DATA-DRIVEN PACKAGING PROCESS FOR BEST-FIT REPACK AND BUNDLE PRODUCTS

CONTEXT

Packaging, repacking and bundling of products is an important process to optimise for companies who want to obtain an advantage from their supply chain. This is especially so with increasing demand for hyper customisation from distributors, wholesalers and end customers. With the rising shift from on-time delivery to "now" delivery, there is strong momentum from the manufacturing industry to digitalise their supply chains for smarter, data-driven packaging that makes more sense.

Today, whether it is to customise the packaging options for end consumer or for wholesalers to resell in bulk, most of the kitting and packaging are still done manually today. It takes time and is laborious, with high margin of error (~5%) in the process of repacking into smaller denominations, wrapping and labeling the products with the right packaging. Furthermore, companies must deal with large quantities of SKUs, managing multiple product bundle variations and accordingly, multiple packaging permutations and considerations.

This increases the complexity and time taken for packing bundle goods, resulting in low throughput rates. Above all, there is also poor workplace safety – workers often use knives to cut in occasionally dim warehouse environments while working with a short turnover time crunch. Once packaging is completed, companies will need to deploy additional manpower to conduct quality assurance and quality control to verify that each box is packed with the right combination of products and accompanying items before items are finally shipped out.

As any supply chain that thrives on operational efficiency, manufacturers are incentivised to leverage on technology to make smarter, data-driven decisions for higher productivity. Thus, this challenge seeks to leverage on data sharing across entire packaging value chain to ensure more efficient packaging operations. This could be done by understanding the unique dimensions and packing requirements for each product, and intelligently picking the most optimal packaging method for each bundle to minimize cost and maximise production. Such automation would help companies streamline its packing process, while ensuring a standard of quality assurance and control, giving manufacturing firms a winning edge in today's fast moving consumer world.

This **ARTC Startup Challenge 2022** is organised by the Advanced Remanufacturing and Technology Centre (ARTC) in partnership with IMDA and A*StarCentral. The theme for the ARTC Startup Challenge 2022 is "**Automation 4.0**", and there are three challenges launched with IMDA's Open Innovation Platform.

The Advanced Remanufacturing and Technology Centre (ARTC) is led by the Agency for Science, Technology and Research (A*STAR), in partnership with the Nanyang Technological University, Singapore (NTU Singapore), with a membership consortium with over 80 members.

PROBLEM STATEMENT

How can we intelligently perform order picking and packaging in a smart and efficient manner for better efficiency and accuracy?

WHAT ARE WE LOOKING FOR?

A working prototype solution with data analytics and AI capabilities that can optimise the packing process by recommending optimal product bundling and packaging materials and learn to improve its recommendations over time. Overall, the proposed solution must reduce the effort and time taken to complete the packing process to improve efficiency and ensure a greater level of accuracy.

The solution should have the following features:

1. **Integrated and smart packaging management system**
   - The solution must allow for easy input of a catalogue/database of different product SKUs, with relevant meta data tags like size, shape, dimensions, and weight.
   - The solution must allow for easy selection of pre-loaded SKUs to be formed into bundles. Thereafter, the solution must be able to recommend bundling/packaging options that optimises the time and packaging materials required, based on pre-loaded characteristics of SKUs.
   - The solution must allow for manual intervention and overrides to the recommended options, and continually learn to improve future recommendations.

2. **Track and recommend type of packaging materials**
   - The solution must be able to track the usage and consumption of packaging materials used, as well as forecast the volume of packaging material required per promotional season based on historical data.
     - This would help both companies optimize their procurement processes when it comes to procuring packaging materials – reducing excess procurement of materials
     - Through historical data collected, the solution should be able to provide better recommend how best to package two or more products together to minimise material wastage.

3. **Automated quality assurance and quality control processes**
   - The solution must be able to keep track of number of bundles/kits produced per packaging cycle and must tally with initial orders to ensure that each repackaged bundle is correctly packed. Problem solvers may propose the appropriate tallying methods, such as having count verification features.

4. **Integration with other in-house systems and further upgrades**
   - To future-proof the solution, the solution should be developed with future integrations in mind, such as warehouse management systems and other manufacturing systems and modules within a smart factory.
   - There are also instances where the certain products are required to be stored in cold-chain environments. It would be ideal if solution providers are able to propose current or future modular upgrades that can optimise packaging in a cold-chain environment.

Overall Performance Requirements

The problem solver should meet the following performance criteria in their proposal:

- **Accurate and fast** - The solution must have a high throughput rate, being able to recommend optimal packing steps and materials.
- **Cost-effective** – The solution must be cost-effective to support the solution to scale. Companies have explored large-scale and off-the-shelf automation process but were costs was unsustainable to be deployed at scale.
- **Seamless Integration** – The solution should be able to integrate and work with existing systems and not impede their performance. Solution providers are welcomed to propose hardware components that is complimentary to this challenge, provided they meet the above criteria.

There are no restrictions on the geographical location of the problem solvers who may choose to apply to this challenge. All start-ups are welcomed to apply. However, the prototype must be demonstrated in Singapore.

POSSIBLE USE CASES

1. **Automated recommendation of packaging materials and processes** – Oliver works at a large FMCG firm. He works directly with the clients (retailers) and warehouse operators to create custom promotional bundles of products. Currently, the custom-bundling process is very labour intensive and time-consuming – Oliver and his team often needs to do various trial-and-errors before finally finding the most optimal packaging that minimises costs and maximises productivity. This process is shortened with experience but is still a rather ambiguous process. Afterwards, warehouse operators would refer to a physically completed sample bundle as a reference point to manually assemble these bundles. Lastly, a quality assurance team would conduct the final check before bundles are shipped out.

   However, with the new automated solution in place, Oliver simply needs to select the SKUs that are included in this season's bundle package into the solution's user-friendly dashboard. The software automatically creates a schematic bundle which optimises the amount of packaging material and assembly time required. Once this custom bundling design is verified by Oliver, the custom-bundling process is fully automated and streamlined, where individual SKUs are selected, wrapped together, inserted into different packing types (as selected by Oliver), sealed, and labelled. This allows Oliver to redeploy his warehouse operators to conduct higher-value activities, thus greatly reducing manpower costs, time, and human error.

2. **More efficient and higher throughput packing –** Xavier, who works in a biotechnology company, oversees the production and planning across the bundling process of reagents and other medical consumables. Xavier usually inspects and deploys manpower (2-5 operators) to oversee this process, where they manually and individually form individual kits of reagents and other materials, before packing them into bigger boxes. The current process is semi-automated, and Xavier is looking for a way to increase productivity and efficiency throughout the process.

With the new solution in place, Xavier can manage multiple projects while keeping a close eye on the quality of each kit. Through an extremely user-friendly interface, Xavier is able to key in the specifications of the kit into a software system (by selecting the right reagent and complimentary items such as instruction manuals that must be packed with each tube of reagent) that helps automate the kitting process. Once Xavier selects the types of reagents he wants to kit based, the digital packaging management system informs him of the number of items, time taken, and specifications of the boxes that will be needed for any particular kitting process. This significantly reduces the trial-and-error needed for Xavier to get the most optimal packaging, allowing for faster throughput and cost efficiency.

WHAT'S IN IT FOR YOU

- SGD 50,000 of prize money for each winner of this challenge (see Award Model)
- 2-year Tier 3 ARTC Membership
- SGD 100,000 A*Star Innovation Voucher
- 4-month Accelerator Programme
- Gain access to IMDA's Technology resources and facility for prototyping
- Co-innovate with ARTC with access to their expertise in developing the solution
- Opportunity to commercialise solution for deployment and adoption by the sector members

EVALUATION CRITERIA

The Applicants shall be evaluated in accordance with the evaluation criteria set out below.

Solution Fit	• To what extent does the proposed solution address the problem statement effectively?
Solution Readiness	• How ready is the proposed solution to go to the market? • Is there any evidence to suggest capacity to scale?
Solution Advantage	• Is the solution cost effective and truly innovative? • Does it make use of new technologies in the market, and can it potentially generate new IP? • To share estimated cost for pilot trial, deployment and software support.
Company Profile	• Does the product have user and revenue traction? • Do the team members possess strong scientific/technical background? • Is the company able to demonstrate financial capability and resources to complete the prototype?

AWARD MODEL

30% of the prize money will be awarded to each selected finalist at the start of the POC/prototype development process, with the remainder 70% to be awarded after completion of the POC/prototype solution, based on milestones agreed between Problem Owner(s) and the solver. Prize money will be inclusive of any applicable taxes and duties that any of the parties may incur.

Note that a finalist who is selected to undertake the prototype development process will be required to:

- Enter into an agreement with Problem Owner(s) that will include more detailed conditions pertaining to the prototype development;
- Complete an application form with IMDA that will require more financial and other related documents for the co-funding support.

Teams with public research performers are required to seek an endorsement from their respective innovation and enterprise office , and submit the attached IEO form together with the proposal.

DEADLINE

All submissions must be made by **28th January 2022, 1600 hours (SGT/GMT +8)**. Problem Owner(s) and IMDA may extend the deadline of the submission at their discretion. Late submissions on the OIP, or submissions via GeBIZ, will not be considered.