

HACCP training in MARDI: A contribution towards the development of HACCP competent human capital

(Pelaksanaan kursus HACCP di MARDI: Sumbangan kepada pembangunan modal insan yang kompeten terhadap HACCP)

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Abstract

Courses and Training Programme, MARDI offers extensive training services to support the food industries and other related agencies to understand and implement food safety standards and requirements. This includes Hazard Analysis Critical Control Point (HACCP) training to extension officers and enforcers from various government agencies. The effectiveness of HACCP training conducted by MARDI was determined and the impact of training to the course participants in terms of knowledge and skills ability of the participants was evaluated. An online survey was conducted involving 200 respondents in 2013 and 104 completed questionnaires were furnished. The study found that the participants' knowledge on HACCP was significantly improved ($p < 0.001$) after attending the HACCP course conducted by MARDI. Thus, it could be suggested that MARDI plays a vital role in building HACCP capability.

Introduction

Food becomes unsafe for human consumption when it is contaminated intentionally or unintentionally by the environment surrounding, animals and human. Hazards may be introduced at any time along the supply chain. Hazards can be categorised into chemical, physical and biological hazards. Chemical hazards appear in food due to wrong agricultural practices from farm to table. At farm, there are wrong applications of pesticides, feeding animals with antibiotics not allowed in animal feeds and usage of hormones to increase animal growth and weight. Inappropriate application of food ingredients, additives and preservatives may also contribute to hazards. Physical hazards are mainly due to adulteration of extraneous matters or foreign

objects. While biological hazards appear with the presence of toxic plants, animals or hazardous microorganisms and their toxins. Consumption of food contaminated with these hazards can lead to foodborne disease.

Foodborne disease is a lingering issue in the world. Although safety measures have been implemented from time to time, the outbreak of the foodborne disease still emerges. Generally, it has been estimated that up to one-third of the population suffer a foodborne disease every year. In United States alone about 76 million cases and 5,000 deaths reported annually (Rocourt et al. 2003). In Malaysia the incident rate was 56 people per 100,000 populations in 2012 (Mazni et al. 2013). It was assumed to be even higher. Large scale production, wide product distribution, globalisation

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of food supply and emergence of new pathogen are some of the factors that affect the occurrence of foodborne disease (David 2010) and interfere the stability of food safety assurance.

Food safety system

To address the global challenges on food safety, developing and developed countries have established high level food safety authorities and strengthened their food safety and quality programme. ISO 9001, Good Hygiene Practices (GHP), Good Manufacturing Practices (GMP), Hazard Analysis Critical Control Point (HACCP) and *halal* certification are the food safety management system and quality assurance programme that have been used by the manufacturers, food handlers, small and medium enterprises (SME), and marketing companies. These are the international standards to recognise whether a product or service offered meets the specified requirements.

Campaigns are launched all over the world to alert consumers about the implementation of these standards, the need of food safety and to reduce the incidence of foodborne disease. TV, radio and social media play the important role in sharing the information. Despite that, government publications are more trusted and can be used effectively to educate the consumers (Bulent 2013). Currently, consumers are more concerned about their food consumption behaviours and they are knowledgeable about food safety. They prefer to choose products that come with *halal*, GMP, ISO 9001 and HACCP logos (Zaiha Zeeti et al. 2012).

GHP contains guidelines for general hygiene activities to control food safety such as cleaning and disinfection procedures, equipment maintenance, pest control and personal hygiene practices. Implementation of GHP can prevent the cross contamination to occur during food production. GMP consists elements such as water quality, design and facilities, maintenance, operation

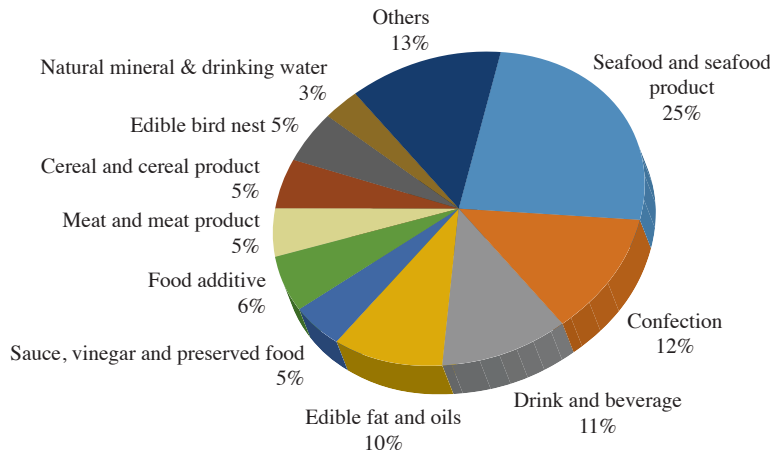
control, staff training, product information, traceability, product recalls, pest control, transportation and consumer awareness. GMP provide assurance that a product is manufactured in a hygienic manner and in accordance to the best standard practice in manufacturing. GHP and GMP are well established systems that build the foundation of a HACCP system.

HACCP is a systematic preventative approach to address physical, chemical and biological hazards in food production. It can be used in all stages of food supply chain as it ables to determine the key controls over processes and identify the risk that may cause the food to be unsafe. By introducing this preventive control, food safety hazards are unlikely to occur. United Kingdom (UK), United States (US) and European Union (EU) has put HACCP as the quality regulations to control food safety and quality for both importers and exporters. HACCP is obligatory for seafood, juice, meat and poultry products but the use of it is widely encouraged for other types of food products.

HACCP in Malaysia

HACCP implementation in Malaysia is a voluntary basis, except for seafood exported to the EU and US. The Malaysian Certification Scheme for HACCP (MCS HACCP) describes procedures, which apply to food premises in gaining HACCP certification. The scheme is administered by the Ministry of Health (MOH), which requires the food premises to set up and implement a HACCP system that meets the HACCP criteria, followed by the application and granting of the certification. MOH acts as a certification body for HACCP. Besides the MOH, the Department of Fisheries (DOF) is involved in HACCP for fisheries and aquaculture, while the Department of Veterinary Services (DVS) is involved with that for slaughter houses and animal farms.

Until May 2014, 341 HACCP certified companies in Malaysia are registered with MOH (Ahmad Nadzri 2014). About 25% of them are seafood and seafood products



Source: Ministry of Health (2014)

Figure 1. HACCP certified food industries registered under MOH (until May 2014)

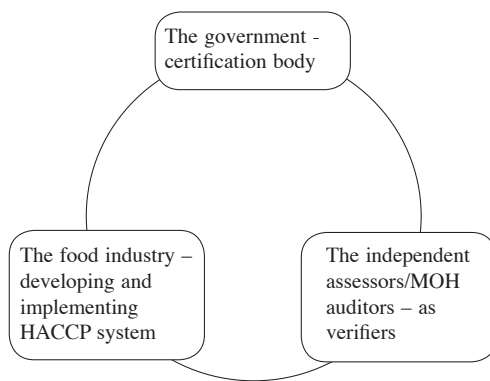


Figure 2. Tripartite Management system for MCS HACCP

manufacturers (Figure 1). The seafood products include frozen and canned fish, prawns, surimi and surimi products. According to Malaysian Investment Development Authority (MIDA) in their 2013 report, this sector remains as the major contributor to the export of processed food. Total export of fish and other seafood exceeds RM2.5 billion per annum. MOH hopes that the implementation of HACCP system in Malaysian food industries is in line with the trend in global food safety.

The MCS HACCP is a practise based on the ‘Tripartite Management’ approach

which involves the government, pool of independent auditors and the food industries (Guidelines for HACCP Certification 2000). This concept is illustrated in Figure 2. The development of HACCP programmes and their implementation is the responsibility of the food industry while the government control agencies are responsible for legislations, guidelines, code of practices, inspections and enforcements. Their responsibility is to make sure that the HACCP programme used by the manufacturers is well designed and properly implemented (Ababouch 2000). There is a requirement in a HACCP team for the presence of people who are able to carry out the technical activities such as identifying hazards, monitoring, assessing, auditing and training. Therefore, there is also a need for training requirement in every aspect of HACCP implementation and management. HACCP training is not only for the food manufacturer but also for the enforcement officers such as MOH. Thus, it important for MOH to maintain a qualified HACCP auditors which also possess specialisation in different disciplines of food processing and food service (Zahara 2000).

HACCP training

Globally, organisations agree that training is essential to the growth of a business and necessary in human resource development (Shahrooz 2012). HACCP training is important to understand and apply food safety related to policies and requirement. According to Mortimore (2001), HACCP training is regularly provided by people who are not HACCP practitioners. They are lecturers, academicians or former hygiene trainers who do not have practical knowledge and are not properly trained in training delivery.

MARDI through Courses and Training Programme provides training in three modules namely Prerequisite to HACCP, HACCP Implementation and, HACCP Verification and Auditing. These courses are recognised by the MOH as courses for their food technologists and HACCP auditors. The trainers of the HACCP courses in MARDI are food researchers who are experienced in providing technical advice to the food industries. They are also HACCP consultants to the food industries or HACCP auditors appointed by MOH or HACCP certification body.

MARDI has conducted HACCP training for both small and big scale food processing industries since 1997. MARDI offers extensive training services to support the food industries and other agencies in understanding and implementing the standard. Hence, HACCP training in MARDI continuously receives high demand from government agencies such as DOF, MOH, DVS, Fisheries Development Authority of Malaysia (LKIM) and Department of Islamic Development Malaysia (JAKIM).

Lesson learnt when Malaysian seafood export was banned by EU in June 2008 due to seafood producers failed to maintain the safety and quality of their products according to the EU requirement. The Malaysian Competent Authorities (CAs) which are the MOH, DOF and LKIM were not knowledgeable on the requirements

for export to the EU. Thus, MARDI was requested to conduct a training to improve knowledge on HACCP and the relevant EU directives and legislations to the targeted personnel from DOF in January 2009. This course not only contributed to enhance HACCP awareness but also contributed for corrective action to be undertake. Subsequently, the export ban to EU was lifted in May 2009. MARDI has since been entrusted and the demand for HACCP training in MARDI is increasing.

Objectives

The HACCP training modules in MARDI were designed for HACCP implementers and auditors. Such training has been conducted by MARDI since 1997. Since then, there is no significant research done in evaluating the effectiveness of the HACCP training programme. The objectives of this study were to determine the effectiveness of HACCP training and to evaluate the impact of training to the respondents' knowledge and skills ability in doing their job. Findings from this study will help MARDI to determine the future planning for HACCP training by strengthening and improving the modules and delivery approaches thus in turn will contribute in enhancing Malaysian international food trade.

Methodology

This study was conducted based on survey research method. A set of questionnaire was developed and verified by a very senior principle researcher who is an expert in research methodology and HACCP training. He is also the reference person for the expertise in industrial HACCP development and practices in this country and ASEAN.

An online survey using one of the most popular online survey software was chosen as the method of survey. This particular instrument was selected due to several factors: i) respondents are from various states, ii) they are all government officers, and iii) the most cost effective approach. The respondents were invited to join the

study by e-mail and asked to complete this survey.

The questionnaire was divided into a few sections. It includes general information about the respondents, their perceived skills and knowledge in understanding HACCP before and after training, their satisfaction level of the impact of knowledge learnt and also their expectation of the training towards their needs. The 5-point Likert Scale was used to measure the evaluation. A total of 200 respondents were contacted by e-mail and 104 respondents completed the questionnaires (i.e. 52% response rate). The research instrument used in the study was a structured questionnaire distributed through online survey which was conducted in 2013, capturing survey's respondents of those who undergone HACCP training with MARDI in between 2010 – 2012. Data were analysed using SPSS software. Descriptive statistics including means, percentages and frequency were computed. Paired sample t-test were used to examine before and after training differences.

Results and discussion

Respondents' profiles

The respondents who completed the survey were mainly female (60.6%) (Table 1). The majority (65.4%) were in the age group of between 21 – 30. Among the respondents, 37.7% were from DOF, 31.7% were from JAKIM, 18.3% from MOH, 8.7% from LKIM and 3.8% from other agencies such as Department of Agriculture (DOA) and MARDI. JAKIM is the competent authority for *halal* certification in Malaysia. *Halal* standard is recommended to be combined with GMP and HACCP requirements (Zakiah et al. 2014) to produce *halal*, safe, nutritious and quality products. Participation from JAKIM and other agencies in HACCP training organised by MARDI will help them to understand and implement HACCP.

Most of the respondents (71.1%) were officers who have at least basic degree in food technology, fisheries science and the like, while 22.1% of them were supporting

Table 1. Respondents' profiles (n = 104)

Profile	Percentage
Gender	
Male	39.4
Female	60.6
Age	
21 – 30	65.4
31 – 40	17.3
41 – 50	9.6
51 – 60	7.7
Government agencies	
MOH	18.3
DOF	37.5
LKIM	8.7
JAKIM	31.7
Others	3.8
Designation	
Supporting staff	22.1
Officer	71.1
Head of Department	6.8
Field of work	
Analysis/laboratory	13.5
Extension/advisory	15.4
Training	8.7
Auditing	62.5
Working experience in this field	
<1 year	5.8
1 – 5 years	65.4
6 – 10 years	17.3
>10 years	11.5

staff. The respondents were also asked about their field of work in the past 3 years. About 62.5% of them were involved in auditing, 15.4% in extension or advisory services, 13.5% and 8.7% in laboratory and training services, respectively. They were responsible for the overall technical supervision of food safety activities in Malaysia including determination of food safety policies, code of practices, food sampling and analysis services, and food premise inspections. More than half of them (65.4%) declared that they had been in their current position between 1 – 5 years. This group made up the majority of the respondents and they are the people who need to be trained as their working experience need to be nurtured. While 11.5% had been at their current position for more than 10 years and

this group of people need to be retrained. A study by Egan et al. (2007) also suggested that the lack of training for senior staffs may restrict their ability to implement HACCP system and to assign appropriate training to their staff.

There were a few interesting factors that need to be highlighted from this study. Interestingly, respondents were ever willing to attend this training as they realised the need for knowledge enrichment and advancement to improve their work performance.

Reasons for participating

Most of the respondents (87.4%) agreed that the main reason for them to participate in the training was to improve their skills and knowledge (Figure 3). Therefore, the MARDI's HACCP training was considered as source of knowledge in this area and furthermore, MARDI is the pioneer agency in developing the HACCP training module. About 51.5% of the respondents stated that, it is a part of their personal career development plan, while 38.8% thought it might be of use in the future. One respondent specifically stated that this training was needed for him to be appointed as MOH HACCP auditor, which was an advancement in his career. By the

end of the training, all participants would have adequate knowledge and skills to implement HACCP.

Training effectiveness

Training effectiveness was evaluated to measure how well the training met the objectives and also to identify programme strengths and weaknesses. HACCP training effectiveness was measured by comparing the mean score in their perceived knowledge and skills before and after training. Respondents were asked to answer six constructs that represent HACCP in general, the elements and the implementation. They have to indicate their level of knowledge and skills in HACCP and also the application of it in doing their job.

The six constructs or the evaluation items were: understanding the importance of food safety (C1), understanding the foundations required for HACCP and the prerequisite programs (C2), identifying significant hazards and controls of CCPs (C3), understanding HACCP principles (C4), documenting HACCP plan manual (C5) and understanding HACCP implementation (C6). 5-point Likert Scale (1 = Very poor, 5 = Very good/great) were used and the mean score of the constructs is depicted in Figure 4.

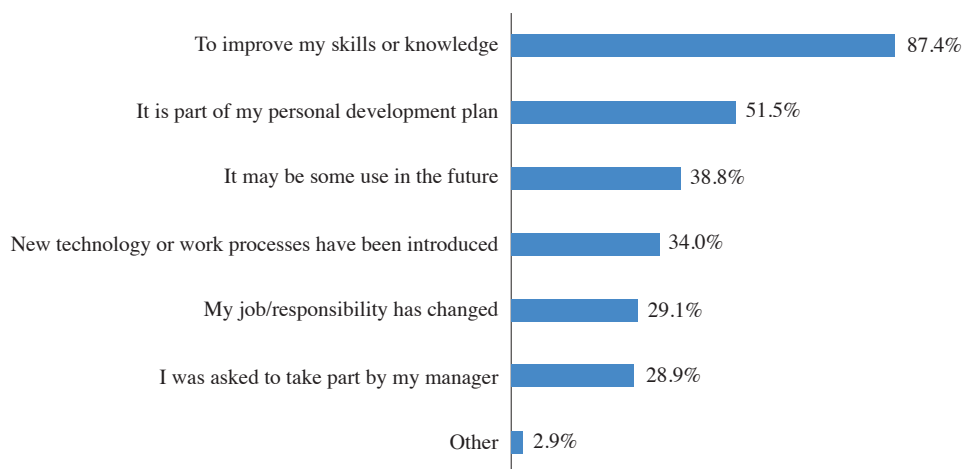


Figure 3. Reasons for participating in the training. Multiple answers were accepted

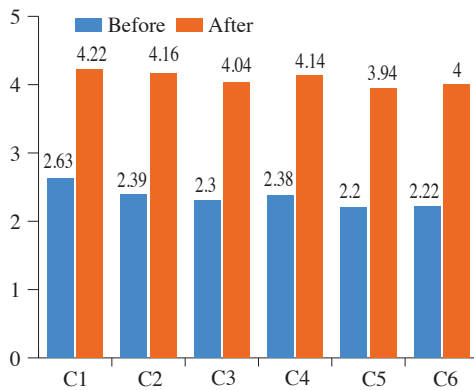


Figure 4. Mean score of the perceived skills and knowledge before and after training ($n = 100$, due to unusable response)

Based on the respondents' rating, the mean scores showed the increment patterns before and after training. The increase in the mean values showed that the HACCP training they received have improved the level of their knowledge, skills and capability in applying knowledge and skills they acquired in the workplace. This study has shown that the respondents understand the importance of food safety, HACCP programmes and HACCP principles. With the increasing skills, they can serve more effectively in carrying out duties as the industry's advisor in implementing HACCP.

The respondents who served as auditors were asked whether there were differences in their auditing skills before and after training, the mean score was 2.45 and 3.94 respectively. This showed an increase of 61% in auditing skills after attending the training. Such increment in skills could surely improve the HACCP implementation in this country.

To assess whether there are significant differences between before and after training, a t-test using SPSS analysis has been conducted. The hypothesis of the study is shown below.

Null hypothesis: There were no differences in knowledge, understanding and skills before and after training.

Research hypothesis: There were differences in levels of knowledge, understanding and skills before and after training.

A significant t-value at $p < 0.001$ indicated that the skills and knowledge gained were significantly different between before and after training for the same respondents (Table 2). The null hypothesis was rejected. Based on these results, HACCP training organised by MARDI has been successfully conducted and achieved the target to provide HACCP knowledge, assist the development and the implementation of HACCP system and also assist in empowering more experts in this field.

Impact of the knowledge learnt

Training can be considered to influence learning and behavioural change that can improve performances (Rama Devi and Nagurvali 2012). As in Khan et al. (2011), training is the main factor that can improve the efficiency and the effectiveness of both employees and the organisation. Training is given to the employee of the organisation to enhance the organisational performance, since they play the important role in the organisational growth and success. To examine how this HACCP training affect their performance and their organisational performance, the respondents were asked to evaluate their contribution from the knowledge learnt and the results are presented in Figure 5.

Responses were entered based on 5-point Likert Scale consisted of strongly disagree, disagree, neutral, agree and strongly agree. Each bar demonstrates the proportion for each response and statement. The answer categories were mostly distributed in the range of agree and strongly agree. All the results proved that by attending HACCP training conducted by MARDI participants could enhance their capabilities since the skills gained and the knowledge learnt could facilitate their daily work function which lead to brighter

Table 2. T-test value
Paired samples test

		Paired differences			99% confidence interval of the difference		t	df	Sig. (2-tailed)
		Mean	Std. deviation	Std. error mean	Lower	Upper			
Pair 1	Before 1 – After 1	-1.59596	.83200	.08362	-1.81562	-1.37630	-19.086	99	.000
Pair 2	Before 2 – After 2	-1.77778	.89847	.09030	-2.01499	-1.54057	-19.687	99	.000
Pair 3	Before 3 – After 3	-1.73737	.93225	.09370	-1.98350	-1.49124	-18.543	99	.000
Pair 4	Before 4 – After 4	-1.76768	.97759	.09825	-2.02578	-1.50958	-17.991	99	.000
Pair 5	Before 5 – After 5	-1.73737	.96453	.09694	-1.99203	-1.48272	-17.922	99	.000
Pair 6	Before 6 – After 6	-1.77778	.99545	.10005	-2.04059	-1.51496	-17.769	99	.000

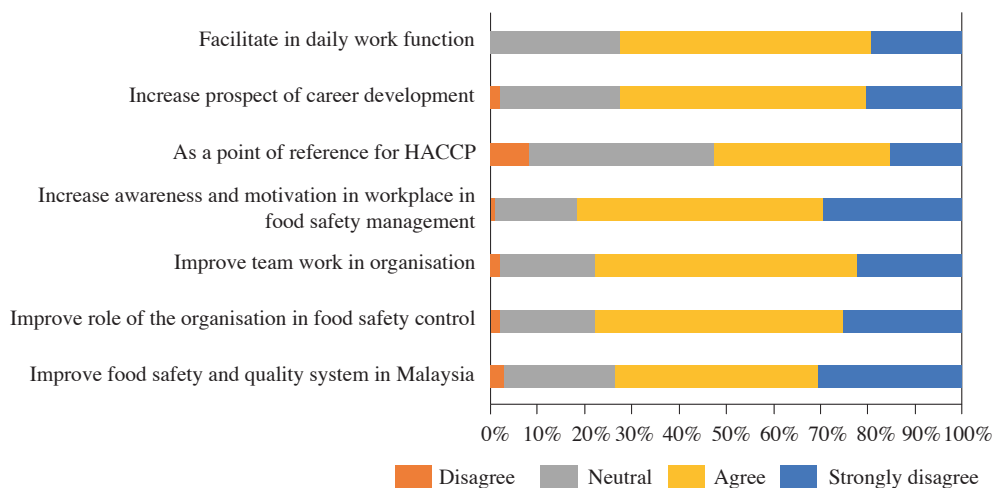


Figure 5. Contribution from the knowledge learnt

prospect of their career development. From the Figure 5, they were some respondents who were disagreed with the third construct that their knowledge gained could make them as a point of reference for HACCP but higher percentage (52%) stated otherwise.

Apart from all the positive effect on the respondents and their organisations, attending HACCP training conducted by MARDI brought out favourable changes on the respondents' behaviour at their workplace. Majority of them (79%) reported that they can increase the awareness, motivation and team work among the management team and to the organisation. They also agreed that they

can contribute not only in improving the role of their organisation in food safety control, but also in refining the food safety system in Malaysia. The finding shows that training is important in developing the employee's performance and the organisation's performance as suggested by Khan et al. (2011).

Conclusion

HACCP training conducted by MARDI is effectively delivered and met the training objectives. This training has also significantly contributed to the empowerment of the participants' competency and their organisations' role

to assist the food manufacturer in HACCP certification and therefore encourage the penetration of local products to the global market. Since 1997, it is undeniable that MARDI through its HACCP training courses has contributed directly or indirectly to the competency of government officers as well as people of the food industry. It is hoped that MARDI should be given a sufficient support to continue and upgrade its HACCP training programme.

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References

- Ababouch, L. (2000). The role of government agencies in assessing HACCP. *Journal of Food Control* 11: 137 – 142
- Ahmad Nazri, S. (2014). GMP and HACCP implementation: Malaysia experiences. *Proceeding of FAO regional consultation workshop: Implementation of GMP/ HACCP in Asia*, 23 – 25 June 2014, Bangkok, Thailand
- Anon. (2000). Malaysian certification scheme for hazard analysis and critical control point: Guidelines for HACCP certification. Ministry of Health Malaysia
- (2013). Malaysia investment performance report. Retrieved on 10 Feb. 2015 from <http://www.mida.gov.my/env3/uploads/PerformanceReport/2013/IPR2013>
- Bulent, E. (2013). Consumer awareness and perception to food safety: A consumer analysis. *Journal of Food Control* 32: 461 – 471
- David, G.N. (2010). Foodborne illness: Is it on the rise? *Journal of Nutrition Review* 68(5): 257 – 269
- Egan, M.B., Raats, M.M., Grubb, S.M., Eves, A., Lumbers, M.L., Dean, M.S. and Adams, M.R. (2007). A revise of food safety and food hygiene training studies in the commercial sector. *Journal of Food Control* 18: 1180 – 1190
- Khan, R.A.G., Khan, F.A. and Khan, M.A. (2011). Impact of training and development on organizational performance. *Global Journal of Management and Bussiness Research* 11(7): 62 – 68
- Mazni, S., See, T.P. and Mohamed Azam, M.A. (2013). Hygiene practices of food handlers at Malaysian government institutions training centre. *Journal of Procedia-Social and Behavioral Sciences* 85: 118 – 127
- Mortimore, S. (2001). How to make HACCP really work in practice. *Journal of Food Control* 12: 209 – 215
- Rama Devi, V. and Nagurvali, S. (2012). Evaluating training and development effectiveness – a measurement model. *Asian Journal of Management Research* 2(1): 722 – 730
- Rocourt, J., Moy, G., Vierk, K. and Schlundt, J. (2003). The present state of foodborne disease in OECD countries. Retrieved on 5 Jan. 2015 from http://www.who.int/foodsafety/publications/foodborne_disease/oecd_fbd.pdf
- Shahrooz, F. (2012). The evaluation effectiveness of training courses in university by Kirkpatrick Model (case study: Islamshahr University). *Journal of Procedia-Social and Behavioural Sciences* 46: 2837 – 2841
- Zahara, M. (2000). The role of government agencies in assessing HACCP – the Malaysian procedure. *Journal of Food Control* 11: 371 – 372
- Zaiha Zeeti, M.Y., Rozhan, A.D., Ghani, S. and Wan Rahimah, W.I. (2012). Awareness and implementation of food quality standards under MARDI's entrepreneurship programmes. *Economic and Technology Management Review* 7: 7 – 14
- Zakiah, S., Amal Hayati, I. and Nurul Himmah, K. (2014). Understanding the development of halal food standard: Suggestion for future research. *International Journal of Social Science and Humanity* 4: 482 – 486

Abstrak

Program Kursus dan Latihan, MARDI menawarkan perkhidmatan latihan dalam bidang kualiti dan keselamatan makanan sebagai salah satu usaha bagi menyokong keperluan industri makanan negara serta agensi berkaitan. Ini termasuk pelaksanaan Kursus *Hazard Analysis Critical Control Point (HACCP)* kepada pegawai pengembangan dan penguatkuasa dari pelbagai agensi kerajaan. Keberkesanan latihan HACCP yang dijalankan oleh MARDI dalam menentukan kesan latihan dari segi pengetahuan dan keupayaan kemahiran peserta telah dinilai. Soal selidik dalam talian melibatkan 200 responden pada tahun 2013 telah dijalankan dan 104 soal selidik yang lengkap telah diterima. Kajian mendapati bahawa pengetahuan peserta mengenai HACCP semakin meningkat ($p < 0.001$) selepas menghadiri kursus HACCP yang dijalankan oleh MARDI. Oleh itu, dicadangkan bahawa MARDI memainkan peranan yang penting dalam membina keupayaan HACCP.