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Productivity in Food Manufacturing (FM) Sector

1. An Overview of Food Manufacturing Sector in Singapore

From 2009 to 2013, Singapore food manufacturing statistics and trends show an increase in the number of workers, starting with 25,984 in 2009 and increasing to 29,071 in 2013. Total output (\$m) increased from 6,893 to 9,690. Establishments decreased by one, from 845 to 844. Contribution to the GDP started and ended at 0.7 percent. Figure 1 shows a summary of these statistics.



Figure 1: Food Manufacturing Statistics

Source: <http://www.spring.gov.sg/Developing-Industries/FM/Pages/statistics-food-manufacturing.aspx>

2. Productivity Challenges I the FM Sector

Environmental and health concerns affect food manufacturing at all levels. Salmonella and other food-borne sicknesses result in destroying tons of fresh crops and canned and frozen foods. The industry needs to adopt and enforce standard hygiene requirements to reduce the loss.

What drives the market? Consumers have less money to spend at a time when raw material prices have increased. Food manufacturers need to develop new processes and products to match what the public is willing to buy. Take pride in reducing carbon footprint by reducing carbon emissions and using recycled materials when possible.

Three specific challenges impacted productivity in the food manufacturing sector. There is a low number of skilled labour and minimal ability to recruit and keep qualified employees. Singapore is slow to adopt productivity improvement tools and automation. Economic and innovative motivation is lacking, preventing the creation of higher value added products.

The ability to reduce costs is a major challenge. Spending power has decreased over the last five years while raw material prices have risen. Transportation and hygiene are an additional expense. A portion is charged to the consumer. Product turnover and handling methods are faster and better handled with robots. They help fulfill the increasing varieties and quicker deliveries in demand by businesses and consumers.

Tetra Pak Inc. U.S. & Canada commissioned an in-depth report comprising qualitative data and 50 interviews with manufacturers and other beverage industry stakeholders and found eight global trends that are expected to dominate food and beverage manufacturing by 2020.

These are:

1. Plant efficiency is critical to long-term survival.
2. Consumers demand more diverse products
3. Food safety takes centre stage
4. Developing markets hold the key to success
5. Sustainability becomes a core business practice
6. Retail brands gain market share
7. "Company size matters" as consolidation speeds up
8. The value chain gets a makeover

source:http://campaign.tetrapak.com/tetra-brik-edge/upload/tb-edge/whitepapers/Whitepaper_Manufacturer_Trends.pdf

Three of these take center stage because they are a pathway to success:

1. Consumers will continue to demand more diverse products.
2. Sustainability will be an important part of doing business.
3. The key to success will be developing markets.

3. Enablers and disruptive technologies to boost productivity in the FM sector

3.1 Food production requires a strong base and modern technology to boost productivity.

SPRING continues to be an integral enabler in promoting a strategic food manufacturing plan. Industry specific productivity metrics are being developed in conjunction with key industry leaders such as Singapore Food Manufacturers' Association (SFMA). SFMA will support local food manufacturers through broad-based initiatives and benchmarking their businesses internationally as well as locally.

Information that enhances productivity understanding and awareness will be dispersed through conferences, seminars, and workshops. A group of local productivity consultants will receive training so that they can guide food manufacturers on workflow redesign and process streamlining.

Businesses will be encouraged to use productivity tools like lean manufacturing and the self-help toolkits and schemes to upgrade branding, technology innovation, and marketing. The launching of a food automation resource will explain updates and advantages of developing customised automation solutions that increase production. Figure 2 shows an example of the use of robotics to improve efficiency of food and beverage production.



Figure 2: An example of industrial robotics to improve efficiency of food and beverage production
Source: newfoodmagazine.com

Deloitte's research (refer to Figure 3) has presented that the current benefits of edible Additive Manufacturing (AM) include product differentiation, product customisation, and direct-to-consumer relationships. There are indications that this may lead to more evolutionary capabilities, such as the creation of unique food formulations for dietary needs, 4 simplified distribution into hard-to-reach locations, and customised medical/nutritional supplements. Use this framework as a guide on deciding how your company can benefit from AM.

3.2 Build and properly use a skilled workforce

Distribution and logistics require a significant amount of time and money. Food manufacturers will be encouraged to concentrate on their duties in the supply chain and outsource the tasks that fall within another company's specialty.

SPRING will provide support to business leaders and middle management through the Business Leaders Initiative. There will be an expansion of the current pool of food technologists, who will then help food manufacturers quickly get their R & D capabilities up and running. Singapore Workforce Skills Qualifications (WSQ) courses will continue to be updated and available from Food Innovation & Resource Centre (FIRC) at Singapore Polytechnic. Classes include packaging technology and food safety and hygiene practices. Sunny Koh, a member of the Board of Directors for the Singapore Manufacturing Federation (SMF), stressed the importance of catering to international market demands when a food marketing business wants to increase orders and its niche in the food industry. Reallocation of employees to more productive work builds self-esteem and the desire to remain with the company.

Automation, particularly robotics, handles repetitious processes like packaging. **Chinatown Food Corporation Pte Ltd** raised productivity and saved money by investing in a conveying system to move products from one area to another. The workers who previously pushed goods on trolleys back and forth were able to perform more productive work.



Figure 3: Deloitte's Additive Manufacturing Framework – Options for deploying AM

Source: <http://dupress.com/articles/3d-printing-in-the-food-industry/>

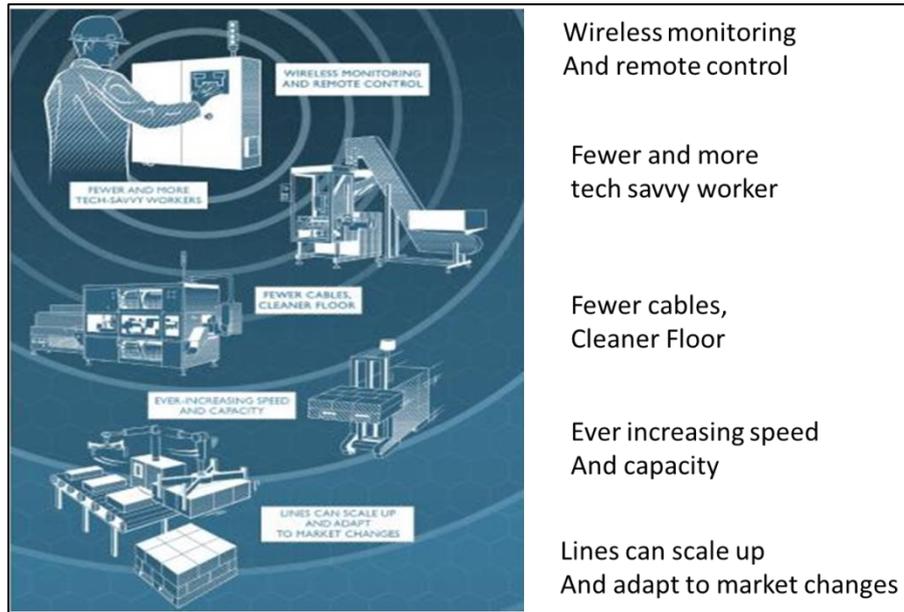


Figure 4: Food Conveying System

Source: <http://www.dairyfoods.com/articles/88168-watching-mars-make-dove-bars--snickers-ice-cream-cones?v=preview>

4. Possible Immediate Actions

Imagine what the plant of the future would look like with wireless monitoring and remote control, few and more tech savvy worker, few cables and cleaner floor, ever increasing speed and capacity to fulfill orders and having production lines that can adapt to rapid market changes. Sounds impossible? The application of innovative technologies in the ensuing sections shows that it is within reach.



Wireless monitoring
And remote control

Fewer and more
tech savvy worker

Fewer cables,
Cleaner Floor

Ever increasing speed
And capacity

Lines can scale up
And adapt to market changes

4.1 Immediate innovative techniques generate higher value for growth

The global demand for functional and nutritious food continues to grow. The demand is expected to exceed SGD 160 billion in 2015. Food quality and safety must keep pace or exceed the demand. The food industry in Singapore holds a good reputation for food hygiene standards. Singapore is in the position to capitalise on that reputation while developing functional and nutritious foods.

Advanced Frontier used innovative techniques to generate productivity and consumer demand in their product. Today's healthier lifestyle trends encouraged the manufacturer of collagen enriched beverages to be innovative with higher value-add. The response has driven company growth. Collaboration with the Food Innovation and Resource Centre (FIRC) brought about the company's successful collagen-enhanced beverage, Colla-e. It was an immediate response to consumer taste and desires.

4.2 People are at the heart of every company.

There is a burden to determine immediate techniques to recruit and retain the best talent so companies are competitive. The tight labour market must be regarded in a different way. No employee looks for the same things in a job. Enhanced food manufacturing is possible with additional training, challenging positions, and a comfortable work environment. Those measures reward contributions of employees and encourage growth, providing employee stability. Companies should develop a nurturing, open employment environment that retains and recruits the best employees.

Educate yourself and your employees regarding streamlined practices that allow rapid product designs. Analyze steps that would be better done by a robot, freeing up valuable time for employees to do other projects. Encourage teams to submit ideas for improvement in achieving productivity goals. Recognition of their contributions and concern will encourage your knowledgeable team to remain with the company.

Case Study

Case Study: Local – Q.B. Food Trading Pte Ltd Robotic Arms Raise Singapore’s Food Manufacturer Productivity

According to Deputy Prime Minister Tharman Shanmugaratnam, robotic arms have proven to be an impressive way of increasing Singapore’s food manufacturing production volume. The robotics have increased volume by 60 percent and doubled its output per worker.

Robotic arms to increase production and reduce reliance on manpower. Local food processing company Q.B. Food Trading Pte Ltd specialises in the import, processing and distribution of frozen, chilled and dry products. One of the few food manufacturers utilising robotics similar to those used in Engineering and Automotive sectors, it has watched productivity increase by optimising this technology.

Support from SPRING Singapore’s Capability Development Grant (CDG) enabled Q.B. Food to begin a project regarding installation of a cheese fabrication line in May 2012. The proposed cutting and packing line required several necessary machines from Europe, including a cheese-cutting machine, packing machine, and robotics pick-and-place system. The project was completed in June 2014.

Since that time, worker output has doubled. Production volume increased 60 percent, from 40,000 portions of cheese to 64,000 portions daily. Labour reliance has reduced from four to three workers for the process. The risk of contamination is minimised because of reduced human contact. Safety and quality assurance benefit from the automated project. The company is in a position to increase sales with a line capable of producing as much as 80,000 portions a day.



Figure 9: Q.B. Food
Source: <http://www.qbfood.com.sg/path/>

DPM Tharman has commented on the potential for further growth due to appealing, safe, trusted food products and the ability to improve productivity even further by using robotics in food production. Q.B. Food, for example, currently exports to Indonesia, Cambodia, and Malaysia. Expansion into new markets is currently in the planning stage.

Overseas Cases of Applications of Robotics

1. Robotics increase food and beverage production

European food manufacturers face stiffer market competition and increased labour costs. The addition of process automation has increased productivity and improved quality and safety. The same process reduces production errors. Technology such as robotics has been used in the non-food segment for some time. It has recently been adapted to a wide variety of applications in the food sector, such as:

- Stir and transfer cheese moulds.
- Turn, cut, portion, package, and palletize cheeses.

The Netherlands is the world's second largest exporter of agricultural products. Dutch robotics specialists like Lely, PWR Pack, and Lacquey BV developed robotics technology that answers the food sector industry's need to remain competitive in fulfilling consumer demands for a safe, fresh, fast food supply.



Figure 6: Robotics to boost competitiveness in F&B Industry

Source: <http://www.arisplex.com/analysis/robotics-to-boost-competitiveness-in-the-fb-industry/>

2. Pick-and-place snacks

Consumers prefer to purchase a variety of snacks in bundle packs. Popular savoury and sweet snacks frequently require gentle handling to avoid breakage and other damage during the packing process. PWR Pack is an expert in creating robotics capable of successfully handling picking and placing challenges.

A three-cell robot is at the heart of the snack complete line. It is designed to fill bundle packs with individually packaged products. Its three pick and place arms feature high performance mechanical-pneumatic grippers. The grippers precisely pick and place products like potato crisp packs.

PWR Pack's intelligent vision system provides high-tech quality control and perfect results by monitoring all running processes. Its platform independent sophisticated distribution software delivers seamless operations at optimum speed during all production stages.



Figure 7: Example of Pick and Place Robot
Source: bestinpackaging.com

3. Precision Gripping

The food manufacturing business also benefits from the special robotic hand similar to the one previously mentioned. It was thought of by Lacquey BV and developed using food grade parts and materials at TU Delft Robotics Institute with TU Delft's under-actuation technology. The hand grips the product, regardless of its size, with precision. Finger position is determined by the even distribution of torque over contact surfaces rather than by a sensor. A universal control box regulates grip force and closing speed.

The robot grippers handle different kinds of products and have an operational lifetime of 5 million or more cycles. Fruits and vegetables are picked up and sorted without bruising or damaging produce. Global food manufacturing producer Food Technology Noord-Oost Nederland BV (FTNON) produced a majority share of Lacquey in March 2015. Plans are to take the system to the international market and to fund the company to enhance productivity of confectionery and baked goods by using this same type of technology.



Figure 8: Lacquey's gripper
Source: <http://www.bobbierobotics.nl/partners>

6. Conclusion

In conclusion, it is useful to recall Mr Gan Kim Yong's speech given at the Food Productivity Conference 2014. He highlighted the need for the food industry to innovate to generate higher value for growth through collaborating with partners, taking advantage of technology and focusing on people. Leverage on available government funding to support your productivity initiatives.

Recommended Readings

Title: Robotics and Automation in the Food Industry: Current and Future Technologies
Author(s): Darwin G Caldwell
Publisher: Elsevier
Year of Publication: 2012
ISBN: 9780857095763

Title: Process Analytical Technology for the Food Industry (Food Engineering Series)
Author(s): Colm P. O'Donnell (Editor), Colette Fagan (Editor), P.J. Cullen (Editor)
Publisher: Springer
Year of Publication: 2014
ISBN: 978-1493903108

Title: Food and Drink - Good Manufacturing Practice: A Guide to its Responsible Management (GMP6) 6th Edition
Author(s): Institute of Food Science and Technology , Louise Manning
Publisher: Wiley-Blackwell
Year of Publication: 2013
ISBN: 978-1118318201

Publications which are in the holdings of the National Library or Public Libraries are denoted by [call number] at the end of each reference. Please check the library's online catalogue to confirm the availability.

References

AsiaOne, Singapore Press Holdings. (2012, October 12). Innovation, productivity, key to growing food manufacturing industry. Retrieved August 12, 2015 from <http://news.asiaone.com/News/Latest+News/Singapore/Story/A1Story20121012-377300.html>

Ferrer, M. (2014, October 15). What will the plant of the future look like? Retrieved August 12, 2015 from <http://www.packagingdigest.com/automation/what-will-the-plant-of-the-future-look-like141015>

Food Innovation and Resource Centre (FIRC) @ Singapore Polytechnic . (n.d.). Productivity Improvement Through Food Automation . Retrieved August 12, 2015 from <http://www.firc.com.sg/wp-content/uploads/2014/03/fau2.pdf>

Gotfredsen, S. (2014, June 30). Robots: boosting efficiency and safety for small manufacturers. Retrieved August 12, 2015 from <http://www.foodmag.com.au/features/robots-boosting-efficiency-and-safety-for-small-ma>

International Enterprise (IE) Singapore. (2014, April 8). Embracing technology to cope with challenges. Retrieved August 12, 2015 from <http://www.iesingapore.gov.sg/Venture-Overseas/Browse-By-Sector/Lifestyle->

[Business/Food-Products/News/mc/News/2014/4/Embracing-technology-to-cope-with-challenges](http://www.iesingapore.gov.sg/Venture-Overseas/Browse-By-Sector/Lifestyle-Business/Food-Products/News/mc/News/2014/4/Embracing-technology-to-cope-with-challenges)
Labs, W. (2015, August 6). The State of Food Manufacturing: It's all about throughput. Retrieved August 12, 2015 from <http://www.foodengineeringmag.com/articles/94287-the-state-of-food-manufacturing-its-all-about-throughput>

Ministry of Trade and Industry Singapore. (2014, September 24). Robotic Arm Raises Productivity for Food Manufacturer. Retrieved August 12, 2015 from <https://www.mti.gov.sg/NewsRoom/SiteAssets/Pages/Robotic-Arm-Raises-Productivity-for-Food-Manufacturer/Media%20release%20-%20NPCEC%20visit%20to%20QB%20Food.pdf>

- Porter, K., Phipps, J., Szepkouski, A. & Abidi, S. (2015). 3D opportunity serves it up: Additive manufacturing and food. Retrieved August 12, 2015 from <http://dupress.com/articles/3d-printing-in-the-food-industry/>
- Refrigerated & Frozen Foods. (2015, March 12). Linde Impingement Freezer Answers Need for Productivity, Efficiency, Yield. Retrieved August 12, 2015 from <http://www.refrigeratedfrozenfood.com/articles/88964-linde-impingement-freezer-answers-need-for-productivity-efficiency-yield>
- Refrigerated & Frozen Foods. (2015, February 10). New freezer technology creates quick-frozen produce. Retrieved August 12, 2015 from <http://www.refrigeratedfrozenfood.com/articles/89011-new-freezer-technology-creates-quick-frozen-produce>
- Saravanan P., & Sathish Kumar S. (2013, January-March). Sensor Grid Middleware Architecture for Food Quality Control Units. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 4(1). Retrieved August 12, 2015 from [http://www.rjpbcs.com/pdf/2013_4\(1\)/\[112\].pdf](http://www.rjpbcs.com/pdf/2013_4(1)/[112].pdf)
- Scientist Live. (2013, April 1). Improving production efficiency by automating the food industry. Retrieved August 12, 2015 from <http://www.scientistlive.com/content/9311>
- Scientist Live. (2013, March 4). Manufacturing execution system boosts accuracy and transparency. Retrieved August 12, 2015 from <http://www.scientistlive.com/content/20280>
- SPRING Singapore. (2015, July 22). Food Manufacturing. Retrieved August 12, 2015 from <http://www.spring.gov.sg/Developing-Industries/FM/Pages/food-manufacturing.aspx>
- SPRING Singapore. (2015, July 22). Statistics: Food Manufacturing. Retrieved August 12, 2015 from <http://www.spring.gov.sg/Developing-Industries/FM/Pages/statistics-food-manufacturing.aspx>
- SPRING Singapore. (2014, October 27). Speech by Mr Gan Kim Yong at the Food Productivity Conference 2014. Retrieved August 12, 2015 from <http://www.spring.gov.sg/NewsEvents/PS/Pages/Speech-by-Mr-Gan-Kim-Yong-at-the-Food-Productivity-Conference-2014-20141027.aspx>
- SPRING Singapore. (2011, November 17). SPRING Invests \$45 Million in Food Manufacturing Industry to Improve Productivity by 20 percent. Retrieved August 12, 2015 from http://www.news.gov.sg/public/sqpc/en/media_releases/agencies/spr%20spore/press_release/P-20111117-1
- Studwell, L. (2015, June 24). 6 ways robots improve food and beverage operations. Retrieved August 12, 2015 from <http://www.packagingdigest.com/robotics/6-ways-robots-improve-food-and-beverage-operations>
- Šuška, M. (April 24). What is FTIR Spectroscopy and How Could It Help in the Food Production Process? Retrieved August 12, 2015 from <http://www.qualifoodacademy.com/posts/what-is-ftir-spectroscopy-and-how-could-it-help-in-the-food-production-process>
- Sweerman, S. (2015, August 3). Robots Move Upstream. Retrieved August 12, 2015 from <http://www.asiafoodjournal.com/article/robots-move-upstream/11815>
- Tetra Pak International S.A. (2012). 2020 Vision: 8 Global Trends That Will Dominate Food and Beverage Manufacturing in the Next 8 Years. (2011). Retrieved August 12, 2015 from http://campaign.tetrapak.com/tetra-brik-edge/upload/tb-edge/whitepapers/Whitepaper_Manufacturer_Trends.pdf