

## Ushering the Era of System Dependency in the Palm Oil Industry

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### ABSTRACT

The call for automation had been a concerned topic amongst palm oil millers during the past few decades and will continue to be one. The industry is facing a shortage of personnel/labour when the young generation opted to leave their home for a career in urban areas rather than in the remotely located palm oil mills. Therefore, the need for automation arises to shift the operation from a human-dependent to a system-dependent one.

In the past, many automation systems had been anxiously introduced and developed, for the palm oil industry. Unfortunately, only a handful of them still survive, while most ended up as *failure* fading into oblivion. The success of such systems is based on a good balance of: (a) dedication and skill of operators, (b) proficiency in the system upkeep and maintenance and (c) optimum automation level of the system.

Any high-tech production plant today could have a sophisticated automation system, which is fully sustainable by groups of highly qualified/paid professionals together with well-trained operation staff. Sadly, such a scenario may not be found in a palm oil mill and as such, a balance has to be maintained during design stage itself.

Keeping the balance between the technology of equipment used and the skill of operators needed to maintain it, is an art to be mastered and the key to success lies in the proper implementation of an appropriate automation system. Perhaps the best example to illustrate this balance is the indexing system used to marshal cages in the sterilization bay. The indexing system is a system to handle fruit cages in the sterilizer bay. Despite being introduced quite recently, this system has received numerous positive feedbacks from users currently using it. Besides keeping the balance, the indexing system owes its success to the following:

- it can be operated by the same set of existing workforce requiring no specialized training, eliminating the need for engaging professionals or high-tech operators;
- it is merely a continuous mechanical handling system, which is simple in concept and robust in construction with minimum maintenance;
- numerous amount of R&D works prior to implementation has made the system a success with sustainability;
- proven reliability with zero failure during years of operation;
- allows a safer and cleaner working environment;
- cheaper capital investment cost compared to conventional systems;
- reduces the amount of labour required for maintenance and operation; and

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- besides keeping the human-system dependency balance, it can also operate as a fully automatic system with least human intervention.

We shall look into details of what makes the indexing system so attractive compared to con-

ventional systems that have a much longer history of operation. *Table 1* gives a brief comparison of various sterilization handling equipment, including the indexer.

Given the facts shown in *Table 1*, it is no doubt that the indexer system is the clear win-

**TABLE 1. COMPARISON OF DIFFERENT STERILIZATION CHARGING SYSTEMS IN USE**

	Capstan/winch	Tractor/bulldozer	Indexer
Handling method	By tensional rope, force provided by motorized winding equipment.	Pulling/pushing force provided by the wheel friction on the floor.	Hydraulic cylinder providing a pulling or pushing force.
Possible risks	Snapping of the rope may cause damages to properties and risk to human life.	It always forces cages to move from a static position with an unpredictable speed that may pose undue damage and risk to human life.	Either static or dynamic, the pulling/pushing speed/ force is determined by the preset values. Its slow and steady movement avoids unpredictable risk/damages.
Possible damages	Fruit cages are pulled at an angle (varies for different distances from winch/capstan to first cage), worn rail track and wheels are common in this system.	Damaged fruit cages due to the impact caused by the pushing force of tractor/bulldozer are common.	The gentle and slow pulling/pushing action reduces wear and tear to both rail track and fruit cages. Proven track records reveals that the 1st mill using indexer has not done any maintenance of cages after three years of continuous operation.
Maintenance cost	Requires frequent changes of damaged steel ropes and rail track. Wear and tear is unavoidable.	Fruit cages require frequent repairs, which are unavoidable.	A routine change to hydraulic oil will prolong the life span of oil seal and shafts. System has to be cleaned daily to prevent corrosion.
System	It is an operator-dependent system and throughput is in the hands of the operator.	It is an operator-dependent system and throughput is in the hands of the operator.	It is system-dependent where operation instruction is pre-loaded into the system during set-up. Consistency of flow is guaranteed.
Operation	It requires alert and cautious operators who co-operate with each other during operation. Average working skill is required.	It requires skillful operators to handle the job or it causes damages to fruit cages during pushing or pulling.	It requires minimum training and skill in the job. With mill upgraded to indexer system, it took only 2 hr for the operations to familiarize with the operation and 8 hr to become skillful operators.
Throughput	Being a fast transferring system, it is difficult to maintain its consistency as it is teamwork dependent.	Being a fast transferring system it is difficult to maintain its consistency as it is teamwork dependent.	Slow yet steady in flow, merely a press of a button initiates a sequential task. As a result, it has a higher throughput than its counterparts, a proven fact in mills using indexer system.



ner, when the choice for a reliable sterilization handling system is made. It is also obvious that the move from human-dependent to system-dependent system carries significant benefits. As in the case of the sterilization handling system, the benefits do not end with the comparison table; it also induces a whole lot of useful and welcome side-effects, such as:

- the sterilizer bay's floor space can be reduced as much as 40%;
- lower number of fruit cages required as spare units during operation;
- minimum number of operators required for operation;
- operations are merely a push of a button and the system carries out its sequential task; resulting in less room for human error;
- since it is a gentle handling system, the design allows for large fruit cages in terms of diameter and tonnage compared to its counterparts;
- easy integration with other automation systems such as the automatic sterilizer door control, automatic tipping station, drawbridge and transfer carriage to provide a fully automatic and continuous handling system; and
- due to its consistency and predictable output, the sterilization operation can now be scheduled well ahead before the current one ends.

With so many advantages and benefits, there is no surprise that one might think that setting up such automation systems might cause a fortune. Well, the shocking truth is that an indexer does not cost any more than a conventional handling system! In fact, with certain plant configurations, it actually costs less than a conventional system!

To keep prices at a competitive level, the balance has to be maintained, as mentioned earlier in the article. With too many high-tech equipment and you may end up with an expensive system plus high maintenance fees. With too little, you may end up with more hassle

rather than benefit since the system will be more human-dependent than system-dependent.

By maintaining the balance during design stages, a simple automation system can be set-up, that is not a luxury with astronomical prices. With such competitive prices as in the case of the indexing system, it is only a matter of time before human-dependent systems are phased out. Keeping the cost differences at a negligible level makes the system-dependent operation a clear choice between the two.

Going back to the example, the indexing system might look simple in design, yet it packs so much under its hood. There is not much secrecy in its design, as the key here is the amount of details taken into account during its design stage:

- the indexing system is a relay-based handling system where synchronization is of utmost importance;
- it is more of a mechanical positioning equipment rather than electrical controls and as such, the priority is focused on the mechanical design before they are integrated electrically for the automatic operation;
- computer aided design tools such as 3-D or 2-D animation are important during the design stages. Trial and error approach will have a high risk of failure and the buyer will have to pay a high price for the mistakes; and
- the integration work is extensive and due considerations have to be given to the followings:
  - a. adequate sequential interlocks to eliminate possible technical damages by careless operators. Too much interlocks on the other hand, will result in difficulty in maintenance and frequent interruption to operation;
  - b. the commonly accepted sequential controller is the PLC or micro-processor-based equipment. They



are not easily replaceable like other electrical equipment like contactors, relays or even fuses. As such, the system has to provide an alternative operating component, should the programmable electronic equipment fails. The system shall have auto, semi-auto and manual controls in order to face less problems during production;

- c. the automation shall provide a user-friendly provision to fine-tune the system. It is not practical/possible to reprogramme the PLC for any fine-tuning tasks as it involves intensive knowledge of logic circuit design. Many of the automation works fail because of the lack of system access for fine-tuning processes; and
  - d. automation does not confine to PLC programming only, instead it covers a wide scope of engineering know-how, be it mechanical, electrical power, pneumatic, hydraulic and even safety procedures in production processes. Most project failures are due to lack of competency in seamless integration in many viable proposals.
- the choice of materials and equipment for the process decide the reliability of

the system. Careful study and analysis of the capability of each component is important to ensure reliability of the system; and

- just as in any commercial design, time and motion analysis is necessary for the throughput evaluation.

From the foregoing discussion, it is clear that the indexer is not something that was designed overnight. It has gone through many stages of meticulous design and refining processes before it turned out to what is delivered to the end-user. At the end of the day, all the hard work was paid off. By carefully selecting the components to be used, prices are also kept at a competitive range compared to the conventional systems besides delivering a reliable and an effective system.

As a conclusion, system automation projects require a great deal of skill and expertise from various engineering fields. Each system has to be specially customized or tailor-made as there are no two systems that are alike down to the bolts and nuts. Due to this reason, technology cloning might prove to be of little success in this field and it is a serious gamble to employ technology cloning for automation works. An automation project is a multi-engineering task that is best handled by competent professionals you can trust. ■

