

“ST26943”, 2nd International Conference on Agricultural and Food Engineering, CAFEi2014”

Food Factory Design: Reality and Challenges Faced by Malaysian SMEs

N.Z. Noor Hasnan^a, N.Ab. Aziz^{a,*}, N. Zulkifli^b, F.S. Taip^a

^aDepartment of Process and Food Engineering, Faculty of Engineering, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia

^bDepartment of Mechanical and Manufacturing Engineering, Faculty of Engineering, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia

Abstract

A competent food factory cannot be achieved if the factory is poorly designed. This paper identified the difficulties experienced by Malaysian small and medium enterprises (SME) in designing a food factory due to challenges faced by them. Two important manufacturing issues were analyzed and discovered to be related with poor factory design i.e. unsatisfactory food hygiene and lacking in sustainability. The analysis was based on a review of Malaysian data and literature. It is concluded that early considerations on food hygiene and sustainability can help SMEs to comply with hygiene standards, reduce cost and increase profit margin.

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Peer-review under responsibility of the Scientific Committee of CAFEi2014

Keywords: Food factory; design; manufacturing system; small and medium enterprises; food hygiene; sustainability

1. Introduction

With an annual export value of more than RM11 billion, Malaysian processed foods are exported to more than 200 countries (MIDA, 2012). Although the export performance of this sector has doubled over the last ten years, Malaysia remains a net food importer with annual import value of more than RM30 billion (MIDA, 2012).

The change in consumers' preference nowadays as a result of busier life styles has raised the demand for convenience products particularly ready-to-heat/eat meals and health foods. The demand is forecasted to rise by

* Corresponding author. Tel.: +603-8946 4302; fax: +603-8946 4440.

E-mail address: norashikin@upm.edu.my

more than 10% per annum (PEMANDU, 2010). However, the local food processing sector is not able to cater the increasing demand and therefore Malaysia is currently having a negative trade balance for edible products and preparations (PEMANDU, 2010). Additionally, the sector lacks necessary compliant with world hygiene and safety standard such as Hazard Analysis and Critical Control Points (HACCP) and Good Manufacturing Practice (GMP), preventing the local products from being accepted and trusted in domestic and international markets (PEMANDU, 2010). Such compliances are important as the certificates have been internationally recognized to indicate that the food products are of good quality and safety.

The incapability of the Malaysian food processing sector to produce products of good quality and sufficiently can be associated with the presence of great numbers of SMEs which are known to face numerous challenges that undermine their production performance. According to Malaysian Investment Development Authority (2012), the sector is dominated by small and medium enterprises (SMEs). Despite their major percentages in comparison to large scale enterprises, they are inefficient to produce consistent volume of outputs and also have difficulties to comply with food safety and hygiene standard (PEMANDU, 2010).

Another emerging issue that has raised concern is that the food processing sector is greatly affected by the rising overhead costs (SMEECorp, 2010). In effort to resolve this dispute, food SMEs generally tend to react with unplanned cost cutting and fail to see the importance of applying sustainability practice in their operation. Failure to manage sustainability elements such as energy and water can potentially lead to higher overhead cost for SMEs as well as brings negative impacts to environment and social (Azapagic et al., 2006).

The issues of food hygiene and lack of sustainability can be found in the basic design of the food factory itself. Surrounded by many challenges, SMEs tend to overlook or ignore the importance of considering hygiene and sustainability during design. Failure to make such considerations produces a design of factory with many errors, which emerge as manufacturing problems once the factory is built.

This paper attempts to present major challenges faced by SMEs in food processing sector and how these challenges affect the SME's capability to design a competent food factory. The two issues on hygiene and sustainability are analyzed in connection with SME's difficulties to design a good factory.

2. Food Manufacturing Premise

According to Malaysian Standard of Industrial Classification (2008), the food processing is a subsector that falls under the manufacturing sector (DOS, 2013). The subsector accounts for about 10% of Malaysia's manufacturing output (DOS, 2011). Out of 37 861 total SMEs in manufacturing sector, 6016 SMEs are involved in the processing and manufacturing of food and beverage products – making it the manufacturing subsector with the second largest concentration of SMEs (DOS, 2011). Also with this number, the Malaysian food processing can be stated as dominated by SMEs reaching to more than 96% establishments (MIDA, 2012).

In food supply chain described by Manzini and Accorsi (2013), manufacturing and processing are performed after consolidation and normally takes place in a food factory. A competent food factory that houses a reliable and responsive manufacturing system is a key factor that brings success to production. Nevertheless, a competent food factory cannot be achieved if the factory is poorly planned and designed. Unlike many other design situations, the design of food factory is unique compared to other types of factory due to the characteristics of raw materials and food products. Food are known as perishable items in which their shelf life and quality may be altered by many factors such as temperature, light, humidity, mechanical static and dynamic stress (Manzini and Accorsi, 2013). Most importantly, food need to be significantly safe and hygienic as it is directly consumed by life beings. For these reasons, the design of food factory involves series of decision-makings on both physical facilities i.e. the building and also the enclosed manufacturing system inside simultaneously i.e. process (unit operations), equipment, factory logistic, material handling etc. This is because both physical facilities and the manufacturing system of factory are integral part of the production process and contributes significantly to its success or failure.

Overall, the design task of a food factory needs to integrate several aspects simultaneously into a well-functioning manufacturing system such as food safety and hygiene, food process and technology, system engineering and information technology. Hence, it is not a trivial task and poses quite a problem to SMEs, in which this can be associated with some challenges faced by them. As a result, they end up designing and planning a factory that is inadequate for food production which causes many manufacturing problems once the factory is in operation.

3. Methodology

Based on review of journal articles as well as reports from Department of Statistics Malaysia (DOS), Small and Medium Corporation Malaysia (SMECorp) and Malaysia Productivity Corporation (MPC), the major challenges faced by SMEs in food processing sector are determined. It is also investigated on how these challenges influence the capability of SMEs in designing a food factory.

Two manufacturing issues i.e. low food hygiene and lacking in sustainability practice are identified to be problems that could arise due to poor design. The two issues were analysed in connection with SME's difficulties to design a hygienic, efficient and sustainable food factory. Here, lacking in sustainability practice is discussed in term of extensive use of water and energy. The analysis was based on a comprehensive review of Malaysian authoritative reports and data of journal articles, scholarly books and magazines, newspapers as well as information obtained from unstructured interview with authoritative and non-authoritative organization i.e. Food Safety and Quality Division (Ministry of Health), Small and Medium Corporation Malaysia (SMECorp), Standards and Industrial Research Institute of Malaysia (SIRIM) and National Consumer Complaints Centre (NCCC).

4. Results and discussion

This section is divided to two parts. The first part presents major SME's challenges in food processing sector. The second section analyses the issues of food hygiene and sustainability that arise during production in connection with SME's difficulties to design a competent food factory.

4.1. SME's challenges in food processing sector

Below are some of the major challenges faced by Malaysian SMEs in food processing sector that have been identified from literature and reports.

- Financial resources

Alam (2010) has quoted in his survey that previous literature has consistently shown that lack of financial resources is the main barriers for SMEs growth. His study found that financial barriers have the most significant impact on the growth of food processing SMEs. Another similar result was obtained by a survey conducted by Zain et al. (2012), in which respondents from SMEs in food industry have ranked financial issues as the most significant challenge. Some of the financial issues that have been constantly associated with SMEs are lack of collateral, complicated loan application procedure, high bank interest and difficulties in obtaining financial assistance and incentives either from bank or government agencies (Alam, 2010; Zain et al., 2012; Aris, 2007; Saleh and Ndubisi, 2006).

- Institutional barriers

Institutional barriers focus on firms' interaction with government, including legalization, taxation, and government support amongst other (Alam, 2010). Alam (2010) quoted that international studies by Zhou and Wit (2009) have reported that institutional barriers can be associated with bureaucracy, license refusal and public procurement regulations. In the context of Malaysia, a study by Senik (2010) indicated that governmental policy related barriers include lack of standardization, lack of transparency, incompetent implementations, mindsets of policymakers, regulations related barriers including long procession time and bureaucracy. With these findings, it shows that despite the active effort made by government such as the establishment of SME Corp. Malaysia and other agencies, national policies on SMEs and grants for SMEs, these efforts can still barely make their way to reach all SMEs successfully. APEC (1994) has reported that there are too many agencies or channels for SMEs without effective coordination and this perhaps leads to ineffective delivery of assistance, advisory services and other incentives to SMEs.

- Access to skilled human capital

Shortage of skilled human capital resources has been reported repeatedly in previous studies as one of the major constraints faced by Malaysian SMEs (Zain et al., 2012; Saleh and Ndubisi, 2006; Talib et al., 2013; APEC, 1994). In general the literature pointed out that there is a lack of skilled and talented workers (APEC, 1994; Talib et al., 2013, Zain et al., 2012). The lack of skill is especially obvious in view of ICT and technology utilization,

involvement in research and development activities, technical professional, management expertise and entrepreneurial skills (Zain et al., 2012; Hoq et al., 2009).

- Lack of knowledge

According to Talib et al. (2013), SMEs are business entities that experience problems in expending and succeeding due to lack of knowledge and eventually the actual know-how. One of the reasons is that most SMEs (especially micro and small enterprises) are family businesses and a technical expertise is often 'passed down', which may lag behind modern technology and may not be the most innovative for the company's good (The Business Times, 2014). Such 'training' is not organized and gives no continuity (The Business Times, 2014). Another reason is that SMEs cannot afford the cost of research and are very dependent on external knowledge to improve their business (Braun and Hadwiger, 2011). Most of large enterprises have their own research and development department and laboratories that can conduct research and experiments in order to pursue new findings, knowledge and innovation (Braun and Hadwiger, 2011). However it has become increasingly difficult to access their findings due to company confidential policies and commercial competition. Therefore, SMEs are turning to public bodies such as government agencies, research institutes and universities for knowledge and trainings. Successful knowledge transfer between these organizations and the industries is yet still questionable since many SMEs until now especially in food processing are still having difficulties to run their production smoothly (Alam, 2010; Zain et al., 2012).

4.2 Manufacturing issues due to poor factory design

The above challenges influence the capability of SMEs to design and build a competent food factory. This section highlighted two manufacturing issues that have arisen due to poor factory design once the factory is in operation. These issues are sustainability practice and food hygiene.

4.2.1 Sustainability

A study called Kajian Sumber Air Kebangsaan has reported that water demand is expected to increase by 63% for domestic, industrial and drainage sector i.e. 10,833 million meter cubic in year 2000 to 17,675 meter cubic in 2050 (WECAM, 2012). While currently Malaysia is consuming water 70% more than the recommended usage by United Nation, the ability of Malaysia to sustain its potable water source and meet the water demand has become questionable (WECAM, 2012). By using the raw data obtained from the National Water Services Commission (2014) and the Department of Water Supply (2014), the water consumption based on volume million litre per day (MLD) by non-domestic sector is analysed. The non-domestic consumption refers to water consumption in commercial establishments, industries, construction sites and offices. It can be stated that water consumption by this sector shows increasing trend from year 2006 to 2013 (Fig. 1). By using the latest data from the Department of Statistics (DOS, 2010), it was found that the food processing contributes about 7% to non-domestic water consumption and also is the third highest water consumer in manufacturing sector (Fig. 2).

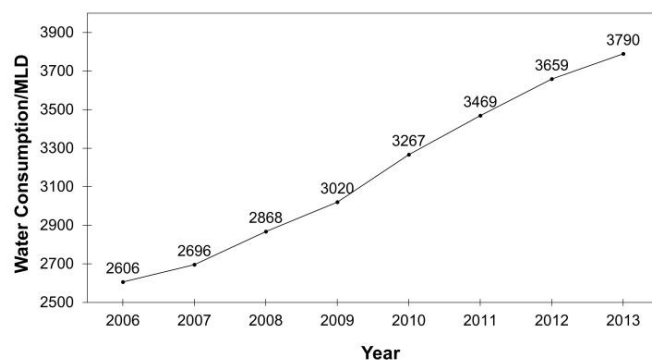


Fig. 1. Water consumption in non-domestic sector (Adapted from National Water Services Commission 2014 and Department of Water Supply 2014).

Worryingly, the demand of industrial water usage is expected to increase as high as 9756 MLD in 2020 and this will exceed the limit of maximum supply of river basins (Seong, 2013). Furthermore, shortage of potable water has been reported in many states and city centres where water demand is high. The intensive use of water in food processing may be attributed to the fact that water has always been a main processing medium throughout all steps in the food process either as an ingredient or as a process aid (Lee and Okos, 2011). In most type of food product manufacturing, major quantities of water are used in equipment washing processes, as well as in sanitation, cooling, pumps, package processing, utilities and auxiliary wants.

Meanwhile, the energy consumption in food industry has been identified as one of eight most intensive in the country (PEMANDU, 2010). Based on the latest data provided by the Department of Statistics (2010), the analysis shows that in term of electricity consumption, the food processing sector is fifth highest in manufacturing sector (Fig. 3). In term of energy obtained from fuels, the consumption of diesel oil and furnace oil is the highest, petrol is the second highest, liquid petroleum gas and natural gas is the third highest in manufacturing sector (Fig. 4 and 5).

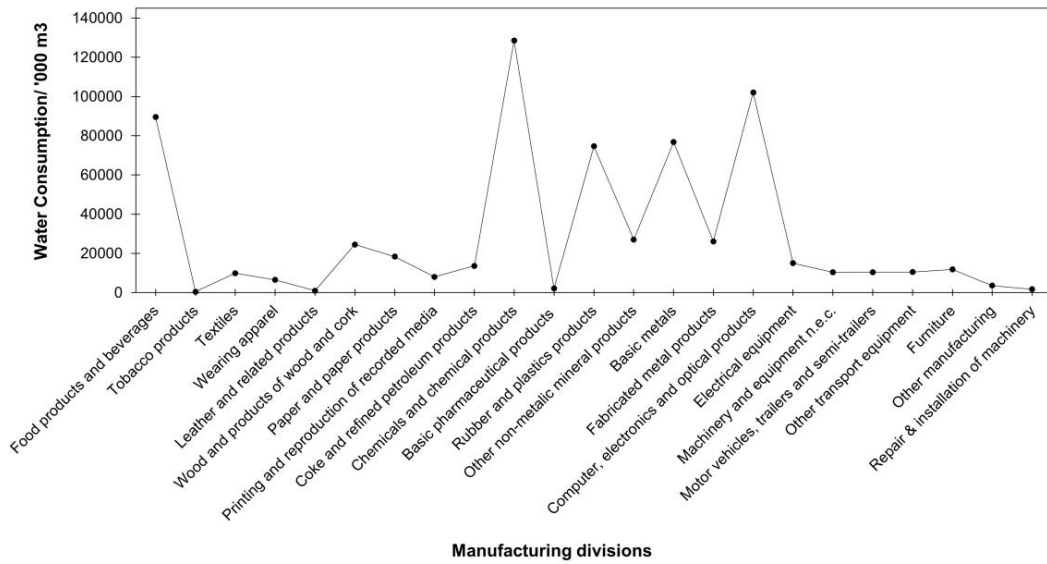


Fig. 2. Water consumption in food and beverage processing in comparison to other manufacturing (Adapted from Department of Statistics Malaysia 2010).

The high consumption of energy and water in comparison to other subsectors in manufacturing can be attributed to the high number of establishments in the sector. Furthermore, the fact that SMEs make up the vast majority of food processing may also be the cause. According to study by Koe and Majid (2013), despite the positive perception of SMEs in Malaysia towards sustainability, the actual practice among SMEs was still low. The study also stated that many SMEs take in sustainability practice as rather new (Koe and Majid, 2013). Moreover, the challenges faced by SMEs as described previously put them in unfavourable position to face new concerns and adjustment issues that could arise from sustainability practice (Burhanuddin et al., 2013).

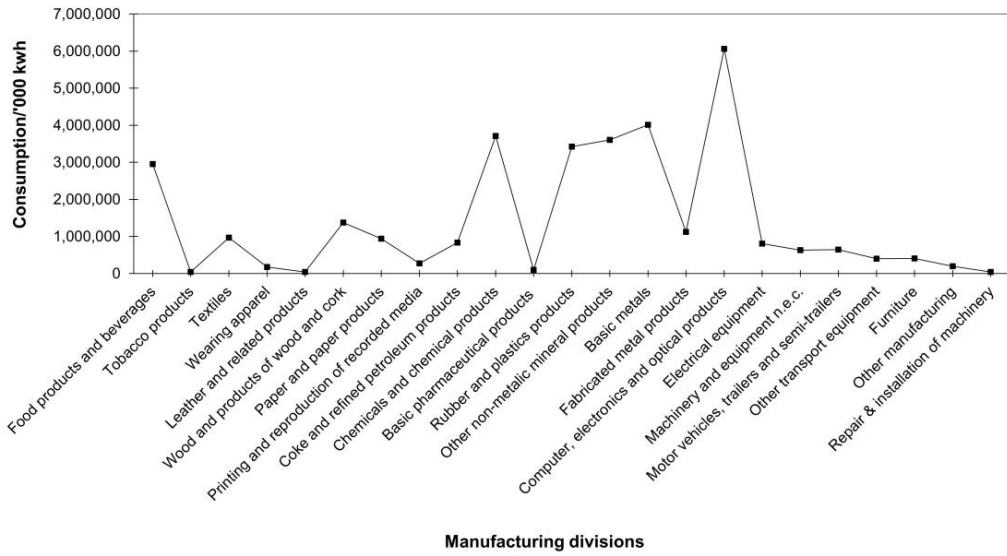


Fig. 3. Consumption of electricity according to manufacturing divisions (Adapted from Department of Statistics Malaysia 2010).

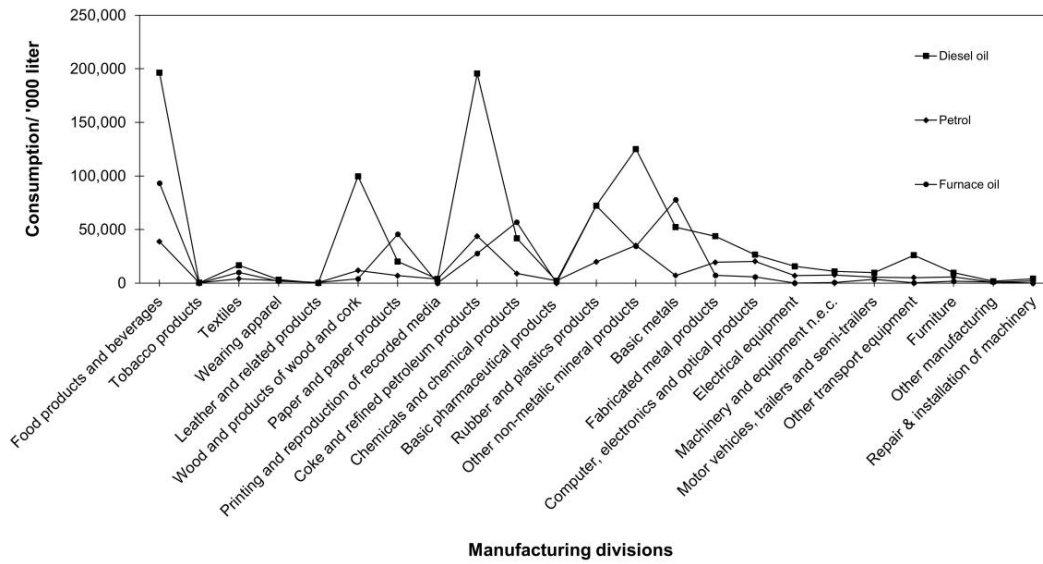


Fig. 4. Consumption of diesel oil, petroleum and furnace oil according to manufacturing divisions (Adapted from Department of Statistics Malaysia 2010).

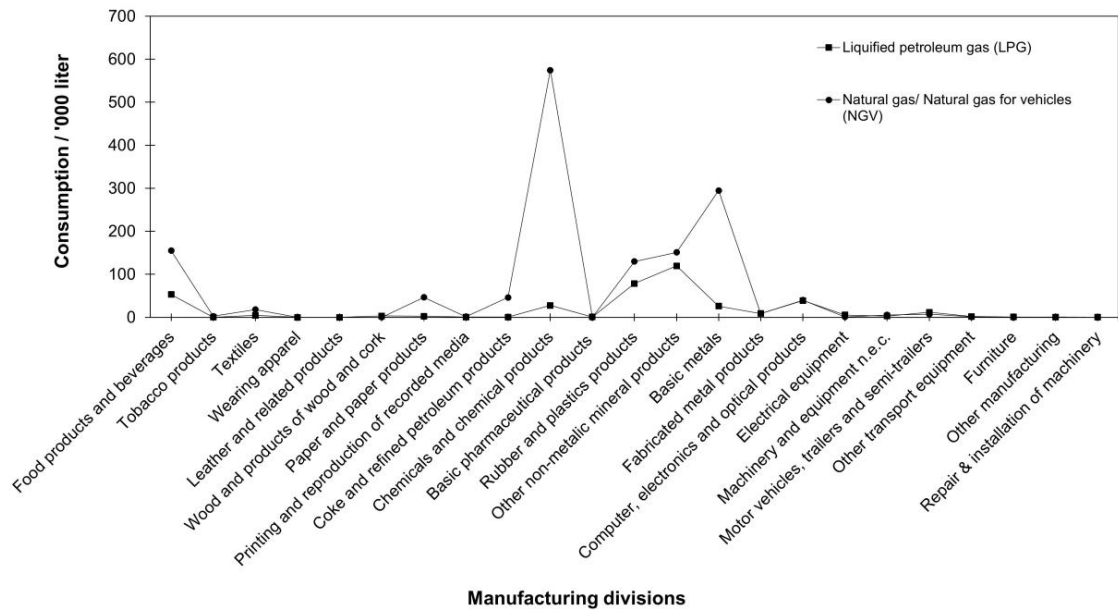


Fig. 5. Consumption of liquid petroleum gas (LPG) and natural gas/natural gas for vehicles (NGV) according to manufacturing divisions (Adapted from Department of Statistics Malaysia 2010).

4.2.2 Hygiene

In recent years, there have been quite a number of food hazard incidences that are often linked to the condition and infrastructure of the factory being unhygienic and improper for food production. Some of the shocking finds exposed by newspapers discovered that the local factories were seen with rats, cockroaches and maggots. The raids also revealed that the floors were dirty and slippery and waste were not segregated systematically. Also, the factories were found to have poor drainage, badly-lit and poorly-ventilated. There were factories that do not provide grease trap and do not have well-functioning cold-room.

The effectiveness of the current enforcement on food safety assurance system become questionable with the recurring incidents of food hazard cases. Therefore, National Consumer Complaints Centre (NCCC) has been recommending for years that the systems Hazard Analysis and Critical Control Points (HACCP) and Good Manufacturing Practice (GMP) should be elevated into regulation and be made as mandatory food safety assurance system in Malaysia (Standard Users, 2008). The effectiveness of HACCP in ensuring food safety and GMP in ensuring food hygiene has become internationally recognized and many developed countries have integrated or are in the process of integrating the HACCP system into their regulatory mechanisms. This recommendation by NCCC is yet still heavy for Malaysian food industry especially for Small and Medium Enterprise (SME) to fulfil. This is verified by the low number of food establishments that have successfully obtained HACCP and GMP certificates as shown by the analysis (Fig.6). The analysis was performed based on the latest record obtained from agencies Food Safety and Quality Division and the latest census by Department of Statistics. Realizing the difficulties of Malaysian industry players particularly SMEs in complying with HACCP and GMP, the Ministry of Health had introduced Skim Jaminan Keselamatan 1Malaysia (SK1M) programme in November 2010. In 2012, SK1M has been redesigned and renamed as Skim Pensijilan "Makanan Selamat Tanggungjawab Industri (MeSTI). MeSTI is an improved scheme that aims to increase the capability of SMEs to implement food safety assurance and consequently comply with Food Hygiene Regulations 2009. MeSTI is however only recognized at national level.

Based on the Figure 6, it can be concluded that the percentages of food processor that are able to meet the accepted international and national level of food safety and hygiene are still low in Malaysia. More importantly, these percentages included the multinational companies which implied that the percentages of certified SME companies are less than the above percentages.

SMEs have greater obstacle in implementing HACCP and GMP due to many reasons. One of the reasons that are highlighted by World Health Organization is inadequate infrastructure and facilities in SMEs factory which make it difficult to fulfil HACCP and GMP. This barrier is attributed to the design of the factory itself. Due to lack of knowledge, some SMEs are not aware of the HACCP and GMP importance and tend to plan their factory without the readiness to invest for design that meet HACCP and GMP requirements. Furthermore, due to financial constraint some of them do not afford to finance the high costs of consultancy for implementation of HACCP and GMP. It is therefore very common to find SMEs running their food production in houses or shop-lots converted into factories, whereby the conditions are filthy and unhygienic, for example with broken walls, floor and ceiling.

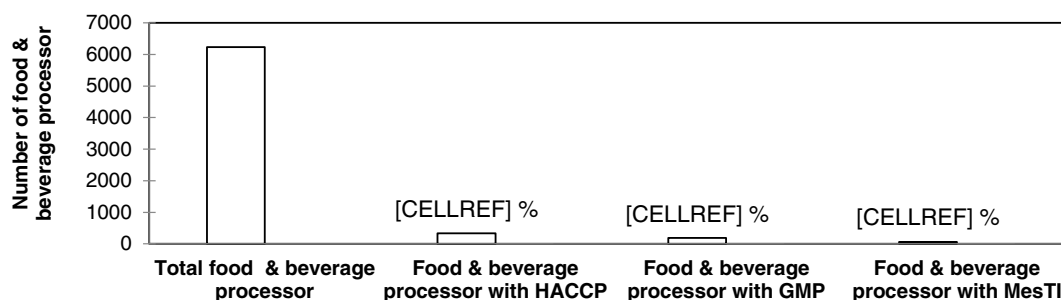


Fig. 6. Food and beverage processor with certificates (Adapted from Food Safety and Quality Division 2014 and Department of Statistics Malaysia 2011).

5. Conclusions

This paper presented the major challenges faced by Malaysian SMEs in food processing sector and how these challenges weakened their capability to design a competent food factory. As a result, they tend to focus only on reducing cost and maximizing financial return at design stage. With these priorities on mind and challenges at hands, it has been identified that two important manufacturing issues could arise later when the factory is in operation i.e. unsatisfactory food hygiene and lacking in sustainability practice. These issues affect their survival and cause setback of growth. It is recommended that research communities to help SMEs particularly in delivering knowledge on food factory design technique. Research finding and know-how on different approaches for achieving food hygiene and sustainability should also be delivered to SMEs. With this effort, SMEs will be able to benefit from the potential advantages of a good factory design such as compliance with food hygiene standards, reduction in manufacturing cost as well as increase in profit margin.

Acknowledgements

This study is part of research project on optimum factory design for food SMEs in Malaysia and is supported by Universiti Putra Malaysia Grant. The authors thank Department of Statistics Malaysia (DOS), Small and Medium Corporation Malaysia (SMECorp), Ministry of Health Malaysia (MoH) and to all people who have contributed to this study.

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Accepted for oral presentation in CAFEi2014 (December 1-3, 2014 – Kuala Lumpur, Malaysia) as paper 198.