PROGRAM FRAMEWORK FOR AGROFOOD INDUSTRY 4.0 COACHING

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1.0 Introduction

As land for agriculture becomes increasingly scarce, technology adoption has been the key driver to boosting agro-food yield and profitability around the world. Thus, the Malaysia Productivity Blueprint (MPB) proposed one of its initiative which aims to improve the awareness of technology applications in the agro-food subsector and support technological upgrades and modern farming techniques, particularly among SMEs.

The Blueprint calls for the development of tailored technologies that are suitable and cost efficient for small local players, such as digital tools from drones, robotics, remote sensing and cloud-based farm management systems under precision farming. To ensure SMEs understand the importance of technological improvements and are receptive to new ways of working with the tailored technology, information on programmes focused on technology adoption for agro-food players will be disseminated. Targetted training programmes will be launched to boost the adoption of productivity-enhancing technologies by SMEs. The impact of technology on productivity will be measured and tracked to extract key lessons for continuous improvements.

As such the aim of this document is to facilitate Agro-Food Productivity Nexus (AFPN) appointed coaches to design coaching programs for agro-food players in Malaysia, in order to create awareness & understanding on the values and importance of the implementation of the industry 4.0 technologies, as well as to prepare them for the transformation.

2.0 Problem Statement

The adoption of digital and computing technologies in the agro-food sectors in Malaysia is still primitive. This phenomenon has resulted to inefficient operations, low yield and productivity, hence, leads to low profitability of the agro-food entrepreneurs.

The low profitability in agro-food industry has caused the shrinking community size in this sector. The low efficiency in operation has also resulted agro-food a labour intensive industry, which discourages new ventures into this sector. This will poise the food security issues, for it has been a real challenge due to climate change, reduced arable land due to pollution and salinization.

3.0 Objectives

The key objective of this framework is to facilitate the coaches to develop the coaching program for agro-food players, with the purposes of:

- To create awareness of industry 4.0 technologies to the agro-food players, specifically on IoT, Big Data Analytics, Cloud Computing, Advanced Robotics & Artificial Intelligence;

- To understand the areas of application of the above-mentioned industry 4.0 technologies and the values which they would bring; and

- To prepare the agro-food players for the adoption of the industry 4.0 technologies through sharing success stories of the early adopters.

4.0 Methodology

The content of the coaching program shall be delivered through virtual platform or face-to-face (if necessary), depending on the availability of both coaches and coachees, and it shall consist of the following:

4.1 Introduction of industry 4.0 & its technologies

4.1.1 Introduction *of* industry 1.0, 2.0, 3.0, and 4.0

i) Industry 1.0: Steam powered machineries were used for production, mainly in manufacturing and transportation (ships and trains).

ii) Industry 2.0: Electric powered motors were used to create mass production with assembly lines.

iii) Industry 3.0: Electronics and basic computing technology were used to automate production.

iv) Industry 4.0: Leverage on advanced computing processing power, internet, advanced electronics and other digital technologies to create autonomous cyber-physical systems, which make the productions and processes highly efficient and convenient to use.

4.2 Design principles

4.2.1 Interoperability

All the stakeholders (devices, hardware, software, people, systems, etc) along the supply & value chain must be able to connect & communicate.

4.2.2 Transparency

The information of each stakeholder must be made available for other stakeholders along the supply & value chain if it's needed, to promote data & information sharing.

4.2.3 Decentralization

The decision making in the connected supply & value chain should be decentralized, for faster responding time interval and less dependent on the networking infrastructure.

4.2.4 Technical Assistant

The industry 4.0 technologies network is capable of self-diagnosis, self-healing, self-configure & self-optimize with minimal human intervention.

4.3 I4.0 Technologies in agriculture

4.3.1 Internet of Things

i) Networking and connectivity of smart devices, by attaching sensors to machines and other physical assets in the operational premises/farms, to generate and collect data.

ii) Data can be collected from the farm by using various sensors, to monitor various aspects of the farming environment, such as soil condition, ambiance condition, plant growing condition, etc.

iii) Actuators can be controlled to respond automatically to the sensors data, to create the optimal growing condition for the plants.

4.3.2 Big Data Analytics & AI

i) Process vast amount of data generated from the rest of the 8 digital technologies, and other stakeholders from the entire supply & value chain, for knowledge discovery to assist in both manual and automated decision making.

ii) Techniques such as machine learning, computer vision, signal processing, data mining etc. are used to produce instructions and decisions to maintain the optimal growing conditions for plants, hence maximise yields quality and productivity, and minimise operational cost and human labours.

4.3.3 Cloud Computing

i) Provide improved data storing and processing facilities via advanced network infrastructure and computing technology.

ii) Comprehensive data analysis and visualisation can be facilitated and provided at lower cost.

(Conduct a demo on IoT gateway, sensors and GUI)

4.3.4 Cyber Security

i) Provide protections to various system and safeguard data transmission by preventing potential cyberattacks.

ii) Technology such as gateways with pattern recognition features to detect network intrusions.

4.3.5 Advanced Robotics

i) Introduce collaborative robots to create a working environment, which human and machines can work together in a more interactive manner.

ii) Minimise the needs of manual labours in farming operations. Hence increase the efficiency and reduce risks of workplace hazards.

iii) Robots can be used for autonomous field plowing and mowing, sowing and planting, spraying pesticides at the precise points with accurate amount, harvesting and plucking, etc.

4.3.6 System Integration

i) Connect the fields to the offices, the vendors to the farmers, the farmers to manufacturers, the farmers to the consumers.

ii) Systems used by different parties can get connected via advanced networking technology.

iii) This can greatly optimise the entire farming business operation. With better system integration, farms can become more interconnected both externally and internally.

4.3.7 Additive Manufacturing

i) 3D printing can be used to create objects by using materials such as rubber, metal, and even graphite (or ceramic), which are very useful to create farming tools and parts for machineries, especially when these parts or tools are needed in a small amount.

ii) *3D printing is useful in getting parts and equipment's*

for designing and building the prototypes, of new farming approaches.

4.3.8 AR/VR

i) Provide illustration of the real word object and also computer-generated digital content and information through a device, such as a mobile phone or smart glasses.

ii) Provide a more interactive data visualisation and facilities control to the farmers, compared to the conventional dashboards and control panels.

iii) If the farmers are venturing into additional business models for the farm, for example, agro tourism, AR can provide a better and more informative visiting experience to the tourists.

4.3.9 Simulation

i) Reflect the physical world production processes in a virtual environment, using real time data.

ii) Simulators are used to run tests virtually, so that settings and configurations can be optimized and well-planned in more efficient way.

iii) This can avoid performing test on the real farms and machineries, yet still can reflect the actual behaviour of the system.

iv) By having the tests on virtual environment, the risks of misconfiguration and wrong settings can be reduced, hence avoid downtime and maximise the productivity.

4.4 The benefits of adoption of industry 4.0 technologies

4.4.1 Yield & Productivity Improvement

i) Appropriate farm settings and systems configuration with advanced infrastructure, devices and data analytic tools for decision making, can help in optimising the farming operations, hence maximise yields quality and productivity.

4.4.2 Operational Efficiency

i) Implementation of autonomous systems with high precision, which can operate 24/7 for various farming operations can minimise human labours in the farm, hence reduce the risk of workplace hazards.

4.4.3 New revenue & new business model on data

i) Being the pioneers in implementing smart farming technologies, the farmers can share their knowledge and experience by providing consultations and training to other farm operators.

ii) Farmers can also venture into new business models such as agro tourism and education.

4.4.4 Sustainable farming

i) Precisely controlled use of fertilisers and pesticides, appropriately treated discharge waste from plants and livestock, accurate land mapping and clearance, can reduce environmental pollution.

4.5 The implementation steps

Staged Approach from Pilot to Scale up – As the agro-food players understand the values of various industry 4.0 technologies, they should not be over ambitious to implement it at large scale. The transformation should be initiated with the pilot projects, and to consider scale-up once they have gained enough knowledge & experience through the pilot projects.

4.5.1 Identify process for pilot project

Agrofood players should identify a process which requires low budget, low technical requirement and can see immediate results for pilot project, such as installing IOT sensors and data visualisation dashboard to monitor the grow medium, etc.

4.5.2 Set goals

Agrofood players must be able to set measurable goals for the pilot project, such as improving yield and productivity (in %) or reducing human labours (in number).

4.5.3 Plan

To allocate budget for the pilot project, to decide on the project duration & technical support team, and also prepare contingency plan for unforeseen circumstances in the system installation.

4.5.4 Implement

Agrofood players should monitor the progress of system installation closely, and trigger the contingency plan when necessary.

4.5.5 Review

To compare the actual achievement with the goals which had been set for this project, and to explore the opportunities for further improvement.

4.5.6 Scale-up

To implement the system/solution at the large scale, or to identify new process for industry 4.0 implementation.

4.6 The success story(ies)

Coaches can consider quoting some examples from the successful implementations which have deployed advanced farming technologies, but the quoted examples must be relevant to the local farmers.

4.7 Assessment through questionnaires

This exercise is to determine the readiness of agro-food players on the pilot project, each question will carry 4 points for “strongly agreed”, 3 points for “agreed”, 2 points for “disagreed”, 1 point for “strongly disagreed”, the agro-food players who score 16 points or above will be considered as ready for the pilot project.

The questions are:

1) I have some good understanding of the industry 4.0 technologies.
2) I can identify the industry 4.0 technologies which are relevant to my organization.
3) I can understand the benefits of industry 4.0 in my organization.

4) I can identify the process/area in my organization which I can start to do the industry 4.0 pilot project.
5) I can estimate the length of time needed to install the system for pilot project.
6) I can estimate the cost of the pilot project.
7) I can estimate the period of ROI (Return on Investment).

The whole coaching program should take around 5 hours, it shall be constituted with:

Interactive Lectures (60%)

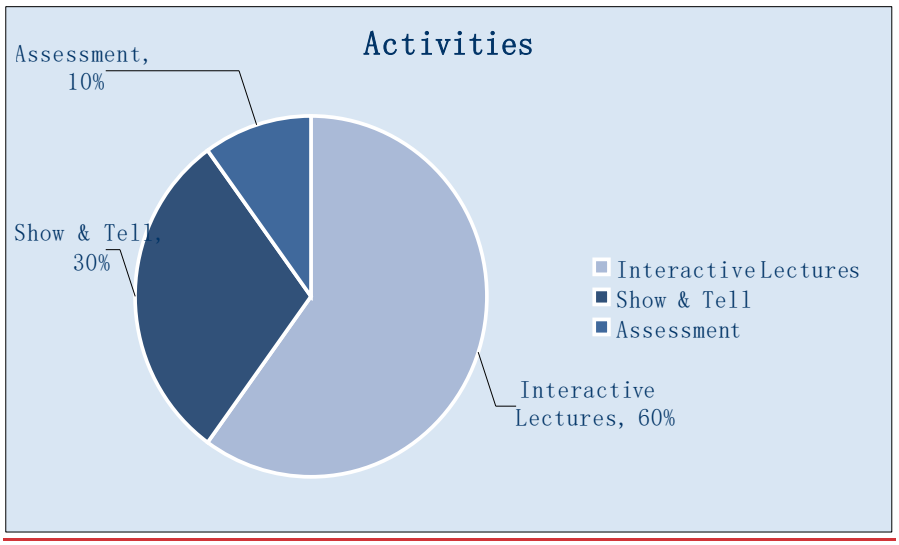
Interactive lecturing sessions to introduce the background and history of industry revolution to the coachees. Detailed orientation on industry 4.0, its nine pillars of digital technology, and the applications of these technologies in agrofood industry will be delivered to the coachees.

Show & Tell (30%)

Simulations and prototypes showcasing will be demonstrated to the coachees, in order to provide the basic understanding on the implementation of Industry 4.0 technologies in various applications in agrofood sectors. Success stories and experience of early adopters will be shared to the coachees

Assessment (10%)

Simple assessment will be carried out to the coachees at the end of the session to evaluate the level of understanding of coachees on the importance and benefits of implementation of Industry 4.0 technology in agrofood sector.



START

Introduction to the History of Industry Revolution

Briefing on Industry 4.0, and its Nine Pillars of Digital Technologies

Orientation of Relevant Industry4.0 Technologies and their Applications in Agrofood Sectors

Simulations and Prototypes Showcasing

Staged Approach Implementation

Success Stories and Experience Sharing

Assessment for Coachees

END

5.0 Qualification of Coaches

The coach should possess good communication skills, have in depth knowledge of industry 4.0 technologies and have experience in the industry 4.0 project implementation in the agricultural sectors. They should be passionate on seeing the local players enjoying the benefits of technology adoption and have experience on the coaching and training the industry players.

6.0 Benefits

At the end of each coaching session, the agro-food players will be equipped with the good understanding of industry 4.0 technologies and see clearly on the benefits of the adoption of these technologies in agro-food sector.

The agro-food players should see the relevancy of certain industry 4.0 technologies for their own deployment and define clearly value of the technologies in their organizations. With this, they shall be able to develop their own implementation blueprint.

The agro-food players shall be ready for small scale pilot project in their farm, which they will gain insight & experience for more serious deployment in future.

7.0 Assessment

Coaches shall design questionnaires to assess the understanding of coachees after the coaching session is finished. With an appropriate assessment to the coachees, the organiser can acquire the level of readiness of the coachees to initiate the pilot project, or if further coaching sessions are needed.

The assessment also helps the coaches to fine tune the way they conduct coaching and improvement their effectiveness in the future sessions.