**
DR. MOHD HISBANY MOHD HASHIM **(CS)**

A total numbers three units of one-third scale 3-storey tunnel form building (TFB) were designed using BS8110, constructed, tested under in-plane and out-of-plane lateral cyclic loading in the heavy structural laboratory. Two numbers of single units TFB were repaired using steel angle, steel plate and CFRP fabric and retested under in-plane and out-of-plane lateral cyclic loading. Another double unit TFB also repaired using additional shear wall, steel angle and CFRP fabric and retested under in-plane lateral cyclic loading only. The visual observation of damages, lateral strength capacity, stiffness, ductility and equivalent viscous damping were determined for all the unrepaired and repaired specimens. Based on the experimental results, the repaired of single unit TFB using steel angle, steel plate and CFRP fabric has higher value of lateral strength capacity, ductility and equivalent viscous damping than unrepaired single unit TFB. Likewise, the repaired double unit TFB using additional shear wall, steel angle and CFRP fabric also has higher value of lateral strength capacity, stiffness, ductility and equivalent viscous damping than unrepaired double unit. It was found that the repaired double unit TFB is the best method of repair and retrofit technique for this research work. It is important to validate the experimental hysteresis loops with model hysteresis loops using the HSTERES program before using this model hysteresis in modeling the TFB using the RUAUMOKO 2D program. Wayne Stewart Rule Model with hysteresis rule number 54 was chosen to validate with experimental results and all the performance parameters were less than 5%. Therefore, this model can be used to determine the dynamic behavior and analysis using Ruaumoko 2D under ten different earthquake excitations inclusive in Malaysia and around the world. From nonlinear time history analysis, it was discovered that double unit TFB can survive under minor to moderate earthquake events which is less than 5 Scale Richter. Further analysis on seismic assessment of repaired double unit TFB was conducting using fragility curve because this is the best method should be adopted to the construction industries if severe damage occurred to the TFB buildings after earthquake. From the analysis of fragility curve, it was noticed that the repaired double unit TFB survive under six local earthquakes in Malaysia, DBE (Type 1 and Type 2) and MCE (Type 1).

FACULTY OF ELECTRICAL ENGINEERING

31

Name : ANUAR BIN MUSA

Title : MODELLING AND CHARACTERISATION OF THE IEEE 802.15.7 MEDIUM ACCESS CONTROL LAYER (MAC) FOR INDOOR VISIBLE LIGHT COMMUNICATION (VLC)

Supervisor : PROF. DR. MOHD DANI BABA **(MS)**
ASSOC. PROF. DR. HJ. MOHD ASRI HJ. MANSOR **(CS)**

Radio Frequency (RF) technologies are presently the main medium for wireless communication systems. However, like many other technologies, RF has constraints such as limited bandwidth and electromagnetic interference which limit the applications of RF technologies in certain scenarios. For example, RF signals can cause interference with aircraft communication systems, medical equipment and devices in the hospital or navigational devices in airports. Meanwhile, current advancements in Light Emitting Diode (LED) devices and materials are driving the applications of Visible Light Communication (VLC). VLC combines both illumination and communication together within one device. VLC uses a white light LED as a source for the data transmission. Many opportunities exist to exploit the low-cost nature of LEDs and their lighting properties for widespread deployment of VLC. However, some characteristics of the optical wireless medium, including mobility, directionality, multi-user access and susceptibility to ambient light noise sources, must be managed and overcome. VLC system is standardised by IEEE 802.15.7 specification. In this dissertation, an analytical model and the ns-2 simulation model of the indoor Visible Light Communication (VLC) is developed and analysed based on the IEEE 802.15.7 standard. The analytical model is developed based on the Discrete Time Markov Chain (DTMC) method. The analytical model is compared with the theoretical CSMA model to verify the correctness of the proposed models.The throughput curves of the theoretical CSMA model, the DTMC analytical model, and the ns-2 simulation model follow the same pattern. The throughput improvement for the DTMC analytical model over the CSMA basic model at the maximum throughput value is ranged from 8 percent to 31 percent depending on the network configuration. The throughput improvement is due to the back-off mechanism implemented by the proposed IEEE 802.15.7 model. Thus, this verifies correctness and the improvement of the proposed DTMC analytical model. The detailed design and implementation of a VLC prototype for an indoor optical wireless communication is also presented based on an Optical Ethernet Transceiver previously developed by the TMR&D Advanced Internet Lighting Application (AILA) team. The VLC prototype consists of an Optical Ethernet Transceiver and the software VLC MAC that manages the connections for multiple users. The software VLC MAC is developed to support multi-user connectivity using the existing Optical Ethernet Transceiver. The throughput of the Software MAC VLC system is about 7.5 Mb/s for 1024 bytes packet size which is 21% lower compared to the maximum theoretical rate. This is due to the unused 0.33 part of the slot size for every packet sent, which can be translated to 16.5 % wastage of throughput. The remainder is due to the packet processing delay at the application layer. Thus, the soft MAC implementation result matches the maximum theoretical rate of the VLC system.

32

Name : EZMIN BINTI ABDULLAH

Title : PAPR REDUCTION USING SELECTED CODEWORD SHIFT (SCS) TECHNIQUE AND SCS-SLM TECHNIQUE FOR SPACE TIME CODING MIMO-OFDM

Supervisor : ASSOC. PROF. DR. AZLINA IDRIS **(MS)**
ASSOC. PROF. DR. AZILAH SAPARON **(CS)**

In the world of increasing mobility, the emerging needs for the cellular and wireless communications have increased enormously. The demand of efficient, reliable and also high speed wireless communications network can be achieved by implementing multiple input multiple output (MIMO) and orthogonal frequency division multiplexing (OFDM). However, in recent years, information technology has progressively led to global energy consumption due to the demands of mobile communications around the world. In this level, the main component to reduce power consumption depends on the high-power amplifier (HPA) efficiency which is associated to the peak-to-average power ratio (PAPR). However, various techniques that have been proposed to reduce the high PAPR are encountered with some drawbacks such as computational complexity and bit error rate (BER) degradation. These drawbacks are due to the formulation and algorithm of the PAPR reduction techniques in the OFDM system to achieve substantial PAPR reduction. In this thesis, a new formulation for interleaving technique using circulant shift is proposed to form an optimum permutation for interleaving technique. In addition, an appended bit side information (SI) is proposed to avoid the BER degradation at the receiver. This technique is called selected codeword shift (SCS) technique. The technique has reduced the PAPR with approximately 19% using only six candidates and avoid the BER degradation effectively. Due to the advantages of proposed SCS, an enhancement of selective mapping (SLM) technique using SCS is proposed. This approach aim to give a booster to SLM in order to achieve substantial PAPR reduction as well as to improve BER degradation. This technique is called SCS-SLM technique in conjunction with combination of SCS and SLM. The results show that both aims are achieved with 28.6% PAPR reduction using six candidates and avoid 8% of the BER degradation in conventional SLM. Finally, the SCS technique and SCS-SLM technique are implemented in the MIMO-OFDM system in order to reduce the inherited PAPR problem. Diversity scheme which are space time (ST), space frequency (SF) and space time frequency (STF) are also introduced in this work to improve the BER performance. The results show that the SCS technique and SCS-SLM technique reduced the PAPR in all schemes and the best improvement is 33% of the PAPR reduction and 55% of the BER.

33

Name : BAKEEL HUSSEIN NAJI MAQHAT

Title : ADAPTIVE RESOURCE ALLOCATION ALGORITHMS WITH QOS SUPPORT BASED ON NETWORK CONDITIONS USING FUZZY LOGIC SYSTEM FOR IEEE 802.11N NETWORKS

Supervisor : PROF. DR. MOHD DANI BABA **(MS)**
ASSOC. PROF. DR. RUHANI AB RAHMAN **(CS)**
DR. ANWAR SAIF ALSHAMIRI **(CS)**

In wireless local area network (WLAN), the primary concern is Quality of Service (QoS) support that aims to satisfy the diverse service requirements and to guarantee higher data rates allocation for different service classes. However, IEEE 802.11n standard does not specify a scheduling algorithm to guarantee QoS. The performance benefits of existing solutions in MAC layers often fall short of providing the QoS support, particularly, it is still experiencing additional access latency and bandwidth allocation disorder where errors occur, that leads flows backlogged. The aim of this thesis is to develop a fair and efficient packet scheduling and adaptive bandwidth allocation algorithms to support QoS for a diverse service class for A-MSDU aggregation in IEEE 802.11n network. This thesis presents four main contributions for QoS provisioning that are robust, scalable, and can be successfully implemented in WLAN networks. The first contribution is the AMS scheduling algorithm. The aim is to satisfy QoS requirements for time sensitive applications by exploiting the A-MSDU attributes and adopting the idea of enabling selective retransmission in our scheduling algorithm to obtain aggregation with small size to support time-sensitive applications and enable prioritization according to the QoS requirements of the traffic classes. The second contribution is an efficient bandwidth allocation algorithm for A-MSDU aggregation called Adaptive Scheduling based Embedded Fuzzy (ASEF) system. ASEF system is fully dynamic with fuzzy logic based approach and adaptive deadline-based scheme for various service class traffics. The algorithm employs fuzzy logic control which is embedded in the scheduler. The function is to control and dynamically update the bandwidth required by the various service classes according to their respective priorities, maximum latency, and throughput. The third contribution is to handle the influence of network channel conditions for the transmission process called Dynamic Sensing Mechanism based embedded Fuzzy (DSMF) expert system. The DSMF is an intelligent based system approach to support selective retransmission process and to enhance the performance by means of sensing the network channel conditions and updating the transmission decision. The final contribution is an efficient selection mechanism scheme for contending stations to access the channel called an Access Channel Selection based Fuzzy (ACSF) expert system for WLAN. ACSF can guarante QoS requirements by allowing the real-time station to occupy the medium channel ahead of the non-real-time. The simulation results show the AMS algorithm significantly improves the performance over RSA-MSDU and the standard for real-time traffic in terms of reducing average delay and packet loss up to 56% and 24% respectively. Improving AMS scheduling by introducing ASEF scheme to allocate bandwidth between real time and non real-time traffics.The simulation results show the ASEF algorithm significantly improves the performance of AMS algorithm for about 67% for non real-time traffic and about 10% for real time traffic in term of reducing packet loss ratio; and improve the system throughput up to 54%. The results obtained by ACNF shows that by taking into account the network condition and channel access in building the scheme would increase the performance by reducing the packet loss by 80% on average and increase the system throughput by 15% on average as compared to ASEF.

34

Name : DAW SALEH SASI MOHAMMED

Title : COMPUTATIONAL INTELLIGENCE OF PROBABILISTIC SIMULATION IN DEMAND SIDE MANAGEMENT FOR AVOIDED UTILITY COST IMPROVISATION IN A GENERATION OPERATING SYSTEM PLANNING

Supervisor : ASSOC. PROF DR. MUHAMMAD MURTADHA OTHMAN **(MS)**
PROF. IR. DR. ISMAIL MUSIRIN **(CS)**
ASSOC. PROF. DR. MOHD WAZIR MUSTAFA **(CS)**

In a generation operating system planning, avoided utility cost (AUC) is customarily implemented to attain the optimal economic benefits in a generating system by taking into account intriguing issues on the energy efficiency, renewable energy sources or conservation programs. In this thesis a new approaches of optimal dispatch of limited energy unit (ODLEU) and demand side management (DSM) using computational intelligence approach is proposed for AUC improvement. Contrary to the conventional approaches, which mainly rely on dispatching of each limited energy unit (LEU) in sequential order, the proposed algorithm comprising with optimization technique is used as an alternative for performing LEU dispatch; which has a tangible impact to improve and increase the AUC value. In order produce a global optimal solution of AUC, the self-adaptive strategy was proposed to serve as a new mutation technique responsible to provide a new population for discrete artificial bee colony. The newly designed algorithm is termed as the discrete artificial bee colony associated with selfadaptive strategy (DABC-SAS). The AUC is originated from the summation of avoided energy cost, avoided expected cycle cost and avoided capacity cost of the generating system. All of the main components in the AUC require the information of probabilistic production cost (PPC) and total expected start-up cost (TESC) of generating unit. The PPC is obtained by considering the uncertain load duration curve and forced outage rate of generating unit. On the other hand, the TESC is determined within the framework of equivalent load duration curve, and frequency and duration method. It is arguably that the probabilistic peak shaving technique incorporating with the equivalent load duration curve significantly improves the performance of ODLEU and DSM towards providing accurate result of PPC and TESC followed by the AUC, in contrast with the other techniques of peak shaving and off-loading. On top of that, performance comparison between the basic concept of ODLEU and DSM that used to determine global optimal solution of AUC are numerically demonstrated in a case study of six generating unit's system. Further investigation on the DABC-SAS that improves the performance of ODLEU and DSM has been carried-out by referring to the global optimal solution of AUC associate with energy efficiency concept obtained for the modified IEEE RTS-79 generating system at every load demand variation of 2850MW, 3000MW and 3050MW. Compendium of the results have shown that the DSM based DABC-SAS outperformed the performance of ODLEU based DABC-SAS, basic approach of ODLEU and basic approach of DSM in determining the global optimal solution of AUC.

35

Name : HABIBAH BINTI ZULKEFLE

Title : FABRICATION OF NANOSTRUCTURED ZnO/MgO BILAYER WITH PVDF-TrFE LAYER FOR METAL-FERROELECTRIC-INSULATOR-METAL (MFIM) CAPACITOR APPLICATION

Supervisor : PROF. ENGR. DR. MOHAMAD RUSOP MAHMOOD **(MS)**
ASSOC. PROF. DR. ROZANA MOHD DAHAN **(CS)**
MRS. RAUDAH ABU BAKAR **(CS)**

The nano-MgO films, nano-ZnO films and nanostructured ZnO/MgO bilayer films were synthesized using sol-gel spin coating method. The uniform and smooth nano-ZnO film was utilized as the oxide dielectric template to produce nanostructured ZnO/MgO bilayer films. The nano-MgO films and nanostructured ZnO/MgO bilayer films were deposited at various deposition parameters (solution concentration, number of layer and annealing temperature). The effect of deposition parameters towards morphology and dielectric properties of nano-MgO films and nanostructured ZnO/MgO bilayer films was investigated. The variation of solution concentrations revealed that nano-MgO film and nanostructured ZnO/MgO bilayer film with 0.4M concentration produced improvement in the electrical properties as seen by the uniform particle distribution. The 0.4M nanostructured ZnO/MgO bilayer film showed an increment in dielectric constant, k (5.71) in comparison to 0.4M nano-MgO single layer film. Hence, 0.4M concentration was the optimized solution concentration utilized for both nano-MgO films and nanostructured ZnO/MgO bilayer films, for investigating the number of deposition layers of these films. For both films, 10 layers of MgO were found to give significant improvement in the surface properties. Most importantly, an enhancement in k value (9.70) for nanostructured ZnO/MgO bilayer film annealed at 475°C. This study has produced a novel metal-ferroelectric-insulator-metal (MFIM) capacitor configuration of ZnO/MgO/PVDF-TrFE by utilizing optimized nanostructured ZnO/MgO bilayer film as dielectric layer, with the integration of PVDF-TrFE as polymeric ferroelectric. With this novel MFIM capacitor configuration, a high electrical strength of polarization-field (P-E) hysteresis loop was obtained. In addition, the enhancement in k value (19.42) for ZnO/MgO/PVDF-TrFE film was caused by the increased in β-phase crystals in the film. This contributed to an improvement in the spontaneous polarization of ZnO/MgO/PVDF-TrFE film. Ultimately, the capacitance value obtained for ZnO/MgO/PVDF-TrFE film was significantly enhanced (35 pF) with the addition of PVDF-TrFE co-polymer film in the capacitor configuration.

36

Name : HASHIMAH BINTI ISMAIL

Title : MODELING AND CONTROL OF XY TABLE USING TRAJECTORY ADAPTIVE ZPETC

Supervisor : ASSOC. PROF. DR. RAMLI ADNAN **(MS)**
ASSOC. PROF. DR. MOHD HEZRI FAZALUL RAHIMAN **(CS)**

Trajectory tracking application is widely used in industry especially for manufacturing process. Control systems design for precise and high-speed trajectory tracking is challenging enough as the plant system model transfer function will be presented by non-minimum phase system. In this thesis, a new digital tracking control technique by utilizing feedforward adaptive ZPETC is proposed to solve the non-minimum phase problem. The proposed feedforward controller design was tested and applied on an XY table by simulation and real-time experiment. XY table is a flat surface mechanical system which facilitates horizontal motion in X and Y axes and normally used for machinery. Good controller design can provide precise trajectory motion of both axes and thus minimize the tracking and contour error of the XY table. The XY table plant discrete-time models were obtained from input-output experimental data using Matlab system identification toolbox. Sampling time 45 ms was used to get nonminimum phase discrete-time plant model and minimum phase system was obtained using 60 ms sampling time. Minimum phase system was also used to test the usability of the proposed control technique. In this study, adaptive feedforward ZPETC without factorization of zeroes was considered. Optimum values for gain compensation filter coefficients of adaptive ZPETC were obtained using Recursive Least Square (RLS) parameter estimation process. To widen the frequency bandwidth of adaptive ZPETC and improving the tracking performance at high frequency, model reference was introduced in this process. Adaptive ZPETC with model reference was tested by computer simulation and real-time experiment. High and low frequency reference inputs were used and the motion performances were then compared to Adaptive ZPETC without model reference, Error Filter ZPETC and Conventional ZPETC for benchmarking. The simulation results of the proposed controller using non-minimum phase system show better motion performance by almost 100% improvement compared to all benchmarking techniques for both high and low frequencies reference inputs. Real-time experiment also shows comparable results which achieved contour error for high reference input of 0.2016 mm whereas 3.6008 mm by using conventional ZPETC, 2.3003 mm for Error Filter ZPETC and adaptive ZPETC without model reference 0.2418 mm. Similar trend of results was obtained for minimum phase system. In conclusion, the proposed method can improve the tracking performance of non-minimum phase system and also can be applied to minimum phase system. This is proven by simulations and real-time experiments works.

37

Name : NOR AZWAN BIN MOHAMED KAMARI

Title : THE ASSESSMENT AND IMPROVEMENT OF ANGLE STABILITY CONDITION OF THE POWER SYSTEM USING PARTICLE SWARM OPTIMIZATION (PSO) TECHNIQUE

Supervisor : PROF. IR. DR. ISMAIL MUSIRIN **(MS)**
ASSOC. PROF. DR. MUHAMMAD MURTADHA OTHMAN **(CS)**

This thesis presents the assessment and improvement of stability domains for the angle stability condition of the power system using particle swarm optimization (PSO) technique. An efficient optimization method using PSO for synchronizing torque coefficients *Ks* and damping torque coefficients *Kd* to solve angle stability problems was developed and used to identify the angle stability condition on single and multi machine system. In order to accelerate the determination of angle stability, particle swarm optimization (PSO) is proposed to be implemented in this study. The application of the proposed algorithm has been justified as the most accurate with lower computation time as compared to other optimization techniques such as evolutionary programming (EP) and artificial immune system (AIS). Subsequently, a newly control technique named as proportional-integral-derivative (PID) incorporated with flexible AC transmission (FACTS) device is proposed in this study to improve the damping capability of the system. The minimum damping ratio *ξmin* was applied as an indicator to precisely determine the angle stability condition based on PSO technique. The proposed optimization technique was compared with respect to EP and AIS. On the other hand, the installation of static var compensator (SVC) as the compensating device has been compared with respect to power system stabilizer (PSS) with lead-lag (LL) controller. PSS with LL controller (PSS-LL) system has been chosen due to well used by researchers of power system around the world and it can be selected as a benchmark model for research purposes. The study was implemented on single machine with infinite bus (SMIB) system. Results showed that the implementation of SVC as a compensating device managed to improve the angle stability condition. The application of SVC-PID was then extended with multi objective (MO) optimization process. The proposed approach was a combination of *ξmin* and maximum damping factor σmax as MO indicator in order to improve the damping capability of the system. The most suitable ratio of *ξmin* and *σmax* was investigated and applied into PSO based search algorithm. It was found that the proposed SVC-PID algorithm with MO as the objective function has been able to produce a better result as compared to the techniques developed in the literature.

38

Name : NURHANI BINTI KASUAN

Title : MODELING AND CONTROL OF STEAM DISTILLATION IN ESSENTIAL OIL EXTRACTION SYSTEM USING FUZZY MODEL REFERENCE LEARNING CONTROL (FMRLC)

Supervisor : PROF. DR. HJ. MOHD NASIR TAIB **(MS)**
ASSOC. PROF. DR. MOHD HEZRI FAZALUL RAHIMAN **(CS)**

Malaysia is one of developing countries endowed with abundant resources of raw materials which have to be exploited especially in terms of technological provision in order to sustain and enhance aromatic plants industries and utilization. The essential oil from plant materials contains fragile aromatic molecules that can easily be destroyed or modified by changes caused during the extraction process. Even a subtle difference in extraction process conditions can have a significant effect on oil quality. Temperature one of important parameters that mostly affect essential oil production. In the conventional steam distillation method, high temperatures and extended heat were exposed to botanical plants that can cause thermal degradation to the extracted oil. In this research, a pilot-scale steam distillation system with temperature monitoring and control module was proposed to maintain process temperature at desired response, to avoid waste of energy usage and inconsistency of oil production quality and quantity due to uncertainties. In this study, the range of controlled steam temperature was set between 80^{o}C to 90^{o}C with time constant of desired reference model at 220 seconds with no overshoot. The model of steam temperature has been derived using auto-regression exogenous (ARX) function. For controller module, a Fuzzy Model Reference Learning Controller (FMRLC) was designed and applied to regulate steam temperature based on desired model reference heating profiles. In the FMRLC, fuzzy controller and inverse fuzzy elements were constructed using 49 and 121 IF-THEN rules respectively. In the study, the controller parameters were tuned until the error analysis, RMSE and SSE values reached as low as possible. The study also investigates the robustness and tracking set-point capability of FMRLC compared with several control methods i.e. Model Reference Adaptive Controller (MRAC-Lyapunov and MRAC MIT-rule), Fuzzy-PID and PID. From the results, it was found that the proposed FMRLC provides the best performance compared to the other controllers. Moreover, the actuation effort of FMRLC was minimised as it achieved lowest SSC among other controllers. Lower SSC value reflects on lower energy usage of the actuator and the resultant of FMRLC controller output response may reduce wear on the heating element. Further assessment has been done on actual Kaffir lime peel to confirm the reliability of designed system on the quality and quantity of production oil. The evaluation of oil quality by GC and GCMS identification has shown that the extracted oil contained all major constituents' of Kaffir lime oil at 85^{o}C steam temperature and the variation of temperature conditions (i.e. from 80^{o}C to 90^{o}C) is evidently influenced the amount of essential oil production.

39

Name : ROSKHATIJAH RADZUAN

Title : COMPACT SINGLE-STAGE INPUT-POWERED BRIDGE RECTIFIER WITH BOOST SWITCH WITH HIGH OUTPUT POWER FOR ENERGY HARVESTING SYSTEM USING 0.18-MICRON CMOS TECHNOLOGY

Supervisor : DR. MOHD KHAIRUL MOHD SALLEH **(MS)**
MR. MUSTAFAR KAMAL HAMZAH **(CS)**
PROF. ENGR. DR. MOHAMAD RUSOP MAHMOOD **(CS)**

The demand on microwatt to milliwatts energy harvesting systems has been increasing recently with the increase of the needs for wireless self-powered device applications. With the small output voltage and the AC output from the micro harvesting generators, highly precise specifications, leading to challenging designs, optimizations and realizations of its every component are imposed. Rectifier, which is normally located right after the energy generator in the energy harvesting system, is required to be compact, with high efficiency to produce as high output power as possible. It is in this context that this thesis is focusing, where a new topology of CMOS bridge rectifier is proposed, offering advantages in terms of the compactness and high output power, which is suitable for wireless power devices applications. CMOS technology is seen as a straightforward solution for compactness as it offers possibility to reduce the full wave rectifier circuit size. The proposed rectifier circuit topology is designed such that the threshold voltage, which is a common source of voltage drop in the system, can be reduced, in order to maintain high output voltage. A boost switch is also integrated in the topology, to play the main role in the system voltage doubler, which is much simpler and requires lesser external connections as compared to other recent topologies. Powered by its input AC voltage, the overall circuit will be implemented using 0.18-micron CMOS process technology with low threshold voltage. The analysis of the MOS-based circuits is performed through numerous designs and simulations using simulation tools. Measurement and testing of the prototypes are carried out using DC-DC probes to validate the proposed idea and concept. While providing 1.272 V dc output voltage across a 2 kΩ resistive load from 1.0 V peak AC input voltage at 50 Hz, the proposed bridge rectifier with boost switch achieved the measured output power of 1.65 mW. The proposed rectifier topology implemented on the highly rated CMOS technology is proven to offer compact and efficient solutions to further enhance the energy-harvesting domain of technology. With the overall active surface area of 0.024 mm2 and with only six external connections, the proposed rectifier design is found to be more compact than other reported rectifiers to date.

40

Name : SINAN GHASSAN ABID ALI AL-NASIR

Title : DESIGN AND DEVELOPMENT OF THE NETWORK INTERFACE, PACKETS SCHEDULING AND INTERFERENCE MITIGATION SCHEMES FOR LTE-BASED FEMTOCELL NETWORKS

Supervisor : PROF. DR. MOHD DANI BABA **(MS)**
ASSOC. PROF. DR. HJ. MOHD ASRI HJ. MANSOR **(CS)**

Cellular networks face numerous challenges in providing services for indoor users.Therefore, femtocells are suggested as a solution to indoor coverage issues that macro cells have failed to address to date in cellular networks such as Global System for Mobile Communication (GSM), Universal Mobile Telecommunications System (UMTS), and Long Term Evolution (LTE). Although femtocells can provide various benefits for both operators and users, many technical challenges must be resolved for effective femtocell deployment in real environments. In this thesis, the network interface, the packet scheduling and the interference management challenges are investigated in order to address these issues with proper solutions. The network interface challenge is related to the integration of the femtocell in a cellular network such as LTE. The proposed solution is to deploy an IP Multimedia Subsystem (IMS) as an integration platform between the femtocell and the LTE cellular network. Thus, an IMS module has been implemented for signalling in a LTE-based femtocell network that contains both registration and invitation procedures. Based on this study, it has been observed that the integration of an IMS in a LTE based femtocell network can improve the network performance since the Packet Loss Ratio (PLR) can be minimised. For the packet scheduling challenge, the authors propose a resource block preserver (RBP) scheduling algorithm in the downlink of the LTE based femtocell network. The RBP algorithm has two layers, upper and lower. The upper layer of the RBP exploits the LTE frame concept that contains a number of sub-frames, whereas the lower layer of the RBP algorithm adopts the concept of a Proportional Fair (PF) algorithm to schedule the non-real time (NRT) flows, while an Exponential/Earliest Deadline (Exp/ED) algorithm is applied for the real time (RT) flows. The proposed RBP scheduling algorithm outperforms the well-known scheduling algorithms in terms of a lower PLR among users in the LTE based femtocell network. Finally, a self-organising power control mechanism is proposed as an interference mitigation scheme for the LTE femtocell network. The notion is based on adjusting the transmission power of the femtocell based on the interference power received at the femtocell downlink in order to reduce the interference between adjacent femtocells. The power adjustment is controlled centred on relevant factors such as the number of femtocells and the distance between the femtocells and the subscribers. Through this study, it has been found that by utilising the proposed interference mitigation scheme, the interference between neighbouring femtocells can be reduced and a desirable QoS for subscribers can be provided when performing RT services.

FACULTY OF MECHANICAL ENGINEERING

41

Name : AMIRUL BIN ABD RASHID

Title : NANOSTRUCTURED TUNGSTEN TRIOXIDE ON INTERDIGITATED MICRO-ELECTRO-MECHANICAL PLATFORM FOR ETHYLENE GAS SENSOR APPLICATIONS

Supervisor : ASSOC. PROF. DR. NOR HAYATI SAAD **(MS)**
DR. DANIEL BIEN CHIA SHENG **(CS)**

In this study, tungsten trioxide (WO_3) nanostructure material is integrated onto interdigitated (IDE) Micro-electro-mechanical (MEMS) platform to form a gas sensor targeting to detect ethylene gas. Traditionally, ethylene gas detection requires the sample of the gas to be collected and measured offline due to the complexity of the measurement system. Even though a newer detection technology which enables for in-situ detection has been developed, the size of the sensor is relatively bulky and very expensive hence it is not suitable for mass outdoor applications examples in the agriculture industry. Therefore, this research explores a different approach to detecting ethylene gas utilizing WO_3 nanostructure as the sensing element of the sensor. This n-type metal oxide family were recognized for its excellent in sensitivity, ruggedness, versatility and relatively low cost to fabricate compared to other gas sensing material technology. The early work in this research is focused on producing one-dimensional WO_3 nanostructure through hydrothermal method. Design of experiment (DOE) technique is used to identify the effect and relationship of the variables in producing WO_3 nanostructure morphology. Field Emission Scanning Electron Microscopy (FESEM) reveals one dimensional, two dimensional and three-dimensional nanostructures have been produced by this facile process. Since the response of the gas sensor is highly dependent on the surface area, the analysis of DOE was focused on defining parameters that will produce one-dimensional nanostructure because it will give the biggest surface to volume ratio compared to the other structures. This type of morphology is also suitable to create the electrical interconnection in between the IDE electrodes to functionalist the sensor. To fabricate the sensor, the synthesized WO3 nanostructures were deposited on IDE platform to create the conduction network between the electrodes. Three deposition approaches have been explored namely in situ growth, drop cast and spin coating process. A dedicated test rig system is employed to perform the functionality testing for the sensor. The changes of sensor resistance value upon exposed to a certain concentration of ethylene gas at room temperature were then recorded to determine sensor performance. It was concluded that the density and the morphology variations of nanostructure network play a major role in sensitivity, response and recovery time of the sensor. The best sensitivity calculated based on the resistance ratio before and after the sensor exposed to ethylene gas was 1.23 at 20 ppm obtained from sensor fabricated by spin coat fabricated sensor. At the same ethylene concentration value, the sensitivity for drop cast and in situ fabrication process are much lower at 1.05 and 1.04 respectively. In terms of response behaviour, spin coat sensor exhibits fastest response and recovery (7 minutes and 13 minutes) as compared to spin coat process (14 minutes and 28 minutes) and in situ process (10 minutes and 16 minutes). This study contributes the knowledge of controlled hydrothermally synthesis of WO_3 and at the same time proves that the fabricated NANO/MEMS sensor platform are able to detect ethylene gas. This finding is significant in developing ultra-sensitive, small in size and requires low power consumption ethylene gas sensor, especially for precision agricultural applications.

42

Name : SITI KHADIJAH BINTI ALIAS

Title : EFFECT OF SURFACE ATTRITION ON THE MICROSTRUCTURE AND WEAR PROPERTIES OF BORONIZED GRADE 304 STAINLESS STEEL

Supervisor : IR. DR. BULAN ABDULLAH **(MS)**
DR. MAHESH KUMAR TALARI **(CS)**
PROF. IR. DR. HJ. AHMED JAFFAR **(CS)**

Grade 304 stainless steel has an excellent strength to weight ratio and high corrosion resistance; unfortunately it possesses very poor wear resistance. The structure of this type of stainless steel is austenitic and cannot be heat treated. This study focused on the effect of surface attrition using the shot blasting method on the surface of boronized grade 304 stainless steel. Boronizing was conducted at temperatures of 850˚C and 950˚C under two types of mediums which were powder and paste for the duration of 8 hours holding time. Boronized samples with thicker boride layer and superior wear properties were thus selected to undergo surface attrition using shot blasting method. The microstructure analysis and boride layer thickness were observed using optical microscopy, scanning electron microscopy (SEM) analyzer and energy dispersive X-Ray (EDX) spectrometry. Other tests such as pin on disc, erosion, microhardness, surface roughness and density were also conducted. Application of surface attrition on the surface of Pa-SB850 sample resulted in the formation of thicker boride layer with the thickness of 120 µm, an improvement of almost three times as compared to Pa-B850 sample with thickness of 43 µm. The microhardness result indicated the enhancement of approximately six times to the value of 1800 Hv compared to as received grade 304 stainless steel samples with the value of 261 Hv. The wear resistance of Pa-SB850 sample improved more than twice in term of COF value of 0.353 as compared to the SS sample with the COF value of 0.856. The erosion wear of Pa-B850 also improved two times compared to Pa-B850 sample with weight loss of 0.0512 g and 0.0911 g respectively at 16 hours erosion time. The implementation of surface attrition treatment resulted in grain refinements that allowed deeper boride layer to be diffuse into the surface of as received grade 304 stainless steel. The developed method makes it possible to implement boronizing in stainless steel which leads to improvement of properties such as hardness and wear resistance.

43

Name : AZNIFA MAHYAM ZAHARUDIN

Title : OPTIMIZATION AND TRIBOLOGICAL PROPERTIES OF SEMI METALLIC FRICTION MATERIALS

Supervisor : PROF IR. DR. MOHAMAD NOR BERHAN **(MS)**
ASSOC. PROF. DR. TALIB RIA JAAFAR **(CS)**

The main goal of this work presented in this thesis was to study the tribological properties of newly formulated semi-metallic friction material under different manufacturing parameters, material constituents and friction test parameters. In the first category, the optimization of manufacturing parameters (molding pressure, molding temperature and molding time) for producing the friction materials using powder metallurgy technique were investigated. The optimum manufacturing parameters were determined using Taguchi method where coefficient of friction (COF) and thickness loss were selected as the quality target. These optimal parameters were 500 kN molding pressure, 150oC molding temperature, and 600 seconds molding time. The results revealed that high molding pressure and temperature do not compulsorily produce the best performance in tribological properties. It could be explained by degradation of the resin structure and the loss of binding properties. The investigation also found that adequate molding time was required for sufficient binding of the tested materials. It was also observed that molding pressure has the strongest effect on physical and tribological properties. High molding pressure may cause the binder to separate from the brake friction material, thus less binder to hold the powder particles in the matrix. In the second category, a study was performed to investigate the effect of phenolic resin, rubber, calcium carbonate and graphite on the tribological properties. The samples were prepared under optimum manufacturing parameters. Samples with 15 wt.% of phenolic resin, 3 wt.% of graphite, 2 wt.% of rubber, 15 wt.% of calcium carbonate, 20 wt.% of steel fiber, 10 wt.% of ceramic fiber, 5wt.% of iron powder, 10 wt.% of copper chip, 8 wt.% of iron oxide, 8 wt.% of friction dust, 3 wt.% of magnesium oxide and 1 wt.% of barium sulphate were the optimum friction material formulation combination which shown the best tribological properties. Through this study, phenolic resin has the greatest influenced on the tribological properties of brake friction materials. Finally, the effect of applied loads and braking times on the tribological characteristics on indigenously formulated brake friction materials were also investigated using Chase dynamometer. Friction and wear tests were carried out under six different loads (445, 890, 1335, 1780, 2225 and 2670 N) and braking times (4, 8, 12, 16, 20 and 24 minutes) while the rotating velocity of the disc was kept constant at 500 rpm during the tests. The brake friction materials were examined for microstructural changes on worn surface using Scanning Electron Microscope (SEM). Generally, it was observed that COF decreases while wear volume increases with increasing of applied loads and braking times. The optimized friction material was observed to be suitable for temperature up to 250oC, load up to 1335 N and continuous braking time less than 20 minutes. An increase in wear volume was corresponding to the microstructural changes and the decomposition of organic materials. The severity of wear mechanism increases with an increasing of applied load and braking time. Test results show that the optimum selection of the manufacturing parameters and materials formulation have the most impact on the tribological and performance characteristics.

44

Name : MOHD ROZAIMAN BIN AZIZ

Title : HYDRODYNAMIC RAM BALLISTIC LIMIT ANALYSIS OF ALUMINIUM TANK

Supervisor : PROF. DR. IR. WAHYU KUNTJORO **(MS)**
DR. VALLIYAPPAN DAVID A/L NATARAJAN **(CS)**

This thesis presents the ballistic impact study for the non-filled and water-filled aluminium tank. This study combined the ballistic limit (BL) and hydrodynamic ram (HRAM) together. Previously, these two areas were not cross-field. Researchers in BL concentrated on determination of the minimum velocity to perforate a target. Common targets are single plate and double plates either in contact or has a space/air in between. There is less study by using double plates with water in between as the target. Meanwhile in HRAM study, many researchers are concentrated on pressure-time history. Less attention was given towards minimum velocity to perforate target. It is important to determine the BL in HRAM study, otherwise the target will not perforate. As a result, pressure-time history cannot be obtained. The main objective of this research is to investigate the BL in HRAM of an (water-filled) aluminium tank, experimentally and numerically (simulation). Meanwhile the specific objectives of this study are to determine the BL and carry-out HRAM investigation thru experiment associate with analytical model, to develop finite element model for BL and smoothed particle hydrodynamics (SPH) model for HRAM simulation and to validate the mode of failure and wall deformation obtained from simulation with experimental results. The tank was impacted with fragment simulating projectile (FSP) with velocities ranging from 239 m/s up to 972 m/s (experiment) and 2000 m/s (numerical simulation). The aluminium tank was 3 mm thick, 150 mm wide and 750 mm long. The ends of tank were closed with two Polymethyl Methacrylate (PMMA) windows, which were fixed to the tank with four steel bars. The test was conducted at the Science and Technology Research Institute for Defense (STRIDE) Batu Arang, Selangor. A commercial software, Hyperworks, was used to perform the numerical simulation. Smoothed Particle Hydrodynamics (SPH) was selected to couple with finite element analysis to simulate the experiment. The result from the experiment showed that the ballistic limit for the aluminium tank was 257.7 m/s. Good agreement was obtained with the numerical simulation. In HRAM, previous researchers obtained pressure-time history by using pressure transducer. So, data was obtained from different particles. In this study, for the numerical modeling approach, the pressure-time history was extended for a single particle. This is a new perspective of tracing pressure-data history since previous researchers focus on different particles. In addition, current study proposed a new value of coefficient _*a*‘ in the analytical model by Recht and Ipson. Less attention was given by other researchers towards value of coefficient _*a*‘ for target double plates with water in between. The coefficient _*a*’ of the Recht and Ipson equation proposed was 0.64. Other results that were discussed in details are the relationship of impact velocity with parameters such as residual velocity, wall deformation, velocity drop and energy, and terminal ballistic.

45

Name : INDAH BINTI MOHD AMIN

Title : MECHANISM OF ALOE EMODIN-INDUCED APOPTOSIS IN ER+-BREAST CANCER CELLS, MCF-7

Supervisor : ASSOC. PROF. DR. NARIMAH ABDUL HAMID HASANI **(MS)**
DR. SITI HAMIMAH SHEIKH ABDUL KADIR **(CS)**
DR. NIK MOHD MAZUAN NIK MOHD ROSDY **(CS)**

Aloe emodin, an anthraquinone exhibits higher cytotoxicity to hepatoma, prostate and cervical cancer cells through cell cycle arrest and apoptosis compared to normal cells. However, its underlying mechanism on ER+-breast cancer cell death remains unclear. Therefore, this study was done to investigate aloe emodin cytotoxicity and its mechanism on estrogen receptor (ER)-positive (MCF-7), ER-negative breast cancer cells (MDA-MB-231) and control breast cells (MCF-10A) in comparison with tamoxifen. Cytotoxicity was determined using WST-1 proliferation assay and Trypan blue exclusion test. Apoptosis mechanism was investigated using Annexin V-FITC/PI staining and DNA fragmentation assay. Both genes and proteins involved in the regulation of cell cycle (p53, p21, CDK1, CDK2, cyclin B1 and cyclin E1) and apoptosis (Fas, FADD, Caspase-3, Caspase-8, Caspase-9, Bax, Bcl-2, and Cytochrome c) in aloe emodin-treated MCF-7 were determined using Quantigene 2.0 Plex and protein ELISA assays respectively. Maximum treatment time was set up to 72 hours in all assays. Aloe emodin inhibited the proliferation of MCF-7 with IC_{50} of 80µM. No IC_{50} value was obtained on MDA-MB-231 and MCF-10A, even up to 150µM. In contrast, tamoxifen was non-selective to all cells with IC_{50} of 27µM, 19µM and 42µM, respectively. IC_{50} values obtained were used in all the other assays. Results from Trypan blue exclusion test were in concordance with the proliferation assay. Study on Annexin/PI staining showed the presence of early and late apoptosis (18.42% ± 3.53 to 29.25% ± 0.55; $p<0.05$, n=3 and 28.45% ± 2.36 to 30.22% ± 0.56; $p>0.05$, n=3, respectively) in aloe emodin and tamoxifen-treated MCF-7 cells. Accordingly, DNA fragmentation was observed. Aloe emodin and tamoxifen enhanced MCF-7 cytotoxicity through apoptosis. In cell cycle signalling, aloe emodin upregulated the expression of p53 and p21 proteins; while downregulating CDK1. Only CDK1 protein is in accordance with gene expression. In intrinsic apoptosis signalling, Bax, Cytochrome c and Caspase-9 proteins were upregulated; while no change observed in Bcl-2 protein. Except for Caspase-9, these results are in accordance with gene expression. In extrinsic apoptosis, Fas and Caspase-8 were upregulated, contrary to gene expressions. These findings indicate that aloe emodin cytotoxic action on MCF-7 cells is through G2/M arrest; both extrinsic and intrinsic apoptosis pathways. Its actions on G2/M phase arrest and activation of intrinsic apoptosis pathways were p53-dependent, while extrinsic apoptosis was p53-independent. Data obtained suggests (i) aloe emodin has potential as a selective apoptotic inducer in ER+-breast cancer management and (ii) and the present study could be used as a basic rationale for *in vivo* experiment setting.

46

Name : NIK NASIHAH BINTI NIK RAMLI

Title : THE NEUROPROTECTIVE MECHANISM OF DREAM VIA ERAD PATHWAY IN DYHYDROXYPHENYLGLYCINE PRECONDITIONED ACUTE ISCHEMIC STROKE RATS

Supervisor : DR. ROSFAIIZAH SIRAN **(MS)**
DR. ANDREAN HUSIN **(CS)**
ASSOC. PROF. DR. ZAINI MOHD ZAIN **(CS)**
MRS. NOR ZALINA ISMAIL **(CS)**

Neuroprotective strategies are required to complement the available medical treatments in order to enhance the brain endogenous protective mechanisms and cushion the effect of stroke injury. Pharmacological preconditioning is an avenue of preventative medication anticipated to be highly effective in protecting and reducing the ischemic induced neuronal damage. Recently, *in vitro* preconditioning studies have shown that prior activation of group I metabotropic receptor (mGluR) with its specific agonist (S)-3,5-dihydroxyphenylglycine ((S)-3,5-DHPG) elicits neuroprotection against excitotoxicity. Furthermore, the activation of group I mGluR regulates the expression of DREAM. DREAM protein regulates transcription of various genes including *edem1* which is a component protein of ER-associated degradation pathway (ERAD). This study elucidates the neuroprotective effect of group I mGluR agonist preconditioning, (S)-3,5-DHPG via DREAM and ERAD in acute ischemic stroke rats. One, 10 or 100 µM (S)-3,5-DHPG was administered intrathecally to 6 adult male Sprague Dawley rats 2 hours prior to the middle cerebral artery occlusion. After 24 hours, the modified neurological severity score (mNSS) and grid walking test were assessed. The rats were sacrificed and the infarct brain volumes were estimated by 2,3,5-triphenyltetrazolium chloride staining. The serum level of neuron-specific enolase (NSE) and brain tissue level of Bip/GRP78 ER stress marker were assessed by ELISA assays. The ischemic penumbra tissue surrounding the ischemic core infarct was dissected and the cytoplasmic and nuclear proteins as well as the total RNA were extracted. The protein levels of nuclear and cytoplasmic DREAM, as well as EDEM1, SEC61α and VCP were analysed by Western blot. The expression of *dream* and *edem1* genes were analysed by qRT-PCR. Finally, the level of protein degradation activity in the ischemic penumbra tissue was determined by the 20S proteasomal assay. One or 10 µM of (S)-3,5-DHPG preconditioning in stroke rats has significantly improved the neurological functions and reduced the brain infarction as well as the NSE level. The DREAM protein has significantly increased in the nuclear compartment after 2 hours of 1 µM (S)-3,5-DHPG administration and in the cytoplasmic compartment after 24 hours of 100 µM (S)-3,5- DHPG administration. Similarly, 1 µM (S)-3,5-DHPG preconditioning has significantly reduced the levels of Bip/GRP78 ER stress marker, DREAM and ERAD proteins as well as proteasomal degradation activity after 24 hours of an ischemic stroke. The expression of *dream* and *edem1* gene were decreased in 1 µM (S)-3,5-DHPG preconditioning compared to non-preconditioning ischemic stroke rats. In conclusion, the 1 and 10 µM of (S)-3,5-DHPG preconditioning enhanced the endogenous protective mechanism via promoting the nuclear DREAM protein to regulate the expression of EDEM1 and ERAD activities in order to alleviate subsequent ischemic injury in the brain whereas 100 µM of (S)-3,5-DHPG preconditioning exacerbated the ischemic injury.

47

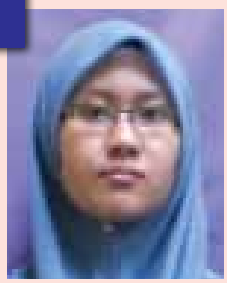
Name : NORHAFIZA BINTI RAZALI

Title : CELLULAR MECHANISMS OF ACTION OF RESVERATROL IN REGULATION OF AQUEOUS HUMOUR DYNAMICS

Supervisor : ASSOC. PROF. DR. RENU AGARWAL **(MS)**
ASSOC. PROF. DR. GABRIELE RUTH ANISAH FROEMMING **(CS)**
PROF. DR. NAFEEZA MOHD ISMAIL **(CS)**

Glaucoma, a common cause of optic neuropathy, is associated with elevated intraocular pressure (IOP) and is the leading cause of irreversible visual disability. Steroid-induced glaucoma, a common type of secondary glaucoma, is also associated with elevated IOP (steroid-induced ocular hypertension (SIOH)). SIOH and glaucoma are currently treated with antiglaucoma agents, which often have suboptimal efficacy and are associated with adverse effects. The objective of this study was to determine if topical application of *trans*-resveratrol reduces IOP in rats with SIOH and to investigate its mechanisms of action. This study was divided into *in vivo* and *in vitro* studies. In the *in vivo* study, we evaluated the oculohypotensive effects of topical *trans*-resveratrol in normal and SIOH rats and investigated the role of adenosine receptors (ARs) and transforming growth factor-β (TGF-β) signalling in the IOP lowering effect of *trans*-resveratrol. Involvement of AR was studied by observing the IOP changes in response to *trans*-resveratrol after pre-treating SIOH animals with AR subtype-specific antagonists. The study also investigated phospholipase C (PLC) activation, extracellular regulated kinase 1/2 (ERK1/2) phosphorylation and increased matrix metalloproteinases (MMPs) secretion in the aqueous humour (AH) as mechanism of resveratrol-induced oculohypotension in SIOH rats. *In vitro* studies evaluated the effect of *trans*-resveratrol on cellular signalling pathways of ARs and TGF-β in primary human trabecular meshwork cells (HTMCs). Single drop of all concentrations of *trans*-resveratrol produced significant oculohypotension in normotensive rats and 0.2% concentration produced maximum IOP reduction. Twice-daily topical application of *trans*-resveratrol 0.2% for 21-day in SIOH rats resulted in significant and sustained IOP reduction. This was associated with significantly higher AH MMP-2 level; significantly reduced trabecular meshwork (TM) thickness and increased number of TM cells. Treatment with *trans*-resveratrol also significantly increased the ganglion cell survival and reduced retinal oxidative stress. Pretreatment with adenosine A_1 receptor antagonist inhibited the oculohypotensive effect of resveratrol. The use of A_1 AR, PLC and ERK 1/2 inhibitors also reduced resveratrol-induced MMP-2 secretion. These results were further supported by *in vitro* study that demonstrated that ERK1/2, PLC and MMP-2 secretion by HTMC is stimulated after resveratrol treatment and these effects are associated with upregulation of A1AR gene expression. Topical *trans*-resveratrol also produced significantly raised plasminogen activator levels and combined TGF-β2+resveratrol treatment caused significant upregulation of inhibitory SMAD7 when compared to TGF-β2-only treated group. Hence, it could be concluded that *trans*-resveratrol-induced oculohypotension in SIOH rats involves its agonistic activity at the A_1AR leading to PLC activation, ERK 1/2 phosphorylation and increased MMP-2 secretion. Increased MMP-2 secretion seems to cause changes in TM favourable for AH outflow leading to reduced IOP. *Trans*-resveratrol-induced oculohypotension could also be attributed to increased level of plasminogen activators, which seems to result from increased expression of inhibitory SMAD7, a TGF-β2 signalling molecule. Although current study, for the first time, has clearly demonstrated the significant effects of topical *trans*-resveratrol on IOP in rats with SIOH and some of the underlying mechanisms; further investigations are needed to fully understand the mechanisms of action of *trans*-resveratrol and to explore its potential as a future antiglaucoma agent.

48



Name : NURUL ALIMAH BINTI ABDUL NASIR

Title : STUDIES TO ELUCIDATE MECHANISMS UNDERLYING THE ANTICATARACT EFFECT OF ANNATTO TOCOTRIENOL IN RATS

Supervisor : ASSOC. PROF DR. RENU AGARWAL **(MS)**
PROF. DR. NAFEEZA MOHD ISMAIL **(CS)**
ASSOC. PROF. DR. SUSHIL KUMAR A/L R VASUDEVAN **(CS)**
DR. SITI HAMIMAH SHEIKH ABDUL KADIR **(CS)**
PROF. DR. RENAD ALYAUTDIN **(CS)**

Cataract, the leading cause of blindness, is currently treated only by surgery. Cataract carries risk of complications and its management increases economic burden. Thus, development of pharmacological options with anticataract effects is important. Oxidative-nitrosative stress, non-enzymatic glycation and osmotic stress underlie cataractogenesis. Since tocotrienol possesses biological properties that may suppress pathophysiological mechanism of cataractogenesis, we investigated its anticataract effects in rats. Tocotrienol was formulated into two widely used colloidal drug delivery systems, microemulsion and liposome, due to its poor aqueous solubility. Firstly, the dose-dependent effects of microemulsion of tocotrienol on cataractogenesis were studied in galactose-fed rats to determine the most effective dose of tocotrienol. Different concentrations of tocotrienol were applied topically twice daily from three weeks prior to galactose diet and continued for four weeks along with galactose diet. Cataract progression was monitored and after euthanization, lenticular oxidative stress was measured. Subsequently, using the most effective dose, anticataract efficacy of microemulsion and liposomal formulation was compared in galactose-fed rats. Additionally, ocular tissue distribution of a lipophilic dye using these formulations was studied. For this distribution study, single drop of solution or formulation containing lipophilic dye was applied and animals were euthanized at different time points. Eyeglobes were dissected, cryosectioned, viewed under confocal microscope and analyzed. Lastly, mechanisms of anticataract effect of tocotrienol were studied in the rat model of streptozotocin-induced diabetes, which is a closer representation of human diabetic cataract. Using this model, the effects of tocotrienol on lenticular polyol pathway, oxidative and nitrosative stress, NFκB signaling pathway, ATP and ATPase content, calpain activity and proteins levels were studied. In dose-response study, 0.03 and 0.02% tocotrienol-treated groups showed slower cataract progression compared to vehicle-treated animals with reduction of lenticular oxidative stress. Faster cataract progression and higher oxidative stress were seen in rats treated with higher concentration of tocotrienol compared to vehicle-treated group. Both microemulsion and liposomal formulations showed similar anticataract efficacy. In ocular distribution study, better intraocular distribution was observed following single drop application of lipophilic dye in microemulsion compared to liposome and solution. In rats with streptozotocin-induced diabetes, tocotrienol delayed the progression of cataract and this anticataract effect was associated with reduction of lenticular oxidative-nitrosative stress, NFκB activation, iNOS expression, lens polyol levels, and restoration of the ATP and ATPase levels, calpain activity and lens protein levels. In conclusion, topically applied tocotrienol shows anticataract effects in rats by reducing oxidative-nitrosative stress and restoring the lens polyol levels, ATP and ATPase levels, calpain activity and lens protein levels.

49

Name : WAN HAFIZAH BINTI W. JUSOF

Title : RELATIONSHIP BETWEEN TIMING OF THE FIRST ZYGOTIC CLEAVAGE WITH CYTOSKELETAL STRUCTURES AND AMINO ACID METABOLIC PROFILES IN VITRIFIED MOUSE EMBRYOS

Supervisor : PROF. DR. NOR ASHIKIN MOHAMED NOOR KHAN **(MS)**
PROF. DR. MOHD HAMIM RAJIKIN **(CS)**
ASSOC. PROF. DR. NURALIZA ABDUL SATAR **(CS)**

Timing of the first zygotic cleavage has been used as a marker of embryo developmental competence and subsequent viability. Previous studies showed that embryos that cleaved early had higher developmental viability. However, the factors contributing to timing of the first zygotic cleavage are unknown. Energy production from mitochondria, nucleus and cytoskeletal organization might be some of the factors involved. Amino acid metabolic profiles might also relate with timing of the first zygotic cleavage as it has been reported to have significant relationships with embryo viability. Thus, the present study was designed to investigate the relationship between timing of the first zygotic cleavage, amino acid metabolic profiles, mitochondria, nucleus and cytoskeletal organization of mouse embryos with subsequent viability. Embryos were retrieved from superovulated ICR mice, 28 hours after hCG injection. At this point of time, 2-cell stage embryos were categorized as early-cleaving (EC), while zygotes with two pronuclei as late-cleaving (LC) embryos. Embryos were cultured overnight in M16 medium supplemented with 3% Bovine Serum Albumin (BSA) in a humidified carbon dioxide (CO_2) incubator. For Experiment 1, both EC and LC embryos were divided into control and treatment groups. For control group, 2-cell stage embryos were cultured until the blastocyst stage. For treatment group, embryos were vitrified by EFS40 or EFS20/40 method for 1 hour and warmed. The vitrified-warmed embryos were cultured until the blastocyst stage. The number of surviving embryos and their development to the blastocyst were observed and counted. For Experiment 2, 2-cell stage embryos were divided into control (non-vitrified) and treatment (vitrified) groups. Embryos in both control and treatment groups were fixed in 4% paraformaldehyde and immunostained to visualize the localization and intensities of mitochondria, actin, tubulin and nucleus. Finally, the embryos were mounted on slides and examined under a Confocal Laser Scanning Microscope. The structures intensity were analyzed by LAS-AF-Lite Software. For Experiment 3, EC and LC embryos were cultured individually in 4 µl drops of KSOM/AA medium supplemented with 3% BSA. The embryos were transferred every 24 hours to fresh 4 µl drops of KSOM/AA + 3% BSA until the blastocyst stage. The spent culture medium was analyzed by Ultra Performance Liquid Chromatography (UPLC) for amino acids metabolic profile. Results showed that nonvitrified and vitrified EC embryos had significantly higher developmental viability and higher cryosurvivability after vitrification by EFS40 and EFS20/40 method. Confocal analysis showed that non-vitrified and vitrified EC embryos had a significantly higher densities of mitochondria, actin and nuclear chromatin compared with non-vitrified and vitrified LC embryos, which appear to result in more efficient cell division, and therefore greater developmental competence. Amino acids metabolic profile showed that EC embryos had a significantly lower amino acids turnover compared to LC embryos in both Day-2 to Day-3 and Day-3 to Day-4 of cultures. These findings suggest that the higher developmental viability of EC embryos was significantly attributed by lower metabolic activity. In conclusion, timing of the first zygotic cleavage was associated with mitochondria, nucleus and cytoskeletal ultrastructure and amino acids metabolic profile that affect subsequent developmental viability and cryosurvival of embryos.

FACULTY OF PHARMACY

50

Name : ASIF NAWAZ

Title : MICROWAVE MODULATED TRANSDERMAL DRUG DELIVERY USING CHITOSAN NANOCARRIER

Supervisor : ASSOC. PROF. DR. WONG TIN WUI **(MS)**

The chitosan has been used as the primary excipient in transdermal particulate dosage form design. This study investigated the transdermal drug delivery profiles and mechanisms of chitosan nanoparticles and their cellular uptake mechanisms by melanoma cells as a function of nanoparticles attributes and pre-treatment effects of skin by microwave. Low molecular weight chitosan of smaller size, higher zeta potential and degree of deacetylation were obtained via microwave ligation of polymer chains at solution state. Low molecular weight chitosan nanoparticles, loaded with free or conjugated 5-fluorouracil, were prepared by nanospray-drying technique with tween 20 and span 20 as additives. Folate was covalently attached to the chitosan-carboxymethyl 5- fluorouracil conjugate when necessary and subjected to nanoparticulation process. The transdermal drug delivery profiles of chitosan-carboxymethyl 5-fluorouracil nanoparticles across the untreated and microwave-treated skins (2450 MHz 5 min, 5 + 5 min; 3985 MHz 5 min) were examined, against microstructural changes of skin. Both constituent materials of nanoparticles and drug encapsulation were required to succeed the transdermal drug delivery. The drug transport was mediated via nanoparticles carrying the drug across the skin and/or diffusion of the earlier released drug molecules from skin surfaces. The drug/nanoparticles transport was facilitated through constituent nanoparticles, chitosan-drug conjugation and microwave fluidizing both protein/lipid domains of epidermis and dermis (O-H, N-H, C-H, C-N) and dermal trans-to-gauche lipid conformational changes. The microwave induced marked changes to the skin ceramide content homogeneity, whereas the nanoparticles largely affected the palmitic acid and keratin domains. Subjecting the skin to pre-treatment by microwave, the transdermal transport of chitosan-carboxymethyl 5-fluorouracil-folate conjugate nanoparticles and their drug exhibited a similar profile as folate-free nanoparticles. *In vitro* melanoma cell culture experiments with endocytotic inhibitors suggested that the internalization of these nanoparticles was largely associated with lipid-raft mediated route. The internalization of nanoparticles increased with prior treatment of melanoma cells with microwave (2450 MHz, 5 + 5 min). It was found that microwave fluidized the lipid regime of the cell membrane and this resulted in increased internalization of the nanoparticles. Overall, combination of microwave and nanotechnology synergized transdermal drug delivery and intracellular trafficking of nanoparticles through preferential skin/cell membrane fluidization at various protein/lipid domains.

51

Name : KIFAYAT ULLAH SHAH

Title : LIQUID AND SPRAY-DRIED NANOEMULSION DESIGNS FOR PULMONARY DELIVERY OF RIFAMPICIN

Supervisor : ASSOC. PROF. DR. WONG TIN WUI **(MS)**
ASSOC. PROF. DR. CHAN LAI WAH **(CS)**

The study investigated the aerosolization and inhalation profiles of rifampicin-oleic acid first generation liquid and solid nanoemulsions and their respective chitosan- and chitosan-folate conjugate-decorated second and third generation nanoemulsions. The liquid nanoemulsions were prepared by spontaneous emulsification method and had their size, zeta potential, polydispersity index, morphology, pH, viscosity, surface tension, density, refractive index, drug content, drug release, aerosolization and inhalation profiles characterized. The first, second and third generation nanoemulsions had average droplet sizes of 43.89 ± 0.36 nm, 52.12 ± 0.36 nm and 59.69 ± 0.26 nm, with narrow polydispersity indices at 0.16 ± 0.03, 0.25 ± 0.03 and 0.23 ± 0.01 respectively. They exhibited desirable pH, surface tension, viscosity, refractive index, density, and viscosity attributes for pulmonary rifampicin administration. The second generation nanoemulsion was characterized by relatively low levels of burst drug release due to intimate chitosan packing at the oil globules' surfaces and viscosifying effect on continuous phase, which was unattainable by the branched folate conjugate of chitosan. All nanoemulsions demonstrated more than 95 % aerosol output and inhalation efficiency greater than 75 % when delivered by nebulization. The aerosol output, aerosolized and inhaled fine particle fractions were primarily governed by the size and surface tension of nanoemulsions in an inverse relationship. The first, second and third generation nanoemulsions were converted to their corresponding solid counterparts by spray drying method. The spray-dried solid first, second and third generation nanoemulsions achieved particle sizes of 7.05 ± 0.38 µm, 7.96 ± 0.33 and 5.45 ± 0.38 µm respectively, with sustained drug release behavior as compared to their associated nanoemulsions due to their large particle sizes and solid nature. The powder exhibited an aerosol output of > 65 % when delivered using Handihaler. The mass median aerodynamic diameters of < 5 µm was achieved for all spray-dried solid nanoemulsions, due to their lower tapped densities resulting in inhaled fraction of > 30 %. Among physicochemical properties of spray-dried nanoemulsions, increased circularity and lower tapped density have been found to improve aerosolization of powder from dry powder inhaler, while higher span value tends to improve the FPF. Due to significantly higher aerosolization potential and inhalation efficiency of liquid nanoemulsions, they were evaluated for their cellular internalization, safety and pharmacokinetics behaviors in cell culture and animal models. A significantly higher level of cellular internalization was observed with third generation nanoemulsion when compared to second generation liquid nanoemulsion due to double receptors targeting in the former via folate and acetylglucosamine moiety of chitosan. The liquid nanoemulsions were regarded as safe and biocompatible with reference to rifampicin in therapeutic doses, because macrophages remain viable (> 80 %) following their incubation with nanoemulsions. The pharmacokinetics analysis revealed that nanoemulsion succeed in maintaining therapeutic level of drug in the plasma for 16 h after intratracheal drug administration, with higher lung drug concentration in case of third generation nanoemulsion. Thus, both liquid and solid nanoemulsions are suitable for use as rifampicin carrier in the treatment of tuberculosis.

52

Name : NAUMAN RAHIM KHAN

Title : SKIN DELIVERY OF 5-FLUOROURACIL VIA ETHOSOMES USING MICROWAVE AS SKIN PERMEATION ENHANCEMENT TECHNIQUE

Supervisor : ASSOC. PROF. DR. WONG TIN WUI **(MS)**

This project focused on formulation and investigation of interplay effects of ethosomes, ethanol and microwave for enhanced skin drug retention with minimal systemic absorption. The microwave was used to modify the skin barrier properties to enhance ethosomes and/or drug penetration/and drug retention which is detrimental to treat local malignant melanoma and to enhance patient compliance. Ethosomes are known to fuse with skin to enable local drug retention. Pre-treatment of skin with microwave and applying liquified medicine is deemed to "cement" the skin thereby raising skin drug deposition. 5-fluorouracil loaded ethosomes were prepared and subjected physicochemical characterization. The molecular characteristics of untreated, microwave and/or ethosomes and/or ethanol-treated skins were examined by ATR-FTIR and raman spectroscopy, DSC and SEM techniques. The skin drug retention was promoted using larger ethosomes with negative zeta potentials that repelled anionic lipids of skin and hindered vesicle and/or anionic drug penetration into deep layers. Due to low ethanol, they were less able to fluidize the lipid and defluidize the protein domains at epidermis to enlarge aqueous pores for drug permeation. Pre-treatment of skin by 2450 MHz microwave for 2.5 min further increased skin drug penetration and retention of E5 ethosomes and provided lower drug permeation than cases treated for 1.15 min and 5 min. Pre-treating skin with microwave fluidized lipid and defluidized protein domains of skin that promoted transdermal drug penetration. A 2.5 min treatment however might be accompanied by specific dermal protein fluidization via C=O moiety which translated to macromolecular swelling, narrowing of intercellular spaces at lower skin layers, increased drug retention and reduced drug permeation. Ethosomes in combination with microwave at 2450 MHz for 2.5 min promoted significant drug deposition in skin from ethosomes *in vivo* with reduced systemic absorption. Pre-treatment of human melanoma cells with microwave exerted cytotoxic effect and also facilitated the intracellular ethosomes accumulation by fluidizing the cell membrane phospholipids reflected by a significant increase in wavenumber corresponding to symmetric phosphate moiety. The endocytosis was primarily promoted by lipid rafts pathway where a significant reduction in fluorescence intensity was observed when melanoma cells were pre-incubated with nystatin. Combined microwave and ethanol pretreatment of skin increased skin drug retention and decreased permeation of aqueous 5-fluorouracil solution. The combination fluidized the skin lipidic domains, defluidized the hydrophilic regimens causing an increase in aqueous pores population and their sizes. The summative effect translated into an increased drug penetration, permeation and retention of drug solution in the skin. When microwave pre-treatment was combined with 100 µl ethanol, rapid movement of ethanol from epidermis to dermis under the gravity bringing extracted epidermal lipids downwards and accumulating them in dermis in addition to fluidization of the extracellular proteins at C-N moieties. The expanded proteins structure and epidermal lipids accumulation in dermis promoted skin drug retention by narrowing the permeation pathways and formation of an additional lipid barrier consisting of ceramide and palmitic acid in dermis.

53

Name : MOHD SALLEH BIN ROFIEE

Title : *IN VIVO* HEPATOPROTECTIVE ACTIVITY OF *Muntingia calabura* LEAVES EXTRACT: A METABOLOMICS ANALYSIS

Supervisor : PROF. DR. TEH LAY KEK **(MS)**
DR. JOHN SHIA KWONG SIEW **(CS)**

Muntingia calabura (Muntingiaceae) is known as 'kerukup siam' or 'pokok buah ceri' locally. It has been used in Southeast Asia and tropical America as antipyretic, antiseptic, analgesic, antispasmodic and liver tonic. This study aims to determine the safety and the metabolic pathways involved in the hepatoprotective mechanism of *M. calabura*. Phytochemical analysis of the extract was carried out. The standardization of the extracts was done using LCMS Q-TOF. The standardized extract was subjected to acute and repeated doses of 28-day oral toxicity study. Three different *in-vivo* hepatotoxic models which are CCl_4-induced, PCM-induced and alcohol-induced were eveloped and a dose dependent hepatoprotective effect of *M. calabura* (100 mg/kg, 200 mg/kg and 400 mg/kg) was conducted. Body weight, food and water consumption were measured every day and rats were sacrificed to collect the serum samples at the end of the 10-days treatment for CCl_4 and PCM induced hepatotoxic rats while samples were collected at the end of 22-days for alcohol-induced hepatotoxic rats. Histopathological study of the liver slice was carried out to confirm the hepatoprotective activity of the extract. Liquid chromatography-mass spectrometry quadrapole time of flight (LC/MS-QTOF) combined with principal component analysis (PCA) were used to determine differentially expressed metabolites due to treatment with hepatoxicant and *M. calabura* extracts. Metabolomics Pathway Analysis (MetPA) was used for analysis and visualization of the pathways involved. This study shows that the body weight, food and water consumption were significantly decreased and histopathological study revealed liver damage in all *in-vivo* models of hepatotoxic rats. PCA score plots of the hepatotoxic rats clustered separately from the control, while groups given pre-treatment with the extract clustered closely with the control. This indicates that the metabolic profiles from the groups which were given pre-treatment with the extract were almost similar to those of the control. Several candidate biomarkers were identified and they were associated with perturbations of major pathways involve in inflammation. Interestingly, all the potential biomarkers were reversed to almost normal level in the group given pre-treatment with the extract. This study has successfully isolated major pathways involved in the hepatoprotective effects of MCME using LCMS Q-TOF metabolomics approach. Several biomarkers and their pathways in hepatoprotection have not been reported previously and may provide potential therapeutic targets and/or options for protection from chemical induced liver injury.

54

Name : MOHD SHAFIQ BIN AAZMI

Title : MODULATION OF GUT MICROBIOME BY PROBIOTICS IN OBESITY AND RELATED METABOLIC ABNORMALITIES

Supervisor : PROF. DR. TEH LAY KEK **(MS)**
PROF. DATO' DR. MOHD ZAKI SALLEH **(CS)**
PROF. DATIN DR. ZORIAH AZIZ **(CS)**

Accumulating evidence suggests that the aberrant taxonomic composition of gut microbiota is one of the etiological factor in the development of obesity. With the inherent plasticity of gut microbiota structure, it provides a new avenue for the application of biotherapeutics to modulate the shifted structure of microbiota in obesity. Lately, much attention has been focused on probiotic as a biotherapeutics candidate for obesity. In contrast, knowledge on the modulating effects of probiotic on the obese gut microbiota structure is still limited and should be evaluated. The present study aims to elucidate the inherent plasticity of gut microbiota and the dynamic response of the host metabolism during the induction of high-fat-diet-induced obesity and upon the amelioration of obesity by probiotics in obese rat models. Two probiotic candidates; (i) single strain *Lactobacillus casei* strain Shirota (LAB13) and (ii) probiotic cocktail LACTO-5™ (*L. rhamnosus, L. acidophilus, B. subtilis, B. longum* and *S. thermophilus*) were supplemented to the obese rats at doses of $1 \times 10_9$ CFU per/day/rat for 12 weeks. The probiotic treatment started after the induction of obesity using high fat diet (HFD, 60% fat). The heterogeneity of gut microbiota structure and its functional complement genes were profiled from the faecal samples of rats from each intervention group (n=3/group) using shotgun metagenomics sequencing. Phenotypically, the weight gain, energy intake, subcutaneous fat, total fat weights, total cholesterol, leptin, ratio of TC to HDL-c and leptin to adiponectin in obese rats were significantly reduced by the supplementation of both probiotics. These confirmed the anti-obesity, hypocholesterolemic and hypoleptinemia effects of both probiotics. The strain-specific salutary effect was noted in the reduction of TG and ratio of TG to HDL-c by LAB13. Both probiotics shifted the HFD-modulated gut microbiota towards the lean structure after the supplementation being given seven weeks after the induction of obesity. Comparative analysis revealed that the abundances of 68 bacterial genera were altered by HFD and probiotics. HFD uniquely modulated 21 genera, 17 of which were promoted and positively correlated with at least one of the obese phenotypes in obese control rats. Thus, these genera may be relevant to obesity. LAB13 modulated 32 genera, the enrichment of 16 genera of which were correlated positively with the ameliorated obese phenotypes. LACTO-5™ modulated five genera, of this, the enrichment of genus *Coxiella* was positively correlated with the ameliorated obese phenotypes. Out of this, three genera were also found reduced by LAB13. Theoccurrences of 13 out of 26 annotated functional categories were enriched in the HFD modulated gut microbiome; suggesting a relative higher metabolic capacity in the obese gut microbiome. Whereas both probiotic-modulated and STD-modulated gut microbiome had lower occurrences of several protein-coding genes for metabolism of carbohydrate, lipids, and nutrient transport; suggesting a relative lower energy harvesting capacity in comparison to the HFD microbiome. Metabolomics analysis showed increment in bile acid synthesis and reduction in glycerophospholipid and fatty acids metabolism after probiotic treatment. These had increased the lipid clearance in body which improved the obese phenotypes. Results from this study suggest the salutary effects of probiotic, in part, are mediated by the changes in the gut microbiota structure and its metabolic capacities in host metabolism particularly bile acid biosynthesis. This study proved the possible mechanistic links between gut microbial-host interactions and its role in obesity.

55

Name : ROSE ISZATI BINTI ISMET NAYAN

Title : WHOLE GENOME SEQUENCING AND ANALYSIS ON THE TRIOS OF THE CHE WONG AND SEMAI:UNDERSTANDING THE MEDICO-GENOMIC ASSOCIATION

Supervisor : PROF. DATO' DR. MOHD ZAKI SALLEH **(MS)**
PROF. DR. TEH LAY KEK **(CS)**

As to date, there is no report on the architecture of the whole genomes of the unique Orang Asli subtribes in Peninsular Malaysia. The Che Wong was selected as the group of interest as they have a dwindling population of 651, while the Semai Orang Asli with a population number of 51,313 was selected as the control group. The Semai is the largest sub-tribe of the Senoi which is also the largest group amongst the Orang Asli. This study aims to understand the variation in genomics composition of the Che Wong and Semai Orang Asli by a deep and systematic characterization of the genome through development of an in-house bioinformatics pipeline. The disease risk and protection conferred by genetic traits were explored via sequencing the whole genome of a trio family of both the Che Wong and Semai sub-tribes. The Che Wong and Semai genomes were sequenced and mapped to the human reference genome (hg19) with an average coverage of 44.1x and 43.0x, respectively. A total of ~6.23 million and ~6.18 million variants were identified for the Che Wong and Semai trios, respectively. An average of 448,166 and 436,520 of these variants were found to be unique to the Che Wong and Semai trios, respectively. An average of 1.6% of the total variants called for the Che Wong and Semai genomes were known to be evolutionary conserved. A closer relationship between the Che Wong and Semai with the Asian populations than the African, American and European peoples was also observed. There is a distinctive difference in health status between the Che Wong and Semai trio where the Semai are seen to be in a healthier state. Medico-genomic association also revealed more disease impact for the Che Wong trio as compared to the Semai trio genomes. A total of 93 and 106 *de novo* mutations (DNMs) were identified for the Che Wong and Semai trio respectively. These mutations were also studied for their medico-genomic association. We report here for the first time the catalogues of the genomic architectures of the Orang Asli, the Che Wong and Semai in precise along with their medico-genomic findings. These data provide new perspectives of the genomics background of the indigenous populations in South East Asia (SEA) which we believe would be useful for the scientific and health community.

FACULTY OF ART & DESIGN

56

Name : RUSMADIAH BIN ANWAR

Title : CHARACTERIZING A SYNTACTIC PATTERN OF FORMGIVING IN DESIGN THINKING PROCESS

Supervisor : ASSOC. PROF. DR. SHAHRIMAN ZAINAL ABIDIN **(MS)**
ASSOC. PROF. DR. ING. OSKAR HASDINOR HASSAN **(CS)**

Design in a creative way involves a high degree of enigmatic and mystery especially at the early stage of a project. On the whole, conventional industrial design investigation faced with numerous of dilemma especially on the design methodology. The unclear design approach practiced among the creative designers comes to the technical hitches to introduce a new product design. The challenge of current trends in design research and point out some of their activities, such as the gap between aesthetic and technical need, and the chasm between ambiguous and quantified in design practice. In line with the awareness of high-quality aesthetic appeal in industrial product development, therefore, exist a need to revamp this uncertainty design activity (form structuring) for more accurate and being understood during the decision-making in product synthesis. This need together with the enhanced understanding and ability to handle visual product form, necessitate structuring throughout the creative process. In order to deal with these problems, it is recommended to develop a research guideline on the observation setup procedure. These promises to improve the ecological validity over the empirical design research methodology include the possible sampling required. The main goal of the analyzes is to formulate a methodology for analyzing qualitative data in an objective way. The design practice was analyzed through empirical design studies to uncover the design thinking approaches and their standpoint on design solutions throughout formgiving process. The results also discussed the solution to both initial problems of design activities. Through the empirical framework of in-vitro design protocol, a descriptive model of the nature and workings of the ablution design as a subject is identified. The framework consists of two main control experiment phases; design protocol analysis, concerning the behaviour of designer during design episode; and meta-analysis, related to the characterizing stage of form syntactic related to the activity of organization and structure of visual product form. The result through circumstantial evidence from both approaches revealed that there is a consistency character that emerge the product perceptual experience during formgiving processes. The insight seeking and form element ordering during design episode has exposed the divergentconvergent of Ablution Function Mean Analysis thinking among designer generates a significant visual surface features of the form structure. Based on the meta-analysis results, the formgiving presentation confirmed the intuition conceptually presented a strategic plan of aesthetic influence through the conceptual and embodiment design.While the representation of syntactic pattern through Dual-Trace Explicit Implicit has aesthetically determined the existing of intuitive gestalt interplay during the creation of form structure. As the main contribution of this work is: (1) the creation of core empirical method relates to *research for design* as 'possible versus feasible' through explicit-implicit strategy; (2) conducted research relates to *research into design* as 'specific versus holistic' through the determination of talent, intuition and form syntactic; and (3) presented research relates *research through design* as 'global versus detailed' through the establishment of variables between design perceptual and behaviour.

57

Name : RUWAIDY BIN MAT RASUL

Title : THE CHALLENGES OF WHEELCHAIR PRESCRIPTION ASSESSMENT ON APPROPRIATENESS AND PRACTICAL DESIGN FOR MALAYSIAN USERS

Supervisor : ASSOC. PROF. DR. MOHAMAD HARIRI HJ. ABDULLAH **(MS)**

The wheelchair has become a main assistive tool for a person with mobility impairment in assisting them to perform daily life activities, and thus maintaining their quality of life. For this reason, the wheelchair was created in various types of design to fulfil the specific categories of mobility. Therefore with a good understanding of their nature mobility, the wheelchair is created to pursue something that reflects their needs. This will then affect the user's abilities and function. Without a correct wheelchair prescription, the users will suffer in term of ability functionality, physical deformities and overall, affect the user's quality of life. One of constrain faced by the wheelchair users, is the need to purchase their own wheelchair. Further to that, the unnecessarily expensive price for a wheelchair creates an additional budget constrain towards the wheelchair users. For this reason, the related government agencies and private organizations offered several schemes to the eligible applicants in obtaining a free wheelchair. However, most of the applicants and recipients didn't receive the exact materials as what was prescribed according to their needs and requirements, in the given schemes. Therefore this research tend to investigate further their needs, constrains, assessment process and satisfaction. As a result to that, the suggestion and recommendation will be proposed in tackling the issues raised. The quantitative approach is used in the first phase to reveal what are the real issues behind the wheelchair users. Following that, the generalizations of ideas can be made. In acquiring further in-depth information's, the qualitative approach has been used upon the selected participants, suing the interview protocol that provided a more detailed and specific data. On the other hand, to familiarize the social interactions towards the wheelchair users, observational study has been conducted. Thus, providing important information's towards social norms against the wheelchair users. As a result, the wheelchair assessment is vital in prescribing towards persons of mobility impairments in determining the suitable types of wheelchair. Moreover, their needs and requirement needs to be included within the prescriptions in relation to their physical ability and limitations. In addition to that, the proposed system in providing the wheelchair provision is faced with issues in the bureaucracy. With this, the wheelchair users would have to wait within 1 – 3 months for their expected wheelchair, which in the end affects the user's daily activities. Likewise to getting what the user's deserve, the wheelchair users are faced with another predicament, which is to accept the wheelchairs that doesn't fit the needs of the user; i.e., types of wheelchair, some parts / accessories may deferent in specifications or sizes. There is a need to reviews the procedure of wheelchair provisions as part of research conclusions. It is important to reduce the time frames to build a strong communications between prescribers, users, organisations and wheelchairs suppliers. As recommendations, a standardized assessment formats as a guideline has to be created in obtaining vital information's in prescribing prescriptions. Furthermore, a proper guideline (pocket books) for prescribers / users/ organizations provided with information's regarding types of impairments to co-relate with types / accessories of wheelchair in term of suitability and costs needed to be produced.

58

Name : WAN SAMIATI ANDRIANA BT W. MOHAMAD DAUD

Title : AN AXIOLOGICAL STUDY ON ISLAMIC VISUAL ART IN MALAYSIA FROM 1957 TO 1999

Supervisor : PROF. DR. DZUL HAIMI MD ZAIN **(MS)**
ASSOC. PROF. DR. ARBA'IYAH AB AZIZ **(CS)**

The Islamic values were determined from Allah SWT through the Al-Quran and the guidance of the Prophet Muhammad SAW. The aims of this study were to determine the axiological aspect of the Contemporary Malaysian Islamic Visual Art, to explore the historical events and the development of the Malaysian Islamic Art from the year of 1957 to 1999, and to provide a comprehensive document on the history of the Contemporary Malaysian Islamic Visual Art based on history, tradition and culture of Islam. This research was conducted by using mixed methods of qualitative and quantitative research method. The quantitative research utilized questionnaire to solicit the data . The information gathered through data collection inclusive of three major issues, the concept, the national policies and the events or exhibitions gathered from various sources, including academic books, journal, proceedings as well as exhibition catalogues cum books of painting, retrospectives, biographies, competition booklets and website. The important events on Islamic art were also gathered through the articles presented at seminars and symposiums as well as newspaper cuttings and magazines. The study also analysed ninety five (95) pieces of artworks consist of artwork from painting, printmaking, sculpture and mix media such as collages, assemblages, digital print, fabric works and two-dimensional construction that were exhibited in Islamic Art exhibitions held in Malaysia from the years 1957 to 1999 and were selected from those created by the Muslim artists with the Islamic Art themes only. As for the survey, 407 questionnaires were distributed to the UiTM communities through out Malaysia focusing on the view and exposure of Islamic Art, the understanding of the axiology philosophy, the awareness of visual art and the artist artwork. The soliciting process has enabled the researcher to record and organize all important details of each selected sample of artworks, including the name of the artist, the venue of the exhibition, and the date according to the Islamic theme exhibition. Other details of the sample artworks also have been put into consideration and recorded accordingly, such as the artwork's title, dimension or size of the artwork, media and techniques used in producing the artwork. The researcher followed the integrative approach and applied the technique of the descriptive quantitative approach and report the summary database on the percentage, to describe, explain and validate the findings. In the assessment of the awareness of the respondents pertaining to visual art, finding reveals that the majority of the respondents has taken art education before were aware of visual art because they have been to an art exhibition and like any exhibited artwork. However, most of the respondents have never heard about the National Cultural Congress (1971). The finding also shows that most Malaysian have never heard of the term 'axiological study' before and does not know about the development of Islamic Art in Malaysia. 71% the respondents believed that the image of the pictures produced by the artists was not an Islamic art and only 29% believed they were Islamic art. This is a clear indication that the Malaysian are lacking in the knowledge pertaining to the Islamic visual art. Hence, it is recommended that further research should review the axiological aspects of visual art in Malaysia and Southeast Asia. The studies on Islamic art and its spiritual message in Malaysian visual art should also be conducted.

FACULTY OF ADMINISTRATIVE SCIENCE & POLICY STUDIES

59

Name : MUHAMMAD AFIF B. ABDUL GHAFAR

Title : THE RELATIONSHIP BETWEEN EMPLOYEE INVOLVEMENT, PSYCHOLOGICAL EMPOWERMENT, AND ATTITUDE TOWARDS ORGANIZATIONAL CHANGE IN MALAYSIAN GOVERNMENT-LINKED COMPANIES (GLCs)

Supervisor : ASSOC. PROF. DR. JASMINE AHMAD **(MS)**
DR. NORZIANA LOKMAN **(CS)**

This research examined how employees in Malaysian GLCs perceived employee involvement, as well as their attitude towards organizational change. In addition, the relationship between employee involvement, psychological empowerment, and attitude towards organizational change was also examined. A mediation model was derived to further test whether psychological empowerment mediated the relationship between employee involvement and attitude towards organizational change. A convenience sample of employees was attained from seven Malaysian GLCs located across the Klang Valley. These GLCs were involved in a diverse range of industries which includes banking, telecommunication, utility, construction, plantation and automotive. A survey questionnaire which consisted of a (1) demographic profile, (2) Power, Information Sharing, Performance-Based Rewards, and Training Scale (PISPT), (3) Psychological Empowerment (PE) Scale, and (4) Attitude towards Change (ATC) Scale, was used to collect data. With a usable sample size of 313, it was found through descriptive statistics that overall, the employees in Malaysian GLCs had a positive perception of employee involvement and also attitude towards organizational change. Through inferential statistics in the form of correlation, regression, and bootstrapping method, the empirical results provided strong support for the positive relationship between employee involvement, psychological empowerment, and attitude towards organizational change. The results also supported the mediating role of psychological empowerment in the relationship between employee involvement and attitude towards organizational change. It is suggested that future research further test the conceptual framework utilized in the current study by utilizing longitudinal data to analyze the variables over a period of time, specifically, before and after the implementation of a specific organizational change initiative. Furthermore, organizational researcher could perhaps obtain qualitative data as a means to provide a deeper insight on the phenomena. Lastly, future study could opt to study specific attitude towards organizational, as opposed to a general attitude towards organizational change which the current study has focused on. The current study contributes to not only the literature, but also to the improvement of policy and practices to drive performance in Malaysian GLCs. From a theoretical standpoint, this research has provided empirical support on the mediating role of psychological empowerment, specifically between the relationship of employee involvement and attitude towards organizational change. In terms of attitude theory, this study has provided support on the uni-dimensional model of attitude towards organizational change. Also, this study further extends the validity of Kanter's structural empowerment theory, as well as Lawler's employee involvement model in a non-western context.

FACULTY OF EDUCATION

60

Name : RUBIAH BINTI DALAIL

Title : THE IMPLEMENTATION OF STANDARD-BASED PERFORMANCE ASSESSMENTS IN MALAYSIAN PRIMARY SCHOOLS

Supervisor : PROF. DR. CHAN YUEN FOOK **(MS)**
PROF. DR. GURNAM KAUR SIDHU **(CS)**

Today's 21st century learning has witnessed a global shift in assessment which has observed a move from assessment of learning to assessment for learning in schools. Henceforth, beginning 2011, the Ministry of Education (MOE), Malaysia implemented the standard referenced educational system that witnessed the integration of formative assessment into teaching and learning practices. However, the implementation has been inhibited by problems such as misconceptions on the intention of the transformed policy, readjustment to teaching and learning approaches, alteration to assessment approaches, adopting a new reporting format and issues surrounding the validity and reliability of scorings and monitoring aspects. Moreover, research has further indicated that integrating assessment tasks into daily teaching and learning activities has been a challenge. Since, there is scant empirical evidence of significant studies conducted in Malaysia, this study aimed to investigate the implementation of standard-based performance assessment in Malaysian primary schools. Specifically, the study sought to examine teachers' knowledge of standard-based performance assessment, their practises and challenges they faced in implementing standard-based performance assessment. Finally, the study also explored strategies to overcome these challenges. The study involved a total of 2 headmasters, 291 teachers and 530 students from two Grade A national primary schools from the state of Selangor in Malaysia. The respondents were selected based on a mixed random sampling technique. Data was collected through the use of measures such as survey, tests, students' performance reports and interviews. The findings displayed that teachers knowledge was at the beginner level and they were confused between obsolete and current knowledge. Teachers' practices in formative assessment were at the mediocre level and they lacked the connection necessary to conduct effective standard-based performance assessment. Teachers admitted they spend only half of their time practicing the needs of assessing students. The Cohen's kappa statistical test indicated that teachers' scoring in formative environment was subjected to low reliability. The result of inter-rater scoring agreement indicated that most of the teachers overestimated their students' performance level. In essence, the findings of the study show that teachers across demographic variable were approximately undecided to define the problems they faced as challenges. Most of their problems were dominated by their belief factor. Consequently, there were many limitations on strategies undertaken by teachers and headmasters as it was confined to tasks assigned by the authority namely district and state educational offices. The findings of this study imply that better professional development and training need to be provided so that teachers can effectively adopt and implement quality standard-based performance assessment system into their 21st century classrooms.

FACULTY OF LAW

61

Name : ANI MUNIRAH BINTI MOHAMAD

Title : THE IMPLICATIONS OF ICT ADOPTION IN THE MALAYSIAN CIVIL COURTS: WITH SPECIAL REFERENCE TO THE LEGAL POSITION IN ENGLAND AND WALES

Supervisor : ASSOC. PROF. DR. ZAITON HAMIN **(MS)**
DR. MOHD BAHRIN OTHMAN **(CS)**

The ICT adoption in the Malaysian courts has been problematic and raises several implications, involving both legal and non-legal ones, such as technical, organisational and social. Previous research in Malaysia had not addressed the said implications. Within this context, the central arguments of this research are two-folds: firstly, the implementation of ICT in the Malaysian courts has impacted not only on the users and courts but also raises a variety of legal, technical, organisational and social implications. Secondly, the lack of legal sanctions to most of the existing ICT applications in the Malaysian courts suggests that law will eventually lag far behind technology and will remain so in the near future. Guided by this thesis, this study aims at examining the implications of ICT adoption in the Malaysian courts on the users and the courts; the implications of the ICT adoption on the laws in Malaysia as compared to that in England and Wales; the theories of unified acceptance and use of technology and risks perception in informing the research; and to propose for the strengthening and improving the delivery of the justice system in the Malaysian civil courts through ICT adoption. Adopting a qualitative research, this study engaged both the primary data obtained from five case studies and the secondary data obtained using the doctrinal approach. The evidence from the research is extensively reported in Chapter Five. The doctrinal analysis of the legal implications of the adoption of ICT in the courts in the United Kingdom as well as Malaysia is presented in Chapters Three and Four respectively. The research found that there are various implications of ICT adoption in the Malaysian courts, as well as the courts in England and Wales, involving both legal and non-legal implications. The research further found that the theories of UTAUT and risks perception have rightly mediated the understanding of the researcher of the benefits and risks involved in the adoption of ICT at the courts. And finally, the research also found that the existing laws in Malaysia involving the Rules of Court 2012 and the Criminal Procedure Code would need to be reviewed on the rules encouraging ICT, electronic legal service of court documents, electronic filing by e-mail, court recording, audio and video conference and proper handling of digital signatures. This study will not only contribute to the understanding of the relevant laws surrounding the ICT adoption in the courts but also, to assist the Malaysian judiciary and the Malaysian Bar Council in dealing with the risks entailing such ICT adoption. Future research is suggested to be carried out using a quantitative approach to quantify such implications, the implication of ICT at other public offices such as the prison, and a comparative study to be carried out with other jurisdictions such as Australia, United States and Singapore.

FACULTY OF COMMUNICATION & MEDIA STUDIES

62

Name : MOHD SHAHNAWI BIN MUHMAD PIRUS

Title : THE INVOLVEMENT OF MALE HOMOSEXUALS WITH MAINSTREAM NEWSPAPERS' REPORTING OF HOMOSEXUALITY

Supervisor : ASSOC. PROF. DR. ILIAS MD SALLEH **(MS)**
PROF. DR. MOKHTAR MUHAMMAD **(CS)**

The contributory factors to male homosexuals' (MH) involvement with mainstream newspapers reporting of homosexuality was observed on news content representation including the reporting criterion and its consistency to be reported to the audiences, triggering the public interest in receiving information and advocating themselves towards a guided living culture. This study was guided with two theories; (i) Uses and Gratifications Theory, and (ii) Social Judgment Theory following a series of content analysis on newspapers reporting of homosexuality that was conducted to understand how it was presented. Using a qualitative approach with phenomenology and popular culture paradigms, informants of male homosexuals from the non-governmental organization were selected randomly through the purposive and judgmental sampling strategies. All data were collected from in-depth interviews and content analysis procedures and analyzed by using thematic analysis and constant comparison strategy. It was disclosed such news reporting became a platform for the male homosexuals to be alert with current updates pertaining to homosexuality issues that established involvement. The inclination in getting involved among male homosexuals' readers with news reporting of homosexuality was also factored by the message conveyance on content delivery, news themes and overall reporting that strongly associated with the public awareness on issues of safe sex messages and crimes. In overall, this study had managed to observe on the role of mainstream mass media in Malaysia as a platform in disseminating the government agenda including to understand the possible factor that generated MH involvement as active audience affecting on their attitude and behavioral change induced by ego involvement.

63

Name : SOMIA ABDUL-SAME'E ANAM

Title : PORTRAYALS OF THE ARAB SPRING IN THE ELECTRONIC MEDIA NEWS AND THE IMAGE OF ARABS AMONG MALAYSIAN ACADEMICIANS

Supervisor : PROF. DR. MOKHTAR MUHAMMAD **(MS)**
DR. MOHAMMAD YAACOB **(CS)**

This study is a media effects research and it is an attempt to examine the type of Arab image, level of Arab Spring awareness among Malaysian academicians, attitude toward Arabs, perception on new status of the Arabs and the news sources that Malaysian academicians depended on to gain news and information about the Arab World. Specifically, the research objectives are to validate and proposes measurement models, validate and propose a full structural model of news exposure influence in the construction of the image of Arab and estimates the influence of attitude and awareness of Arab Spring as mediator factors, as well as to examine the moderation effect of the variables. This study employs correlational survey as the methodology of study. A total of 300 Malaysian academicians from five public universities located in Klang valley were selected as the sample. For data analysis, the study employs Structural Equation Modelling (SEM) method using AMOS statistical software to analyze the direct and indirect influence of moderator and mediator variables in the relationship between variables and employs SPSS software to analyze the descriptive part of the data. The findings suggested that the internet was a main news source used by Malaysian academicians and Arabs have a moderate image among Malaysians. The findings from SEM part suggested that all the measurements models are accepted after modification and the model-fit is acceptable and achieved all the measures of construct validity .This study also suggested that all of the dimensions of the variables are significantly correlated and also significantly explained by its observed variables and there is no significant difference between the proposed model and observed model. Thus, all Null Hypotheses were also accepted. Findings of hypothesis testing showed also that the hypothesized full structural model of Arab Image fits the data. The model fit of the final hypothesized model suggested that time exposure does not contribute to the model. The findings of indirect analysis suggested that both awareness and attitude play as mediating effects to achieve "assumption of statistical power proposed". Strong support was found for the hypothesis of the relationship between attitude and image, and also between attitude and perception. Eventually, the findings of this study added to the body of knowledge concerning the Arab world and Malaysia and to the scholars and researchers in the field of communication and media, especially, electronic media and image. Further, the findings from this study contribute to the knowledge regarding the news assumption of mediation analysis in media effect studies.

64

Name : YASSIN MADANI ABDUL ALKADIR

Title : THE INFLUENCE OF INTERCULTURAL COMMUNICATION ON THE DECISION OF MIDDLE EASTERN STUDENTS TO STUDY IN MALAYSIA

Supervisor : PROF. DR. MOKHTAR MUHAMMAD **(MS)**
ASSOC. PROF. DR. MOHD ADNAN HASHIM **(CS)**

Consideration of the influence of intercultural communication factors on the decision of students to study overseas is a new tool that integrates the field of communication and decision making sciences, and is widely used in educational institutions in highly diversified educational environments. This study aimed to identify the most important and critical intercultural and non-intercultural communication factors that influence Middle Eastern students to study in Malaysia. The study was conducted in three stages to address the objectives of the study. The first stage involved group discussions and interviews with a selected group of Middle Eastern students from the undergraduate to postgraduate levels. The research literature was reviewed to ascertain some factors affecting students' decisions to study overseas, and this stage led to the identification of some preliminary factors that have encouraged Middle Eastern students to study in Malaysia. This stage provided a clear picture and understanding of intercultural and non-intercultural communication factors that have had an impact on the decision of Middle Eastern students to study in Malaysia. It also provided some insights on the intercultural communication barriers Middle Eastern students encountered in Malaysia and which may have serious impacts on the flow of Middle Eastern students in the future. A qualitative study was conducted to determine the factors that have influenced Middle Eastern students to choose Malaysia as the country to pursue their studies. The results of the qualitative study, group discussions and the outcome of the pilot study and related literature analysis was used to draw up the theoretical framework of the study, which represented an adapted model for decision making. The model incorporated religious and cultural factors that were introduced in the adapted model for decision making and which have not previously been investigated and explored thoroughly in relation to educational decision making. In the second stage, validity and reliability tests of the adapted model were conducted to determine the most important factors influencing the decisions of Middle Eastern students to study in Malaysia. The third stage involved a survey among Middle Eastern students in selected Malaysian universities. The findings of the study have shown that cost benefit analysis does not have a serious impact on the decision of Middle Eastern students to study in Malaysia. For the purpose of policy recommendation and remedial action, the study has listed some major intercultural communication barriers that may have serious impacts on the flow and continuity of study for Middle Eastern students in Malaysia.

ACADEMY OF CONTEMPORARY ISLAMIC STUDIES

65

Name : MOHD. HAPIZ BIN MAHAIYADIN

Title : *AL-DARURAH AL-SYARCIYYAH* DAN APLIKASINYA DALAM PENGGUNAAN *MUHARRAMAT* MASA KINI

Supervisor : PROF. DR. MUHAMAD RAHIMI OSMAN **(MS)**
ASSOC. PROF. DR. MOHD DANI MUHAMAD **(CS)**

Pelbagai produk gunaan hari ini tidak bebas sepenuhnya daripada unsur haram (*muharramat*) dalam bentuk asal ataupun derivatifnya, secara langsung atau tidak langsung. Terdapat empat sumber sebagai fokus *muharramat* dalam kajian ini iaitu gelatin, plasma darah, alkohol dan gliserin, sering digunakan dalam keperluan industri makanan, farmaseutikal dan kosmetik. Sebagai pengguna paling ramai di Malaysia, umat Islam terpaksa menghadapi fenomena tersebut dengan berhati-hati atau menggunakan beberapa produk tersebut atas sebab d*arurah*. Prinsip d*arurah* merupakan suatu *rukhsah* syarak bagi menyelamatkan nyawa dan pelbagai d*aruriyyat al-khams* pengguna disebabkan ketiadaan alternatif halal, penyakit, kebuluran, paksaan, pertahanan diri dan kesulitan umum yang sukar dielak (*cumum balwa*). Kajian ini ingin menganalisis konsep *al-darurah al-syarciyyah* secara terperinci di samping menditilkan jenis-jenis *muharramat* dan perbezaan kedudukan hukum serta kesannya terhadap penggunaan ketika d*arurah*. Pada dasarnya, penggunaan *muharramat* memerlukan suatu panduan sistematik disebabkan kepelbagaian jenis haram dalam ketiga aspek penggunaan di atas menampilkan bentuk aplikasi d*arurah* yang berbeza. Sesuai dengan sifat sebuah kajian kualitatif, landasan teori darurah dan *muharramat* dibina berdasarkan telaah kritis terhadap kitab-kitab fekah, usul fekah dan kaedah fekah berautoriti daripada empat mazhab muktabar termasuk Zahiriyyah. Dua intrumen penting iaitu *istihalah* dan *ihtiyat* turut disentuh kerana penerimaan aplikasi *istihalah* memberikan impak positif terhadap ruang penggunaan pelbagai produk farmaseutikal moden khususnya. Seterusnya mekanisme aplikasi d*arurah* dapat direkonstruksi ke dalam sebuah model lebih berstruktur untuk menjustifikasi keadaan d*arurah* selain menjadi panduan penggunaan *muharramat* kepada pengguna Islam setempat. Berdasarkan model tersebut, sesuatu kes d*arurah* dinilai dengan tiga parameter utama ; penentuan tahap kesulitan, jenis *muharramat* dan herarki penggunaannya, serta kesan haram terhadap d*aruriyyat al-khams* pengguna. Beberapa senario d*arurah* telah dianalisis. Terdapat sebahagiannya diiktiraf sebagai d*arurah* dan sebahagian lagi tidak. Bagi senario d*arurah*, pengguna dibenarkan memakan, menerima rawatan atau menjalani pembedahan yang menggunakan sumber haram ataupun derivatifnya mengikut Jadual Hirearki *Muharramat* Daripada Minimum kepada Maksimum. Kajian ini turut mengemukakan beberapa saranan kepada para pengguna Islam, pihak industri dan pihak kerajaan tentang langkah-langkah efektif ke arah menjadikan Malaysia sebuah negara Islam yang berorientasikan *'Halal Business dan Trading Culture'*. Budaya ini sepatutnya menjadi teras kepenggunaan h*alalan tayyiban* yang menjamin sekuriti produk gunaan domestik dalam setiap rantaian penghasilannya daripada pencemaran unsur *muharramat*.

ARSHAD AYUB GRADUATE BUSINESS SCHOOL

66

Name : IBRAHIM AWANG BESAR

Title : CORPORATE ENTREPRENEURSHIP ON GOVERNMENT LINKED COMPANIES PERFORMANCE: THE ROLE OF PERCEIVED ENVIRONMENTAL MUNIFICENCE AND DYNAMISM AS MODERATING VARIABLES

Supervisor : ASSOC. PROF. DR. SARIDAN ABU BAKAR **(MS)**

Financial performance of the Government Linked Companies (GLCs) has been the subject of public scrutiny and their performance has always been compared with the performance of non-government linked companies (non-GLCs). Generally, GLCs performance is said to be underperformed as compared to non-GLCs and continues to be a major concern. A tall order was given to GLCs to improve their financial performance by advocating innovation, proactiveness and risk-taking as means of transforming the economy from a knowledge-based to innovation-based economy. The aim of this research is to examine the effects of corporate entrepreneurship dimensions on organization's financial performance of GLCs in Malaysia. In addition, external factors such as munificence and dynamism were injected to examine if these variables do moderate the relationship between the corporate entrepreneurship and financial performance. Scales for dimensions of corporate entrepreneurship, financial performance and environmental munificence and dynamism have been adopted from the existing literature. Using usable data of 282 from the 450 respondents as a sample frame, across diverse industries such as construction, consumer products, finance, industrial products, infrastructure, plantation, properties and trading and services, this research analyzes the effect of corporate entrepreneurship dimensions on financial performance of GLCs. The 450 respondents are selected using purposive sampling due to the nature of the industry. According to Sekaran (2005), a sample of 100 to 500 is sufficient to generalize the population.The research found that corporate entrepreneurship dimensions of innovation, proactiveness and risk-taking have a significant and direct impact on financial performance of the GLCs. However, environmental munificence and dynamism variables did not moderate the relationship between corporate entrepreneurship and financial performance. But, environmental munificence and dynamism moderate the relationship between innovation, proactiveness and risk-taking and financial performance. This research concludes that financial performance of GLCs could be improved by employing corporate entrepreneurship strategy, where CE contributes 48% to financial performance and its sub dimensions of innovation (38%), proactiveness (19%) and risk-taking (11%) respectively.

67

Name : HAZRIAH BINTI HASAN

Title : EFFICIENCY DETERMINANTS OF MALAYSIAN PUBLIC WAQF IN A DYNAMIC ENVIRONMENT

Supervisor : PROF. DR. ISMAIL AHMAD **(MS)**
ASSOC. PROF. DR. JAAFAR PYEMAN **(CS)**

Managerial efficiency is all important in financing a not-for-profit foundation. Waqf or endowment is among one of the Islamic financial institutions set up for the sole intention to serve as a catalyst for economic growth and development of Muslims. In Malaysia, every state does its own Waqf department under the organization of State Islamic Religion Councils (SIRCs). As sole single trustees of Waqf funds, SIRCs are responsible to do all the bodily processes and transactions done for the development and aggregation of finances as easily as to invest and administer the revenues from the finances. This research is divided into three analyses. Firstly, this research did an extensive measurement using the Data Envelopment Analysis (DEA) to investigate the dynamic efficiency performance of Waqf Departments in Malaysia. This research breaks the efficiency measurement into three sections;

- **i.** Dynamic DEA analysis to cover the Technical Efficiency (TE), Pure Technical Efficiency (PTE) and Scale Efficiency (SE) in static CRS efficiency measurement, VRS efficiency measurement, dynamic CRS efficiency measurement with two approaches of input orientation and output orientation.
- **ii.** Two-stage DEA measurement to measure both Waqf collection and Waqf distribution functions. The Two-stage DEA separates the collection function from the distribution function.
- **iii.** Waqf Management Efficiency (WME) Index that measured by DEA Malmquist Total Factor Productivity Index. This WME Index is to detail on the efficiency changes that comprises of Efficiency Change, Technical Change, Productivity Change, Scale Efficiency Change and Total Factor Productivity Change.

Secondly, this research applied Logistic Regression to the binomial efficiency scores for the robustness check. Finally, this research executed the dynamic panel data examination on the state's economic indicator as for determining the determinants of the Waqf efficiency. Thorough procedures were applied; panel unit root test, diagnostic test and dynamic test in reaching at the final result of Generalized Method of Moments. DEA analyses prescribed the efficiency measurement on Waqf Departments of SIRCs by operating both input and output information from the institutions. Various scales extracted from the analyses and from the result, the most efficient Waqf Department constituted its score that equal to 1, in which said the perfectly efficient. The state with score less than 1 is categorized under the inefficient score. Out of thirteen states, SIRC of Pulau Pinang, Sabah, Terengganu and Negeri Sembilan mostly resulted in the efficient score. LOGIT analysis then did check for the likelihood of the occurrence of efficiency for Waqf Department. From the result, it confirmed the observations of TE, PTE and SE in DEA previously by its binomial categorization function. GMM panel data analysis did justify State Investment and State Revenue as the determinants for Waqf efficiency. Significantly, this research did a comprehensively measurement of institutional Waqf departments and external determinants. Waqf practitioners and administration may adopt WME Index as to evaluate yearly performance of public Waqf as per adequate information prevails.

68

Name : ROHATI BINTI SHAFIE

Title : FACTORS INFLUENCING FIRM'S ENVIRONMENTAL PERFORMANCE IN MALAYSIA

Supervisor : ASSOC. PROF. DR. NOREHAN@NORLIDA MOHD NOOR **(MS)**
ASSOC. PROF. DR. SYED JAMAL ABDUL NASIR SYED MOHAMAD **(CS)**

The changes in the global environmental conditions have placed great challenges to the governments, industries and societies. Business organizations are often blamed to be the sources of these environmental problems. Their role in mitigating these problems shall not be underestimated. Higher environmental performance can be translated into eco-advantage which enhances a firm's competitiveness. Drawing from the resource-based theory, this study aimed to examine the internal and external factors influencing the environmental performance of firms certified under the ISO 14001 in Malaysia. Five hypotheses were generated by taking into consideration two internal factors (i.e. environmental policy and environmental training) and three external factors (i.e. regulatory stakeholders' pressure, community stakeholders' pressure and customer pressures). The total population of the study was 643 firms. Thus, this study employed census, with all the 643 firms used in the study. Five (5) face-to-face interviews and thirty (30) pilot tests from 15 firms were conducted to pretest the survey questionnaire. A total of 628 questionnaires were mailed to the respondents after excluding 15 firms from the pilot test. A total of 268 manufacturing firms responded to the questionnaires. In this research, structural equation modeling was applied to test the hypotheses. It was found that the "environmental policy", "environmental training", "regulatory stakeholder's pressures" and "customer pressures" influenced the firm's environmental performance in which "customer pressures" was found to be the dominant factor. Two novel findings included the positive impact of regulatory stakeholder's pressure on (1) the firm's environmental policy; and (2) the firm's environmental training. This research provide a model to synthesize both internal (environmental policy and environmental training) and external (regulatory stakeholder's pressure and customer pressures) constructs that influence a firm's environmental performance. Findings from this study may motivate managers to integrate environmental agenda as the firm's corporate strategy. The empirical results and the findings shed lights on the practitioners as to how to enhance a firm's environmental performance through green practices incorporated in both the internal factors (i.e. environmental policy and environmental training) and external factors (i.e. regulatory stakeholders' pressure, community stakeholders' pressure and customer pressures). In addition, this research provides an aspiration to firms that have yet to implement EMS practices and to encourage them to be more eco-friendly.

69

Name : YASSIEN AHMED HOUSEN MASOUD

Title : CONTRIBUTION OF FORMULATION AND IMPLEMENTATION STRATEGY ON ORGANIZATIONAL PERFORMANCE: EXAMINING THE MODERATING EFFECT OF ORGANIZATIONAL CULTURE

Supervisor : ASSOC. PROF. DR. SARMINAH SAMAD **(MS)**
PROF. DR. ZAINI ABDULLAH **(CS)**

Formulation and implementation strategy play a major role in organizational performance. The main purpose of this study was to examine the relationship between formulation and implementation strategy on organizational performance and examined the moderating effect of organizational culture on this relationship in Yemen of Ministry of Health. The population of the study was staff at top and middle management level in Yemen Ministry of Health. Data was collected based on self-administered questionnaire from the selected sample. 120 useable samples based on the random sampling were used in the study among staff at top and middle management in the Yemen Ministry of Health. Data in this study was analyzed based on descriptive and inferential statistics using SPSS version 22. The finding showed that there was significant and positive relationship between formulation and implementation strategy with organizational performance. The findings showed that the implementation strategy has contribute more significantly than formulation strategy on organizational performance. The findings also showed that organizational culture has moderated the relationship between formulation and implementation strategy and organizational performance. The study is important from the both theoretical and practical perspective especially for practitioner and scholars to refer. This research will provide the Yemen Ministry of Health and other stakeholders with important data and insights on current state and practice of formulation and implementation strategy by Ministry of Health in Yemen.

FACULTY OF BUSINESS MANAGEMENT

70

Name : AZREEN BINTI ROSLAN

Title : THE MEDIATING EFFECTS OF ENTERPRISE RISK MANAGEMENT PRACTICES ON ORGANIZATIONAL ATTRIBUTES AND ORGANIZATIONAL PERFORMANCE

Supervisor : ASSOC. PROF. DR. HAYATI MOHD DAHAN **(MS)**
PROF. RAMAYAH THURASAMY **(CS)**

Risk is inherent in all organizations, but if inefficiently managed will affect the confidence and expectations of the stakeholders. The development of an enterprise risk management (ERM) program enables organizations to manage corporate risks in a holistic manner as opposed to the silo-based perspective in traditional risk management frameworks. ERM is a best practice technique to evaluate and manage risks in an integrated manner to cater to the new economic reality. Further, ERM is a management tool to assist top management to make informed decisions. Past studies have established positive effects of ERM practices, as organizations are better prepared to manage their feasible threats in a holistic and integrated manner. In fact, there are general consensuses of researchers that organizations practicing ERM are found to perform better due to the fact that such organizations are able to ensure that the total risks facing their organization are well managed. More specifically, their current, future and emerging risks are identified and controlled to allow the organization to achieve their strategic objectives. For this to happen, top management support is crucial to drive ERM and ensure better organizational performance. However, evidence pertaining to this is still scarce. As such, this research aims to provide a better understanding of the influence of organizational attributes on the extent of ERM practices towards organizational performance. A research model is developed to examine and evaluate the attributes of ERM practices and its influence on organizational performance. In addition, two underpinning theories namely Agency theory and Contingency theory are used to justify these relationships. The existing empirical evidence with regard to the risk management activities of nonfinancial organizations were collected, in order to gain insight into the extent of ERM practices. A questionnaire survey technique is employed to collect data from the public listed of nonfinancial companies. 102 useable responses were received and further analyzed using the appropriate statistical procedures. The research model was then tested using the partial least squares (PLS) technique. Smart PLS 2.0M3 was used to validate the research model and test the proposed research hypotheses. The empirical results of this research lead to several significant findings. This study confirms that ERM practices positively influences organizational performance. Under the construct of organizational attributes, organizational structure and role clarity are found to have significant positive relationship with the extent of ERM practices. However, the result does not support hypothesized relationships between board composition (board independence and role separation) and the extent ERM practices. In addition, findings showed that the extent of ERM practices mediates the relationship between organizational structure and role clarity with organizational performance. However, the findings showed that the extent of ERM practices does not mediate the relationship between board composition and organizational performance. Theoretically, this study provides further insights on the attributes and outcomes of the extent of ERM practices within Malaysia public listed of nonfinancial companies' context. Methodological and managerial implications were discussed and several possible avenues for future research were identified and proposed. In short, the findings of this study shed new light to the existing ERM literature and provide better assurance to the industry practitioners on the significance of ERM practices in the organization.

71

Name : AZREEN JIHAN CHE MOHD HASHIM

Title : MODELLING PREDICTORS OF ATTITUDE AND BEHAVIOURAL INTENTION FOR HALAL SKIN CARE PRODUCTS

Supervisor : PROF. DR. ROSIDAH MUSA **(MS)**
PROF. DR. FARIDAH HASSAN **(CS)**

Studies and interest on human behaviour in relation to halal industry have been increasing over the recent years. Drawing upon a social psychology theory, Theory Planned Behaviour (TPB) developed and congruity theory were employed as theoretical foundation for developing the present conceptual model. This thesis initially conceptualises key psychological factors that could predict and explain purchaser's attitude. The data for this research were collected from 470 respondents who are user and non-user of halal skin care products in Klang Valley via drop off and collect survey technique. This research has shed new light in better understanding of the existing knowledge by incorporating relevant constructs as the predictors of attitude such as, spiritual intelligence, spiritual congruence, product image and product involvement. The significance of this study lies in the fact that, it attempts to identify and empirically investigate the predictors of attitude among the users and non-users. Subsequently, examines the predictors of intention such as attitude, subjective norm, and perceived behaviour control in a halal skin care products (compliance with Muslim Shariah requirement) context. Structural Equation Modeling (SEM) was utilised to test the hypothesised relationships among the constructs, as postulated in the research model. The results from hypothesis testing show that twelve hypothesised links were supported and two were not supported. With some minor modification, a plausible model that has a statistical and explanatory power for interpretation of results was confidently established. The findings from this study could offer several major contributions to the marketing and behaviour theory as well as to the marketing practitioners. Initially, spiritual intelligence and spiritual congruence have a positive significant effect on attitude and influences continuous to purchase halal skin care products for users, but not for non-users. Consequently, product image is the most influential predictor's of attitude and has positive significant influence in intention to purchase halal skin care products for non-users, and spiritual intelligence for users' respondent. Finally, it was revealed that product involvement found to be a significant predictor of attitude towards purchasing halal skin care products for both users and non-users. In terms of the predictors of intention on purchasing halal skin care products, the results delineate several interesting findings. Primarily, attitude, subjective norms and perceived behaviour control have positive significant effect in influencing user and non-users to continuous to purchase and intention to purchase halal skin care products. The research unveils four new links namely for users, spiritual intelligence, spiritual congruence (that have not been examined empirically by previous research), product image and product involvement. On the other hand, for the non-users, product image and product involvement seems to be significant predictors of intention to purchase halal skin care products. Notably, the research has also developed and validated a new measure scale of spiritual intelligence particularly in halal skin care products. These findings form part of the strategic recommendations to marketing strategy in the face of understanding purchaser attitude and behavioural intention which has established an empirical foundation for future research.

72

Name : EMAN NAFA ALJAGHTHAMI

Title : PSYCHOLOGICAL CAPITAL, LEADERSHIP STYLES AND WORK ENGAGEMENT AMONGST WOMEN TEACHERS IN SAUDI ARABIA'S PUBLIC SCHOOLS: THE MODERATING ROLES OF PERSON-ORGANISATION FIT

Supervisor : PROF. DR. HJH. NOORMALA DATO' AMIR ISHAK **(MS)**
ASSOC. PROF. DR. CYNTHIA YOLANDA DOSS **(CS)**
PROF. RAMAYAH THURASAMY **(CS)**

A research reported that the ratio of engaged employees in Saudi Arabia is lesser than the world's average rate, in which only four out of ten males and women Saudis are engaged, compared to six in every ten as the average in the world. This study aims to examine the link between women teachers in Saudi Arabia's public schools and their job. To make them love their jobs and enjoy being teachers rather than just accept it as it is their destiny. Examining the level of psychological capital, leaders will know how to trigger the teachers' work engagement. The purpose of this study is to examine the factors influencing work engagement of women teachers in Saudi Arabia public schools. This study also investigates the moderating effect of person-organisation fit. The scope of this research was to evaluate work engagement among women teachers in Saudi Arabia's public schools, specifically, Jeddah, Riyadh and Dammam. A total of five constructs were investigated after a review of literature on the field of work engagement and psychological capital, especially in the Middle East and Saudi Arabia. The Gain Spiral concept, The Broaden and Build theory and JD-R model, formed the basis of the conceptual framework of the proposed model of work engagement, psychological capital and leadership style. Based on the literature review, a conceptual model of work engagement, psychological capital and leadership style was proposed and a suitable research method was selected to test the hypothesized model. A quantitative approach used in this research for data collection. Primary data was collected by means of questionnaires distributed in Riyadh, Jeddah and Dammam, the three principle cities of Saudi Arabia. The unit of analysis in the present study was individual; the target population were Saudi women teachers in public schools. A total of 414 valid responses were finalized. The Partial Least Squares (PLS-SEM) approach was utilized to test the hypotheses. The results for the direct relationships between the independent variables psychological capital, leadership styles (transactional, transformational), and the dependent variable work engagement shows that all independent variables have positive influence on dependent variable work engagement. At the same time, it was found that the moderator variable person-organisation fit, has an effect on the relationship between psychological capital and work engagement. Furthermore, it has no effect on the relationship between leadership styles (transactional, transformational) and work engagement; aslo this research recommended extensive investigation of other variables such as the. organisational culture inside the schools. Finally, this study provides academic and practical implications for the Ministry of Education in Saudi Arabia to invest in improving and developing the performance of women teachers in Saudi Arabia.

73

Name : LUJAIN AHMEDEHSAN MANDOURAH

Title : THE RELATIONSHIP BETWEEN HUMAN CAPITAL AND ORGANISATIONAL PERFORMANCE, WITH THE INFLUENCE OF SOCIAL CAPITAL AND ORGANISATIONAL CULTURE

Supervisor : ASSOC. PROF. DR. SARMINAH SAMAD **(MS)**
DR. NUROL'AIN MUSTAPHA **(CS)**

Saudi Arabian economy is in stage of achieving efficiency-driven nation. The kingdom exceeded the stage which depends on the infrastructure to the stage of dependency on the human capital based economy which allow Saudi Arabia to be in the right track of development. Human capital (knowledge, skills and competency), social skills (communication and teamwork) and organizational culture (market, clan, adhocracy and hierarchy) are found to be critical among factors that could be linked and give influence on performance in the organizations. This study therefore aimed to examine the relationship between human capital and organizational performance in Saudi private organizations. It examined also the relationship between human capital and social capital as well as between social capital and organizational performance. Consequently the mediating effect of social capital in the relationship between human capital and organizational performance was also examined. Finally the study examined the moderating effect of organizational culture in the relationship between human capital and organizational performance. The data was analysed based on the random sampling and the self-administered questionnaire, with a response rate of 85%, questionnaire collected from 170 managerial staff that representing the selected organizations in Saudi Arabia. Descriptive statistics, confirmatory factor analysis (CFA), hierarchical multiple regression and Structural Equation Model (SEM) in AMOS were used to analyse the collected data in this study. As hypothesised the results revealed that human capital was significantly and positively related to organisational performance. It was found also that human capital was related to social capital as well as social capital was related significantly to organizational performance. The results also revealed that social capital has mediated the relationship between human capital and organizational performance. Accordingly, it was found that one dimension of organizational culture namely market has moderated the relationship between human capital and organizational performance. The findings of this study could serve as the guidelines for private organizations as well government organizations in Saudi Arabia. These findings are important as this is among the recent research conducted to investigate the relationship and influence of human capital, social capital and organizational culture on organizational performance from the perspective of private organizations in Saudi Arabia. Findings of this study will be beneficial to the policy makers, practitioners and researchers. The findings will also add to the existing body of knowledge in areas of organizational studies, human capital and social capital in specific and intellectual capital in general, organizational culture and organizational performance.

74

Name : NOR AZAIRIAH FATIMAH BINTI OTHMAN

Title : MODELLING KNOWLEDGE TRANSFER OF NURSING STUDENTS DURING CLINICAL PLACEMENT

Supervisor : ASSOC. PROF. DR. RABIAH ABD WAHAB **(MS)**
DR. NUROL'AIN MUSTAPHA **(CS)**

The current study explored factors affecting behavioral of knowledge transfer and the antecedents predicting this within the Theory of Planned Behavior (TPB) framework. This study made an attempt to incorporate knowledge transfer-related variables (articulability of knowledge, credibility of knowledge source, gap of theory-practice, embedded knowledge and environmental uncertainty) into the framework. The premise of the model is to provide guideline of necessary conditions that are influential to knowledge transfer behavior in the clinical placement. It is hoped that by holistically understanding and paying closer attention to these predictors, a more comprehensive strategy can be devise beforehand to alleviate any problems that might negatively hinder activities of acquiring and applying new knowledge at the point of clinical placement, which subsequently maximize required clinical experience and in turn increase the levels of clinical competence. The posited model was validated quantitatively using field surveys to one of key stakeholders of clinical placement; the nursing students. The influence of the variables selected for this study was tested on two distinct samples of Lower Semester Group, LSG (semester 1- 3) and Higher Semester Group, HSG (semester 4-6) separately. A total of 2880 questionnaires were distributed to nursing students from all government-affiliated nursing institutions throughout the country. A total of 2779 (96.5%) was returned and only 2638 were usable for analysis. Data analysis statistical technique of Partial Least Square (PLS) was conducted to analyze the hypothesized relationships and to test adequacy of the proposed model. For LSG, eight (8) of ten (10) hypotheses were supported. For HSG, with excerption to three (3), all of the hypothesized paths are in the direction hypothesized. The Model show reasonably good fit supported by the acceptable level of the *GoF* indices of 0.389 (LSG) and 0.383 (HSG). The finding of this study which is solely focuses on knowledge transfer from the recipient of the knowledge perspective, is contributing to the existing TPB framework and knowledge transfer literature with new measures, constructs and structural paths added in rarely tested context; clinical placement. The study could provide direction for nursing authority in directing appropriate resources that are conducive to knowledge transfer at clinical placement when developing nursing curriculum structures in the future.

75

Name : NORAZNIRA BINTI ABD RAZAK

Title : RESOURCES – PERFORMANCE RELATIONSHIP: THE MEDIATING ROLE OF ENTERPRISE RISK MANAGEMENT (ERM) IN MALAYSIA

Supervisor : PROF. DR. HJH. ZURIAH AB RAHMAN **(MS)**
DR. HALIMAHTON BORHAN **(CS)**
ASSOC. PROF. DR. HAYATI MOHD DAHAN **(CS)**

This study analyses the relationship between firm resources and its performance while examining the mediating roles of enterprise risk management in the firm resources – firm performance relationship within the context of the Resource-based view theory (RBV) and Donabedian theory. A quantitative approach is employed in this study and responses from 223 risk managers among Malaysian listed firms under Malaysian Bourse were analyzed by using Partial Least Squares (PLS-SEM) technique. The results show that intangible resources are directly related to performance, meanwhile through the mediating effect of enterprise risk management (ERM), an indirect relationship was confirmed. However, tangible resources and capabilities show negative results on the relationship with the performance of the firm and further analysis using ERM as mediator yields the same negative results. A positive relationship between ERM and performance of the firm was also obtained. On the basis of the outcome of this study, it shows that intangible resources need to be fully optimized by firms in order to improve their performances. Overall, the findings of this study reveal how firms may gain competitive advantages and eventually be able to sustain their firms' performances by implementing an integrative model of intangible resources and effective ERM process in their routines and practices.

76

Name : NURUL NADIA ABD AZIZ

Title : ORGANISATIONAL CAPABILITIES AND COMPETITIVE ADVANTAGE: THE MODERATING EFFECTS OF MANAGERIAL COMPETENCIES IN PROCESSED FOODS SMES IN MALAYSIA

Supervisor : ASSOC. PROF. DR. SARMINAH SAMAD **(MS)**
DR. LENNORA PUTIT **(CS)**
ASSOC. PROF. DR. RABIAH ABDUL WAHAB **(CS)**

The premise of this research is that the SMEs in Southeast Asia, including Malaysia, are facing difficulties to survive. Recently, some scholars have argued that the SMEs in Malaysia have a lack of competitiveness regarding costs, products and services. Thus, this study aims to provide a better understanding of continuous knowledge sharing by determining; (1) the effects of organisational capabilities on competitive advantage among the food processing SMEs in Malaysia; and (2) the relationship between innovation, networking, financial capabilities, and competitive advantage. Furthermore, this study incorporates knowledge and skills as a moderating variable, renamed as managerial competencies which possibly strengthen the likelihood that strong organisational capabilities may lead to competitive advantages. Therefore, this study also aims to determine the moderating effects of managerial competencies on the relationship between organisational capabilities and competitive advantage. A random sampling technique was applied to collect the data from 2,384 SMEs processing food products in Malaysia. A total of 330 SMEs in the food processing industry had participated in this study. The main instrument for this study is a set of questionnaire which was adopted from previous studies. A structural equation modelling using AMOS was applied in analysing the direct and moderating effect hypotheses. The fitness index statistics confirmed that the overall model fit and all of the paths in the model were statistically significant. The results support the hypothesised effects of the organisational capabilities on the competitive advantage. These valuable findings show that the organisational capabilities explain 93 percent of the variance in competitive advantage. All three constructs of the organisational capabilities (innovation, networking and financial capabilities) individually had significant and positive relationship with the competitive advantage but with a low strength of relationship magnitude. Managerial competencies were also found to moderate the effects of organisational capabilities on the competitive advantage. In brief, this study contributes to the competitive advantage studies through a comprehensive empirical research. Focusing on the scale and scope dimensions, this study highlighted, in particular, the importance of the firm internal resource capabilities as the potential influencers of the SME's competitive advantage. This study provides useful implications and recommendations for the practitioners and policy makers on how to help Malaysian food processing SMEs increase their competitiveness in penetrating the hypermarkets and further the global market.

77

Name : NUSRAH SAMAT

Title : ORGANIZATIONAL FACTORS, INDIVIDUAL FACTORS, PERCEIVED ORGANIZATIONAL SUPPORT AND PERCEIVED PUBLIC RECOGNITION ON UNETHICAL BEHAVIOR AMONG POLICE PERSONNEL

Supervisor : ASSOC. PROF. DR. HJH. NOORMALA DATO' AMIR ISHAK **(MS)**
PROF. DR. HJH. AIZZAT MOHD NASURDIN **(CS)**

Ethics has been an issue of enormous interest and growing concern from time to time in most areas including in the management field. The inculcation of unethical behavior in both public and private organizations has proven to be an elusive and never ending quest. The issue of unethical conduct is also evident in Malaysia. This can be seen by the increasing frequency of coverage in media, printing and electronic, on unethical behavior and misconducts by individuals and local organizations. Unethical behaviors lead to a wide range of negative consequences. The costs associated with unethical behavior in the organization are great, estimated to be in the amount of billions annually as well as it may negatively impact the organizations' ability to achieve sustained profitability. This will lead to financial failure and will have a deep impact on its stakeholders or might even harm the strength of the society. A study on the determinants of unethical behavior is deemed important. This will help organizations in determining which variables contribute to such behavior. Amidst the widespread concern regarding the high incidence of crimes, perceptions of corruption in the Royal Malaysia Police (RMP), and general dissatisfaction with the conduct and performance of police personnel, there is a desire to see improvements in the services provided by the police. Thus, the main purpose of this study is to investigate the antecedents of unethical behavior among police personnel as government servants. This study seeks to examine the relationships between independent variables comprising of three organizational factors (ethical climate, superior influence, and peer influence), four individual factors (locus of control, Machiavellianism, and religiosity), moderating variables (perceived organizational support and perceived public recognition), and the dependent variable of unethical behavior. A total of 755 questionnaires were distributed to police personnel attached from five districts police headquarters (DPH) and one police station in Kuala Lumpur, a total of 643 questionnaires were returned. Unethical behavior was found to have three dimensions (personal use, falsification, deception) instead of six dimensions as conceptualized by earlier researchers. The regression analysis discovers that the independent variables explained 13%, 26% and 15.2% of the variance in personal use, falsification and deception (unethical behavior). Hierarchical regression analyses provide evidences that both perceived organizational support and perceived public recognition moderated the relationship between some of the organizational and individual factors with unethical behavior (personal use, falsification, deception). Some limitations of the study were also discussed. The suggestions for future studies were also recommended.

78

Name : SYAZLIANA ASTRAH MOHD IDRIS

Title : THE INFLUENCE OF HUMAN RESOURCES MANAGEMENT PRACTICES, CORPORATE CULTURES AND TASKS INTEGRATION ON THE PERFORMANCE OF ACQUIRING COMPANIES IN MALAYSIA

Supervisor : ASSOC. PROF. DR. RABIAH ABD WAHAB **(MS)**
ASSOC. PROF. DR. AINI JAAPAR **(CS)**
DR. NUROL' AIN MUSTAPHA **(CS)**
ASSOC. PROF. DR. MADINAH HUSSIN TORRANCE **(CS)**

Despite decades of research, the key factors for success in Mergers and Acquisitions (M&As) and the reasons why M&As often fail remain poorly understood. The major reasons identified for this low performance include unrealistic expectation, unskilled execution, and incompatible cultures. However, many companies involved have only been evaluated based on their compatibility regarding financial figures and technical aspects, lack of research focused on the people issues. Malaysia has been continuously become the highest ranking in M&A exercises for the years of 2004 to 2007 and ranks between 2nd to 3rd among the top acquirers in the world for the following seven years. Unfortunately, many of Malaysian acquiring companies faced decline in their sales growth for the first 3 to 7 years that shows their performance has not been impressive after M&A and impacted Malaysian economy. In view of this, there is a need to investigate the influence of human resource management (HRM) practices and corporate cultures integration, focusing on the improvement of company performance. The research aims to investigate the influence of HRM practices on the performance of acquiring companies in Malaysia by examining the mediating effects of corporate cultures and tasks integration between the link. A research model is developed to investigate the influence of HRM practices dimensions (skill-enhancing, motivation-enhancing and opportunity-enhancing practices) on the company performance by examining the mediating effects of corporate cultures and tasks integration in post-M&A phase. Theoretical lenses; resource based view (RBV) and the competing values framework (CVF) are adapted in this research. A mail survey technique is employed to collect data from acquiring companies involved in M&A between the years of 2004-2009. Out of 277, 171 useable responses were received and further analysed using the partial least square (PLS) technique. Smart PLS 2.0M3 was used to validate the research model and test the proposed research hypotheses. The results signify that HRM practices dimensions, corporate cultures and tasks related integration factors are critical for the success of M&A. However, company performance is not influenced indirectly by opportunity-enhancing practices as these practices did not receive statistical support. The lack of opportunity-enhancing practices such as employee involvement could be one of the factors of M&A failure or taking longer period to success in most acquiring companies in Malaysia. Following these findings, a number of implications are offered. Specifically, corporate cultures and tasks integration provided greater room for understanding the impact of HRM practices on the effectiveness and efficiency of the M&As strategies. Finally, the industry players involved in M&A exercises must act upon the importance of HRM practices in order to optimise their cultures and tasks integration towards better performance of post-M&A phase.

79

Name : WALEED ABDULKAFI AHMED

Title : THE RELATIONSHIP BETWEEN STRATEGIC PLANNING AND ORGANIZATIONAL PERFORMANCE: EXAMINING THE MODERATING EFFECT OF TRANSFORMATIONAL LEADERSHIP

Supervisor : ASSOC. PROF. DR. SARMINAH SAMAD **(MS)**

This study was to examine the relationship between strategic planning (consists of three dimensions strategic planning level, strategic planning implementation and strategic planning barriers) and organizational performance. It examined also the moderating effects of transformational leadership on the relationship between strategic planning (consists of three dimensions strategic planning level, strategic planning implementation and strategic planning barriers) and organizational performance in Yemen banks. The data was collected through self-administered questionnaires from 246 respondents who were the top and middle management staff of Yemen Banks with the percentage of 61.5%. This data was further analyzed using mainly the Structural Equation Modelling (SEM) to investigate causal and moderating relationships between latent variables utilizing the SmartPLS. The results revealed that all of the strategic planning dimensions were significantly and positively related to organizational performance. Accordingly, strategic planning dimensions have contributed significantly on organizational performance. The results have also found that transformational leadership has moderated the relationship between dimensions of strategic planning and organizational performance except for dimension of strategic planning barriers. These findings provided support for all the hypotheses unless one hypothesis of the moderating effect of transformational leadership on the relationship between strategic planning barriers and organizational performance. Findings from this study is very valuable and could serve as guideline for policy makers in organizations especially in Yemen banks in their decision making. It contributed also to the existing body of knowledge and closing the gap of previous empirical findings. These findings are important, as this is, to my best knowledge, the first study that has been conducted to examine the contribution of strategic planning on organizational performance and the effect of transformational leadership in moderating this relationship in Yemen banks context. The findings will benefit both scholars and practitioners as it may provide new insights for further research and help with decision making.

80

Name : ZURITA BINTI MOHD SALEH

Title : LINKING SUPPLY CHAIN SOCIAL CAPITAL FACTORS, SUPPLY CHAIN INTEGRATION STRATEGY AND OPERATIONAL PERFORMANCE IN THE MALAYSIAN FOOD PROCESSING INDUSTRY

Supervisor : PROF. DR. ROSMIMAH MOHD ROSLIN **(MS)**
DR. IDA ROSNITA ISMAIL **(CS)**
PROF. DR. SOFIAH ABD RAHMAN **(CS)**

The food processing industry has become a significant contributor to Malaysia's socio-economy and is also an important source of employment. However, lately, this industry has been experiencing problems in terms of its fragmented supply chain system, lack of latest technology adoption, sub-standard grades of raw materials and low product innovation. Furthermore, this industry is often associated with poor understanding and execution of best business practices. The current business environment has witnessed increased competition from foreign food companies having the same entry opportunities in the local market whilst many of the Malaysian food processing companies find it difficult to penetrate overseas market. To a large extent this is because of aggressive competition from the counterparts in Thailand, Indonesia and China, who have already established their presence globally and are more receptive to market changes. Existing studies have established that supply chain is the key towards competitive ability. In view of this, there is a need to investigate the supply chain integration strategy (SC integration strategy) between the food manufacturers and their supply chain partners both internally and externally. This study focuses on how to improve the operational performance of the food processing industry. It analyses the integration strategy between food manufacturers and its supply chain partners to allow for greater understanding in the field of supply chain management (SCM). Drawing upon the Supply Chain Management (SCM) perspectives and Social Capital Theory, this study evaluates the relationships between critical constructs; Supply chain (SC) structural, Supply chain (SC) relational, Supply chain (SC) cognitive, Supply chain (SC) integration strategy and operational performance. This study intends to shed lights into the potential of supply chain integration in establishing effective supply chains of food processing. Based on this premise, the objectives of the study are to establish a link between the main independent constructs of social capital, SC integration strategy and operational performance and their dimensions as well as to examine the mediating role of SC integration strategy. This study contributes to knowledge by examining the presence of the social capital constructs as enablers and the influence of SC integration strategy. Data for this study was gathered through a mail survey of food processing manufacturers utilizing the questionnaire as the instrument. A total of 184 food processing manufacturers participated in the survey. The analysis used the PLS path modelling approach by examining the mediating effects of SC integration strategy. The findings reveal that each of the main social capital constructs has positive and significant effects on SC integration strategy. However, one of the social capital main constructs, SC structural as represented by IT management and IT technical infrastructure, did not demonstrate significant relationship on operational performance. Importantly, this study provides empirical evidence that SC integration mediates the relationship between individual SC social capital construct and operational performance. This finding is consistent with the movement of the industry players towards implementing 'best practices' that emphasized on SC integration. Following these findings, a number of implications are offered for the food processing industry. The food industry players should invest on soft behavioural aspects and adopt SC integration strategy in order to enhance their performance particularly in the operational perspectives of supply chain management.

81

Name : FARAH AIDA BINTI AHMAD NADZRI

Title : CRITICAL SUCCESS FACTORS OF MICRO ENTREPRENEURS UNDER THE AIM AND *ASNAF'S* ECONOMIC DEVELOPMENT PROGRAMME

Supervisor : PROF. DR. HJH. RASHIDAH A. RAHMAN **(MS)**
PROF. DR. NORMAH HJ. OMAR **(CS)**

The microfinance concept was introduced by Professor Muhammad Yunus in 1970s with the aspiration to improve the poor people live by providing them the accessibility to the financial services. Generally, the microfinance programs in Malaysia can be divided into two categories, repayable and non-repayable micro funds. As previous studies on repayable financing by Microfinance Institutions such as Amanah Ikhtiar Malaysia (AIM) suggested that in general, the programme has a positive socio-economic impact, empirical studies on the economic development programmes by Zakat Institutions that provide the non-repayable micro funds showed that the successful or effectiveness of this programme is questionable. Therefore, this thesis aims to study on the critical success factors of micro entrepreneurs under the AIM and Program Pembangunan Usahawan Asnaf Zakat Selangor (PPUAZ). Based on the previous literature, a conceptual framework is developed that the performance of micro entrepreneurs under the AIM and PPUAZ is causally related to four factors, namely financial management; human capital; social networking; and entrepreneurs' characteristics. In order to meet the objective of this study, the quantitative (surveys) and qualitative (interviews) approaches are used. The surveys were conducted first in order to explain the relationship between the four critical success factors and the performance of the micro-entrepreneurs. Later, the findings from the questionnaire were verified in the interview sessions with 17 randomly selected participants. Based on the surveys conducted, it was found that financial management and human capital have positive significant impact on the financial performance of the micro entrepreneurs, while financial management, human capital, and social networking have positive significant impact on the non-financial performance of the micro-entrepreneurs. Interestingly, it was also found that the AIM participants are financially performing better as compared to the *asnafs* PPUAZ, however, the *asnafs* PPUAZ score higher in term of the non-financial performance as compared to the AIM *sahabats*. However, based on the interviews and observation, this study found that to some extent, all the four factors suggested by the previous literatures do affect the overall performance of the micro entrepreneurs. Despite the SEM analysis suggesting that Person Entrepreneurship FIt does not affect the performance of the micro entrepreneurs, the observation however found that there were some differences between the attitudes of the successful micro entrepreneurs as compared to the others. Moreover, this study did also suggest a new model named "Islamic Microfinance Business Model" to further enhance the effectiveness of the current microfinance practice.

82

Name : MOJTABA SHAYAN NIA

Title : REAL ACTIVITIES MANAGEMENT, FINANCIAL DISTRESS AND CORPORATE GOVERNANCE: MALAYSIAN EVIDENCE

Supervisor : ASSOC. PROF. DR. HUANG CHING CHOO **(MS)**
PROF. DR. ZUBAIDAH ZAINAL ABIDIN **(CS)**
DR. RADZIAH MAHMUD **(CS)**

Positive accounting theory predicts that firms approaching deteriorating financial performance may make income-increasing accounting choices. The firms manipulate earnings upward in an attempt to ride out what is probably deemed by the management as a temporary bad period. The primary objective of this thesis is to examine real activities based earnings management among distressed Malaysian firms over the years, covering both prior and after being officially designated as "PN17 firms". Additionally, the study aims to investigate whether real activities management techniques among distressed Malaysian firms change across time and industries in which the firms operate. The study also aims to examine the moderating effects of corporate governance on real activities management. The study detects real activities manipulation by investigating patterns in cash flow from operations (CFO), discretionary expenses, and production costs. This study uses the Roychowdhury (2006) models to derive the normal level of CFO, discretionary expenses and production costs. Deviations from the normal levels are termed abnormal CFO, abnormal discretionary expenses and abnormal production costs. In addition, a review of the corporate governance literature revealed several attributes that may affect the degree of real activities management, simply because their role in enhancing monitoring mechanism. The corporate governance attributes are organized into two categories: 1) Ownership Structures; and 2) Board of directors' Composition. Imposing all the data availability requirement yields 4,130 firm-years over the period of 2001 to 2011, including matched samples of 295 distressed firms and 295 non distressed firms. The results complement the existing literature on earnings management in several ways. Firstly, the results document evidences that are consistent with real activities manipulation during the years preceding and succeeding PN17. The results reveal distressed Malaysian firms engage in sales manipulation and reduction of discretionary expenditures to improve their reported margins over the years prior to being officially designated as "PN17 firms". In addition, the results also indicate that the firms apply these techniques in a more aggressive manner in the years following the categorisation under PN17 list. Secondly, the results provide a new insight on the way managers from different industry engage in real activities manipulation. This study indicates that earnings management tools change according to the industry in which distressed firms operate and the number of years preceding the categorisation of PN17. Finally, the findings suggest that the degree of real earnings management among distressed firms are associated with corporate governance attributes, namely ownership structure and board of directors' composition. The primary contribution to knowledge of this research is its extension of the literature on the phenomenon of real activities management among the financially distressed firms. The findings of this study is applicable by stock market participants towards the evaluation of companies' board composition and the role of the ownership structures in constraining managerial opportunistic behaviours. Furthermore, the findings will also assist Bursa Malaysia in detecting the areas that are likely to be manipulated by managers.

83

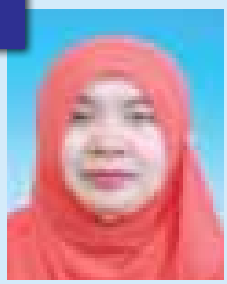
Name : NASER BASHIR A. GHANEM

Title : THE INTERVENING IMPACT OF MAS EFFECTIVENESS ON THE RELATIONSHIP BETWEEN CONTINGENT VARIABLES AND ORGANIZATION PERFORMANCE: A STUDY OF LIBYAN BANKING AND PETROLEUM ORGANIZATIONS.

Supervisor : PROF. DATIN DR. SUZANA SULAIMAN **(MS)**
ASSOC .PROF. DR. WEE SHU HUI **(CS)**

This study is undertaken with the purpose of examining the relationship between management accounting system effectiveness (MASE) and organization performance (OP). Specifically the research seeks to figure out what are the benefits derived from MAS that OP could have from what expected to be the main influences in MASE. Moreover, the research concentrates on MASE that resulted from contingent factors, organizational coordination and control requirements (OCCR) and information quality IQ. In particular, examine the effect of MASE arising from OCCR and IQ on OP with regard to individual impact (INIM) in developing countries' concept, the case of Libya. More specifically, IQ as one of the MAS requirement and OCCR which consist of information interdependence (INFIN), formalization (FO) and information inter-organization (INFORG) are the selected contingent variables, with MASE modelled as intervening mechanism between these contingent variables, and OP. This study also looks for evidences about the effectiveness of suitability of MAS' information from system users' perspective (perceptions of MAS's end users such as CEOs). Previous researchers have realized the contribution of information technology (IT) in improving the individual performance chiefly in terms of productivity and effectiveness (Iivari, 2005a). The study is beneficial and significant because it supports the need to consider individual and environmental factors together. The expected outcome of the research is that MASE that rose from the impact of the contingent variables has a direct positive impact on OP. Also the relation between system effectiveness and performance may effected by INIM. In addition, using users who work in companies that are working in a developing country, Libya, and have adopted sophisticated systems, those systems help exchange information between departments and other companies electronically as the population of this study is a useful for this research because of the fundamental changes that Libyan economic have especially after the lifting of the embargo on Libya which took place April 1999 when the UN Security Council had suspended the sanctions imposed on Libya and by 2003 the sanctions was terminated. This change has created a good environment for researchers to conduct studies because, recently, some of the current organizations have adopted advanced systems such as communication, banking and oil and gas companies (Twati, 2008, Leftesi, 2008) , and hence the existence of the knowledge that individuals gained to evaluate these systems after they have got practical experience in both advanced and traditional systems. A quantitative approach was chosen for this study using items from previous studies. The result shows significant mediating effect of MAS effectiveness on the relationship between the chosen contingent variables and organization performance and the comprehensive measurement contributed in this study shows a satisfied result. However individual impact shows weak moderating impact and the end user satisfaction and MAS usefulness show different impact on organization performance. In conclusion, this study is seeking to develop the above by relaying on an existent established knowledge of the literature that studied both AIS and MAS's variables (contingency perspective) and tools (Nicolaou, 2000, Chenhall and Morris, 1986, Rom and Rohde, 2007) and the contribution of this study was clearly recognised.

84



Name : NIK ZAM NIK WAN

Title : ENVIRONMENTAL INITIATIVES OF SMEs IN MALAYSIA:AN INVESTIGATION OF REPORTING PRACTICE AND MOTIVATIONS

Supervisor : DATO' PROF. DR. HJ. MUSTAFFA MOHAMED ZAIN **(MS)**
PROF. DR. RUHAYA ATAN **(CS)**

SMEs are considered as the backbone of most economic growth worldwide including Malaysia but their existence and importance as individual are frequently under estimated. SME's individual environmental impacts seem to appear at a minimum level but environmental cases reported otherwise. Even though they should be equally accountable, little is known about SMEs' initiatives in preserving the environment. Inspired by the above, this study decided to explore Malaysian SMEs' involvement in environmental initiatives including environmental reporting. The motivations for environmental initiatives of SMEs in Malaysia are investigated to provide opportunities to encourage and to educate more SMEs to implement the environmental initiatives and communicate their environmental information. This study used qualitative research methodology employing grounded theory approach. The data collection process included semi-structure interviews, content analysis of documents and observations and focused only on SMEs that are registered as members of FMM. Through interviews, observations and content analysis this study revealed that the SMEs did implement some environmental initiatives. Despite being said to be smaller in nature findings of this study indicated that Malaysian SMEs also demonstrated their responsibility towards the environment. These SMEs not only complied with the related environmental rules and regulations but they also committed their limited financial resources to implement several environmental initiatives. Among the non-mandatory initiatives implemented are environmental management system, waste management, energy conservations, tree planting and creating environmental awareness. It was identified that the SMEs did have environmental reporting as part of their environmental initiatives. They communicated to their stakeholders the companies' environmental policies and objectives, their environmental friendly practices and the environmental initiatives implemented. However, it was also identified that the information was provided more on ad hoc basis rather than systematically and periodically and mostly did not convey the complete information of actual environmental initiatives implemented. Thoroughly, this study discovered the key motivating factors for environmental initiatives amongst SMEs by reviewing the 'who' could motivate from the lenses of the Stakeholder theory which give rise to a 'stakeholder-driven factor'. Meanwhile, the Institutional theory is utilised to justify as to 'how' the SMEs are influenced to engage in environmental initiatives and it give rise to 'institutional-drive'. It was identified that regulators, customers, the environment through the nature of the business and owners-managers are the factors that could motivate the SMEs to implement the environmental initiatives. Without doubt, the findings of this study support the Stakeholder theory. The theory is further enhanced by providing thorough and in-depth explanation of the relation between the SMEs and its stakeholders. This has given rise to the discovery that not all the SMEs' customers will become the motivating factors for them. There are only some categories of customers that can act as motivating factors meanwhile others cannot. SMEs' Implementation of Environmental Initiatives Index is developed from the findings and can be utilised to identify the possibility for an individual SME to engage in environmental initiatives. Since this study has revealed that SMEs did implement environmental initiatives and practice environmental reporting, they should be motivated to present the information to the public. Environmental reporting could act as evaluation tools to assess the SMEs equally accountability towards the environment.

FACULTY OF HOTEL & TOURISM MANAGEMENT

85

Name : LOVELYNA BENEDICT JIPIU

Title : ASSESSMENT OF FOOD SAFETY KNOWLEDGE, ATTITUDES, PRACTICES, AND TRAINING OF FOODHANDLERS IN THE CONTEXT OF HACCP GUIDELINES IN MALAYSIAN PUBLIC UNIVERSITIES

Supervisor : PROF. DATIN DR. TOH POH SE **(MS)**
PROF. DR. SON RADU **(CS)**

This study aimed to assess the knowledge, attitudes, and practices (KAP) of food handlers in relation to food safety. Data collection was conducted using questionnaires that were completed by food handlers working in foodservice in public universities. Data were also collected by direct observation of food handlers performing their routines, the foodservice premises, and detection of pathogens in randomly selected food samples. Questionnaires were completed by 260 food handlers, and 130 food handlers were observed. Eleven public universities located across Malaysia were involved. Thirty-three premises were observed, and 127 randomly selected food samples were collected for pathogen detection. Rasch model analysis was used for validation, odds ratios were determined, and multivariate analysis of variance was performed to determine the relationships between the variables. The majority of the food handlers had not received any formal food safety training; therefore, they did not have a high level of general food safety knowledge, and corresponding behavioural practices were lacking. The majority of the food handlers who had completed training had higher knowledge scores than those who had not, but this was not statistically significant. Food handlers with or without training demonstrated knowledge of risks of foodborne illnesses, time and temperature abuse, improper hand washing as well as cleaning practices. Overall, food handlers' attitudes toward food safety were positive regardless of food safety training. Lower attitudes scores for food safety and personal hygiene were found among the food handlers in the foodservice industry. The following unsafe practices were observed: inadequate hand washing, misuse of gloves, inaccurate use of thermometers, incorrect holding and storage of food, poor personal hygiene, and improper cleaning and sanitizing of work surfaces. A further finding that should be of great concern to law-enforcing bodies, such as the Ministry of Health, is that pathogens, such as *Escherichia coli O157:H7, E. coli O157*, and *Vibrio cholerae*, were detected in food samples. Recommendations are made to improve the KAP of food handlers. Greater emphasis should also be placed on increasing food handlers' personal sense of responsibility for food safety, increasing their food safety knowledge, and improving their food safety practices. Further studies are also needed to better understand how training affects food handlers' KAP. Recognizing the need for training programs that are accessible and relevant to institutional managers and food handlers, this research seeks to determine what prevents foodservice managers from allowing employees to participate in food safety training.

86

Name : MAZNI BINTI SAAD

Title : THE IMPACT OF FOOD-HYGIENE PRACTICES, LEADERSHIP EFFECTIVENESS, AND SPIRITUAL INTELLIGENCE TOWARDS *PROGRAM LATIHAN DAN KHIDMAT NEGARA* (PLKN) FOODSERVICE PERFORMANCE

Supervisor : ASSOC. PROF. DR. MOHAMAD FAIZ FOONG ABDULLAH **(MS)**
ASSOC. PROF. DR. MOHAMED AZAM MOHAMED ADIL **(CS)**
DR. NORMALINI MD KASSIM **(CS)**

Food poisoning cases in the National Service and Training Programme (PLKN) camps are on the rise for over 10 consecutive years despite measures taken by responsible parties and therefore require further attention. Specifically, an unchanged pattern of foodborne incidence has triggered an alarming question on the sustainable operation of food service business in these camps. The objectives of this study are to (i) assess the Food-hygiene Practices of food handlers at PLKN, (ii) to analyse the relationship between Leadership Effectiveness, Food-hygiene Practices, and Spiritual Intelligence (SQ) and (iii) to investigate the impact of these study variables; Leadership Effectiveness, Food-hygiene Practices, and SQ on PLKN"s Foodservice Performance. The existing level of Food-hygiene Practices was assessed through questionnaire, interview, and observation, as well as microbial sampling experiments. The questionnaire also assessed the relationship and impact of the four parameters of the study (Leadership Effectiveness, Food-hygiene Practices, SQ, and Foodservice Performance). The survey yielded 87.80% responses from 81 operating camps in Malaysia and provided 1026 usable datasets. Six sets of interviews were conducted among the supervisory personnel of the PLKN camps. For empirical data, 288 microbiological samplings of food-contact surfaces (FCS) and 36 drinking water sources were conducted. The data was analysed using the partial least square and appropriate statistic tools. The microbial analyses failed to correlate with the cleanliness survey, but were consistent with food poisoning outbreaks in the camps. FCS with flat open surfaces such as cutting boards and food trays were found exposed to secondary contamination during the drying and storing stage. They were also prone to transferable bacterial contaminants, thus regular washing and rinsing with hot water is necessary to improve the level of effective cleaning. The camp operators can conduct hygiene control tests independently using a simple microbial swab kit as suggested by this study. An adequate number of food handlers per trainees for every meal session should be reconsidered by the camp operators. This study significantly proved that an effective foodservice manager evokes positive feelings among the food handlers to form a situation of continuous well-being during routine practices. At empirical level, the established interconnectedness between the spiritual and practical person and his/her work applications and expectations underlie and support their thoughts of self-development and success at work. Producing and presenting quality food and services reflects a sense of obligation in helping others through correct practices, while keeping account of one"s good deeds for the benefit of one"s journey towards the next life. Out of 17 tested hypotheses, SQ Holistic and SQ Challenge failed to reject the null hypotheses in favour to our research hypotheses for food performance. With the large and valid datasets, the positive results showed that the model proposed in this study could be generalized to the routine practices-and-performances of other foodservice institutions. Overall, this study has successfully achieved its objectives. The results provide suggestions for PLKN foodservice to develop at a significant level, to be profitable while satisfying customers by meeting their expectations and preferences in healthy food consumption, and to face present challenges while remaining competitive in an increasingly aggressive world.

87

Name : MOHD HAFIZ BIN MOHD HANAFIAH

Title : INTERLINKING TOURISM DESTINATION COMPETITIVENESS DETERMINANTS, TRAVEL AND TOURISM COMPETITIVENESS INDEX AND TOURISM PERFORMANCE

Supervisor : ASSOC. PROF. DR. HJ. MOHAMAD ABDULLAH HEMDI **(MS)***
PROF. DR. ISMAIL AHMAD **(CS)**

This thesis contributes to the tourism destination competitiveness (TDC) literature by providing validated measures of TDC determinants and empirical understanding of the impact of TDC determinants on the Travel and Tourism Competitiveness Index (TTCI) ranking and tourism performance. The purpose of this thesis was to articulate and test the relationships between TDC determinants, TTCI ranking, and tourism performance by taking into account the effects of the macroeconomic condition of destinations. This study provides an analytic review of TDC determinants with a twofold objective, that is, to test the TDC determinants' statistical soundness and to assess the ability of the determinants in explaining the TTCI ranking and tourism performance complexity. Also, the relationship between TTCI ranking and tourism performance will be examined, and the moderating effect of destination's macroeconomic conditions was tested and analysed. The structural relationship was explored through the examination of underlying TDC theoretical model, as reflected in the literature review. Data from 115 destinations were used to test the hypothesized relationships via partial least square-structural equation modeling (PLS-SEM). Measurement instruments of TDC determinants, TTCI ranking, tourism performance and macroeconomic conditions were adopted and validated based on data collected from secondary sources. The results from the measurement model confirmed the construct of TDC determinants: core resources, complementary resources, infrastructure quality, destination management, environmental management, tourism price and globalisation. Moreover, the structural modeling results provide varying support for the hypotheses defined. First, the results show that the TTCI ranking was merely an index and did not posit causal relationship with the important TDC determinants (tourism core resources and attractions) while four TDC determinants were found to be significant in explaining tourism performance. Second, the TTCI ranking did influence tourism performance positively. However, the Multi-Group Analysis (MGA) result proved that TTCI rankings significantly affect tourism performance in less-developed destinations, but not for the developed ones. This study found that despite the TTCI theoretical importance and usefulness as tools for tourism destinations' ranking, several measurement issues still surround the foundations of TTCI measurements. These findings extend the application of the underpinned theories of TDC studies and contribute to the body of knowledge. Implications of the findings are discussed, and future research directions are recommended.

88

Name : MUHAMMAD IZZAT ZULKIFLY

Title : TECHNOLOGY READINESS, CUSTOMER PERCEIVED VALUE, CUSTOMER INFORMATION SATISFACTION AND BEHAVIORAL INTENTION ON TABLET-BASED MENU ORDERING EXPERIENCE

Supervisor : PROF. DR. MOHD SALEHUDDIN MOHD ZAHARI **(MS)***
ASSOC. PROF. DR. HJ. MOHAMAD ABDULLAH HEMDI **(CS)**

It is a common practice among restaurateurs to provide menu cards as a medium of communication to speak about their menu items. Many limitations have been identified from the use of this method of menu ordering such as customer indecision and other forms of service failures. Tablet-based menu ordering system which is „self-service" in nature is gaining popularity among restaurants due to its capacity to handle descriptive menu, other information and illustration as well as other interactive options and many other benefits. The success of this system depends on how restaurants balance the use of technology and human touch. Too much dependency on technology would take away the human-touch value which is important in a foodservice operation. Not much is known about Malaysian customers" technology readiness and how they perceived the value offered by this system, thus it is difficult to figure out the effectiveness of the system based on their information satisfaction on the menu ordering experiences which will then influence customers" behavioural intention. This study empirically investigates the causal relationship between technology readiness, customer perceived value, customer information satisfaction and behavioural intention towards the tablet-based menu ordering system. A quantitative investigation through survey questionnaire among customers who already had the experience was conducted. Data from a total of 421 respondents were analyzed through the process of multivariate analysis using Structural Equation Modelling (SEM) via Analysis of Moment Structures (AMOS). The exploratory factor analysis (EFA) and later the confirmatory factor analysis (CFA) validated the scales used in the study. The results suggest that all constructs; technology readiness, customer perceived value, customer information satisfaction and behavioural intention were significantly related. The strength between technology readiness and customer information satisfaction would change with the presence of customer perceived value. Similarly, the relationship strength between customer perceived value and behavioural intention was altered when customer information satisfaction was included. These concluded that customer perceived value mediate the first relationship while customer information satisfaction mediates the latter. Malaysian customer can accept this kind of ordering experience and other restaurants should see this as an opportunity to invest on the system. Finally, the implications of the findings are discussed, and future research directions are recommended.

89

Name : NORIZA BINTI ISHAK

Title : INTEGRATION AND ADAPTATION OF FOODWAYS TOWARD COMMON ACCEPTABLE FOOD AND FOOD IDENTITY FORMATION

Supervisor : PROF. DR. MOHD SALEHUDDIN MOHD ZAHARI **(MS)**
DR. SALIM ABD TALIB **(CS)**

This study attempt to measure the extent to which integration through food knowledge, food media and food for social events of the Malays, Chinese and Indian foods influenced the adaptation of foodways (preparation and consumption) toward establishment of the common acceptable food and Malaysian food identity formation. This study is structured through a self-administered survey with the individual Malays, Chinese and Indian chefs / cooks who are currently working in the medium / large food catering operations / services and had experienced of preparing and consuming the three Malaysian major ethnic cuisines. Fifty medium / large food catering operations / services located at the Klang Valley cities namely Kuala Lumpur, Putrajaya, Kajang, Petaling Jaya, Shah Alam, and Klang have been chosen for data collection. A total of 402 responses were obtained from the survey processes with 392 were usable. The data collected was analyzed using structural equation modeling (SEM) software program AMOS 22.0. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were executed to validate the scales. Four main dimensions of the overall measurement model were produced and tested in agreement with a rigorous refinement process for the models. The results generated from the structural modeling evidenced that the three dimensions of integration attributes and the formation of food identity is significantly related. Furthermore, the presence of adaptation of foodways capable of modifying the strength of the relationship between integration attributes and common acceptable food. In other word, adaptation of foodways through preparation and consumption explicitly mediate on the relationship between integration attributes and common acceptable food. It is interesting to note that common acceptable food is also having the mediating effect on the relationship between adaptation of foodways and food identity formation. Through these findings, it can be deduced that adaptation of foodways through preparation and consumption of other ethnic cuisine not only help to develop a common acceptable food among the major ethnic (Malay, Chinese and Indian) but, gradually shape the formation of national food identity.

90

Name : ZURENA @ RENA SHAHRIL

Title : RESTAURATEURS AND DINERS RESPONSIVENESS TOWARD SMART CARD USAGE IN RESTAURANTS

Supervisor : PROF. DR. HJ. MOHD SALEHUDDIN MOHD ZAHARI **(MS)**
ASSOC. PROF. DR. HJ. MOHAMAD ABDULLAH HEMDI **(CS)**
PROF. DR. FAUZIAH NOORDIN **(CS)**

With the general thrust of developments and in line with technological advancement and demands of the economy, the payment systems have gone through incredible revolutions. This scenario is offering greater competence and expediency to customers and businesses and the growth in technology without an exception of food and beverage industry has played a vital role in changing diners' payment habits. The availability range of payment services in the restaurants today including the smart card in response to diverse market demands of the changing behaviour and lifestyle of the diners significantly influence their actual usage behaviour. Nevertheless, although smart cards are viewed as a promising and enabling technology, their levels of acceptance and usage have not been at its peak in the Malaysian restaurant industry. This study is empirically investigating restaurateurs and diners responsiveness toward "Touch 'n Go" smart card usage in Malaysian restaurant sector. In integrating, entwining the issues or to facilitate the research problems and the findings both quantitative and qualitative approaches were opted. The insight on the issues was obtained through the interview with 6 restauranteurs while the deeper understanding is validated through self-administered survey among the 400 restaurant diners. With the various statistical analyses ranging from descriptive, inferential and SEM Partial Least Square used to answer the research objectives, questions and hypotheses, some useful insights pertaining to the issues investigated was significantly obtained. The restaurateurs acknowledged that the "Touch 'n' Go" company needs to create more awareness of the public from simply sees this payment card as the only mode of paying for the public transportation but goes beyond on it application including in the restaurants sector. With that, the service providers should aggressively take a positive action by recommending and encouraging the restaurateurs to intensify their promotion of this payment services. An interesting aspect and the most remarkable findings is also drawn from the quantitative analysis that the awareness and brand image in addition to perceived usefulness, ease of use and trust strongly moderate diners in using the "Touch 'n Go" card. This result in fact corresponded well with the proposed study model and strengthened the Theory of Reasoned Action, the Theory of Planned Behavior and the Technology Acceptance Model as the underpinning theories for this study. It was also found that simply making people aware of the smart card and its availability in the restaurants will not necessarily increase the usage without increasing the trust and changing the attitudes of the users which manifest that social marketing campaign may be the best way of uplifting the awareness. In addition, it is interesting to note that the perceived trust as the predictor to awareness, brand image and the actual usage behaviour manifestly impart novel and new contribution not only to the restaurants, foodservice operations but to the growing body of literature as well. Finally, findings flow from this study dealing with the smart card technology obviously provides valuable insight to the academicians and practitioners including the major stakeholders, restaurateurs and diners as the end user.

FACULTY OF INFORMATION MANAGEMENT

91

Name : ISMAIL SAMADI

Title : DETERMINANTS AND IMPACTS OF DIGITAL LIBRARY USAGE: A SURVEY AMONG SELECTED IRANIAN UNIVERSITIES

Supervisor : ASSOC. PROF. DR. MOHAMAD NOORMAN MASREK **(MS)**
DR. HJ. SAIFUL FARIK MAT YATIN **(CS)**

In the age of information, digital library (DL) adoption among Iranian universities and academic higher learning institutions has been very common. It is no longer considered as a lavish technological investment, but rather treated as technological need and necessity crucial to the survival of the university. Various studies have revealed that universities and academic higher learning institutions have benefitted from the installation of the digital libraries. In an academic environment, DL usage is purely volitional or optional. Innovative users would effectively use the DL for some specific reasons and objectives, while others may simply ignore it. This situation simply suggests that there are some determining factors that shape the usage behavior of the users. Given that digital libraries (DL) have been implemented in most Iranian universities and academic higher learning institutions, knowledge regarding users' usage behavior is still very limited. Not much is really known about the extent users; especially students exploit the DL for the purpose of enhancing their performance and productivity. Similarly, little is really known about the factors that shape Iranian students' DL usage behavior from users' lenses. To this effect, this study is aimed to investigate the usage behavior of users in a DL environment in selected Iranian universities. In addition, it is also aimed at investigating the determinants of DL usage behavior. Finally, this study also intends to investigate the impact of DL usage behavior among users. The conduct of this study was using a quantitative approach. Three universities were involved in the study, namely University of Tehran, Tehran University of Medical Science and Sharif University of Technology. These universities were chosen because they are the top three biggest universities in Iran. On top of that, DLs have been implemented in these universities for more than ten years. Preliminary studies involving interviews, observation and review of materials (i.e., the DL itself) were undertaken to understand the phenomenon of DL usage and its corresponding determinants and impacts. The findings of the studies were then used to refine the theoretical framework and the corresponding testable hypothesis. In order to test the hypotheses, a self-administered questionnaire was disseminated to a population which consisted of DL users in the three participating academic libraries. A convenience sampling technique was adopted so as to ascertain that respondents were well represented by various departments. A total of 750 valid responses were analyzed to test the developed hypotheses. Structural Equation Modelling (SEM) approach was used to analyze the data. The findings suggest that DL use has a significant relationship with individual performance. In addition, it was also found that technological characteristics are also significant predictors of DL use. Among the four dimensions of individual characteristics, the study found that only attitude towards DL as significant predictor. The findings of the study can viewed from both theoretical and practical perspectives. From the theoretical viewpoint, it has developed an empirical based framework depicting the determinants and impacts of DL use. From the practical viewpoint, the developed instrument can be used to gauge the performance of the DL.

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