FACTORY AUTOMATION IN TEA PLANT USING IOT

Engagement Approach

By Vishal Vimal Kumar

TATA GLOBAL BEVERAGES

ACKNOWLEDGMENT

The success and outcome of this project required a lot of guidance and assistance from many people and I am extremely privileged to have got this all along the completion of my project. All that I have done is only due to such supervision and assistance and I would not forget to thank them.

I respect and thank Mr. Nikhil Mathur, for providing me an opportunity to do the project work for Tata Global Beverages and giving us all support and guidance which made me complete the project duly. I am extremely thankful to Mr. Pawan Satyawali for providing such a nice support and guidance, although he had busy schedule.

I owe my deep gratitude to our project guide Mr. Sunil T, who took keen interest on our project work and guided us all along, till the completion of our project work by providing all the necessary information for developing a good system.

I would not forget to remember Mr. Rakesh Raghavendra and Mr. Sandeep Munshi for their encouragement and more over for their timely support and guidance till the completion of our project work.

I am thankful and fortunate enough to get constant encouragement, support and guidance from all which helped me in successfully completing our project work. Also, I would like to extend our sincere esteems to all staff for their timely support.

INTRODUCTION

Tata Global Beverages Limited (formerly Tata Tea Limited) is an Indian multinational non-alcoholic beverages company headquartered in Kolkata, West Bengal, India and a subsidiary of the Tata Group. It is the world's second-largest manufacturer and distributor of tea and a major producer of coffee.

Tata Global Beverages markets tea under the major brands Tata Tea, Tetley, Good Earth Teas and JEMČA. Tata Tea is the biggest-selling tea brand in India, Tetley is the biggest-selling tea brand in Canada and the second-biggest-selling in United Kingdom and United States, and JEMČA is the biggest-selling tea brand in the Czech Republic.

In 2012, Tata Global Beverages ventured into the Indian cafe market in a 50/50 joint venture with Starbucks Coffee Company. The coffee shops branded as "Starbucks Coffee - A Tata Alliance" source coffee beans from Tata Coffee, a subsidiary company of Tata Global Beverages.

The company was renamed as Tata Global Beverages to include the range of health and nutritional beverages it wants to enter. Via subsidiary companies, Tata Global Beverages manufactures 7 crore kilograms of tea in India, controls 54 tea estates, ten tea blending and packaging factories and employs around 59,000 people. The company owns 51 tea estates in India and Sri Lanka, especially in Assam, West Bengal in eastern India and Kerala in the south. The company is the largest manufacturer of Assam tea and tea and the second-largest manufacturer of Ceylon tea.

Set up in 1964 as a joint venture with UK based James Finlay and Company to develop value-added tea, Tata Global Beverages has now product and brand presence in 50 countries. It is one of India's first multinational companies. The operations of Tata Global Beverages

and its subsidiaries focus on branded product offerings in tea, but with a significant presence in plantation activity in India and Sri Lanka.

The consolidated worldwide branded tea business of Tata Global Beverages contributes to around 86 per cent of its consolidated turnover with the remaining 14 per cent coming from bulk tea, coffee and investment income.

With an area of approximately 159 square kilometers under tea cultivation, Tata Global Beverages produces around 3 crore (30 million) kg of tea annually. Instant tea is used for light density 100% teas, iced tea mixes and in the preparation of ready-to-drink (RTD) beverages.

Tata Global Beverages owns five brands in India: Tata Tea, Tetley, Kanan Devan, Chakra Gold, and Gemini. The company has a 100% export-oriented unit (KOSHER and HACCP certified) manufacturing instant tea in Munnar, Kerala, which is the largest such facility outside United States. Tata Global Beverages has subsidiaries in Australia, Great Britain, United States, Czech Republic and India

Despite a global presence the brands are distributed differently depending on the location. As Tata tea is far better known in India and a powerful brand there, it is pushed on this market and countries with a large Indian population. Therefore, Tetley is the company's global face and the largest markets focus on the Tetley brand. Where both brands co-exist in one market, Tetley is positioned as the premium brand.

Tata Global Beverages worked with Janaagraha on a voter registration drive, with the campaign name "*Jaago Re!*" ("Wake Up!"). Following this, the company moved the campaign on to opposing corruption. The Jaago Re! website encourages discussion on this and other social issues.

In January 2014, Tata Global Beverages and International Finance Corporation (IFC) which is part of World Bank were criticized for poor working conditions, low wages, and gross human rights violations in a report released by Human Rights Institute at Columbia Law School. The

report alleges Amalgamated Plantations Private Limited (APPL) that is partly owned by Tata Tea and IFC is in violation of many of provisions of Indian Plantation Labor Act (PLA) on its tea plantations in Assam and West Bengal. In March 2014 a documentary on The Guardian news web site claims that Tata Global Beverages is underpaying the minimum Indian wage at an Assam tea plantation that Tata co-owns with Tetley and other major tea producers.

In October 2015, a movement of 6,000 female labourers calling themselves "Pempilai Orumai", or women's unity laid siege to the Munnar tea estates, one of Kerala's most popular tourist destinations and owned subsidiary of Tata Tea's plantation in Kerala. Trade and tourism were brought to a near standstill but, after nine days of protest and marathon negotiations overseen by the chief minister of the state, it gave in.

It was a stunning victory: a group of semi-literate women had taken on the most powerful interests in the state and won. The spark that ignited the protest was a decision to cut the 20% bonus paid to tea pickers, but its roots go much deeper than that. "Part of the women's complaint is that they live in one-bed huts without toilets and other basic amenities and, while they earn significantly more than the tea workers in Assam, they say the 230 rupees (£2.30; $3.50) they are paid for a day's work is half what a daily wage labourer in Kerala would get.

IOT PROJECT- SAMPLA FACTORY

HOW HAS IOT HELPED?

IoT is touching our lives in one way or the other. As the world starts adapting more technologies people have started becoming more data savvy. Same is applicable in the case of tea/ coffee or any beverage consumption. People need more and more data about how tea / coffee they have consumed. This is where a real-time dashboard where every cup dispensed is reflected helps bring in transparency for the companies installing them.

There are IoT enabled machines, which allow capturing data about every cup consumed. Software's in machines throw error codes to server using IoT if a fault happens in the machine. This error codes trigger a ticketing mechanism, which is assigned to our repair and maintenance team. The error codes provide firsthand information about the type of error to our operations and repair teams. This enables us to provide a seamless experience to our customers as time spent in maintenance activities gets significantly reduced.

In the discussion around big data, automation and the Internet of Things (IoT), more attention is often paid to the technologies, sensors and data-collection devices than to how analytics can be leveraged for business benefit. Enterprises should worry less about "things" and focus more on how those things can transform their organization and business processes to achieve operational excellence.

To date, manufacturing operations have focused their efforts on optimizing their physical assets. They look at improving their waste removal, refining their supply chain and working to create lean operations on the factory floor.

These efforts and the metrics that drive them are cost-focused, seeking to cut procurement, conversion and execution costs and create more efficient inventory levels.

But today, data resides everywhere in manufacturing—in Enterprise Resource Planning (ERP) systems, Product Lifecycle Management (PLM) systems, Manufacturing Execution Systems (MES) and Supplier Relationship Management (SRM) systems, in machine tools and in thousands of spreadsheets, files and folders across the company. Data also resides outside the enterprise, across the value chain with partners on both the supply and the sales sides. The goal of sound Industrial Internet strategies is to break down organizational, process, data and system silos and automate the collection of data across operations. An enterprise that uses a deeper, wider and smarter analysis of its data will see big operational dividends.

A few daring manufacturers are testing this ground by deploying a combination of technologies to take advantage of big data, automation and the IoT to create the Industrial Internet of Things (IIoT), with the aim of improving employee health and safety, decreasing financial risk, reducing production downtime and time-to-market and improving quality in processes and products. However, these successes do not come from technological prowess. Manufacturers succeed in IIoT because their deployments create measurable business value.

The following six use cases are examples of how manufacturers are putting IIoT to smart business use:

1. **Rapid Costing:** In many industries, manufacturing functions are considered as internal suppliers to the product management group or the sales team and, therefore, must provide cost estimates during tendering and business development cycles. Tough market dynamics require rapid

costing on price indications about a piece of equipment, and this quick turnaround can be a decisive factor in whether the enterprise wins or loses major orders. Historical data including hit-rates, customer preferences, footprint requirements, past tendering records, executed projects and product definitions must be combined in an IIoT strategy to inform tendering feedback, reduce lead time and increase quality of tendering.

2. **Non-Conformance Report (NCR) Analytics**: Manufacturing organizations usually collect data points regarding non-conforming events that arise on the factory floor. An NCR is issued when a product, process or procedure does not comply with set standards. It can also represent a significant deficiency. An NCR is generally used as a tool to reduce errors as much as possible and keep faulty products and equipment from reaching customers. IIoT technologies can help analyze NCR data, find relationships between NCRs and support the prediction of future non-conformances.

3. **Plant Load Optimization:** Sales and Operations Planning (S&OP) processes are the core of a manufacturing company. They allow management not only to get a handle on the business but also to create a command and control system that integrates strategic business plans and tactical day-to-day operations. S&OP helps guide daily operations and monthly plans toward long-term business goals and aligns manufacturing, suppliers and customers. Depending on the product´s lifecycle, the S&OP process can define the load forecast over time, which helps determine which products an enterprise will manufacture at which plant—and creates the basis for plant loading. This decision has implications on operational and financial performance. Historical load, industrial footprint, executed projects, scope changes and customer behavior are data points that can optimize plant loading. To understand and balance the trade-offs to optimize loading requires an IIoT strategy.

4. **Shop Floor Operational Improvements:** Manufacturers are increasingly interested in the use of low-cost sensors attached to machines for preventive maintenance and condition-based monitoring. Some are

finding wireless connectivity and big data processing tools can make it cheaper and easier to collect actual performance data and monitor equipment health. For example, critical machine tools are designed to operate within certain temperature and vibration ranges. Sensors that can actively monitor and send an alert when the tool deviates from these prescribed parameters can aid in preventing malfunctions. When critical equipment fails, operations can quickly fall behind and miss on-time delivery, leading to delayed projects and cost overruns. Big data in an IIoT solution can help improve overall equipment effectiveness (OEE), minimize equipment failure and enable proactive maintenance to reduce or eliminate downtime.

5. **Suppliers and Supply Chain**: Access to real-time supply chain information helps identify issues before they happen, reduces inventory and potentially reduces capital requirements. The IIoT can help manufacturers gain a better understanding of this information. By connecting plants to suppliers, all parties involved in the supply chain can trace interdependencies, material flow and manufacturing cycle times. IIoT-enabled systems can be configured for location tracking, remote monitoring of inventory and reporting of parts and products as they move through the supply chain. They can also collect and feed delivery information into ERP, PLM and other systems.

6. **Health, Safety and Environment:** Key Performance Indicators (KPIs) for health, safety and environment (HSE) include data for injury and illness rates, short- and long-term absences, near-misses, vehicle incidents and property damage or loss during daily operations. These measurements are typically stored in myriad systems, spreadsheets and emails and are reported sporadically during management reviews or audits. Lagging indicators do not have any relational value and companies rarely perform thorough root cause analyses. A well-defined Industrial Internet and analytics strategy will help isolate and address HSE issues.

Though enterprises' may have a general awareness about their carbon footprint, they are usually missing cost-effective measurement systems and modeling/performance management tools to optimize energy and heating.

Using IIoT and automation to monitor environmental controls, such as HVACs and electricity grids, can generate cost-saving opportunities by helping companies better understand applicable economy model operations and avoid peak demand charges. Integrating weather data and predictive modeling also can help reduce energy expenses and plan energy usage, a large component of manufacturing costs.

AN INTEGRATED APPROACH FOR MONITORING TEA PLANTATIONS

Abstract

This study proposes an approach to develop a simple, time efficient and generic approach to assess and monitor tea plantations in Northeast India using time series remote sensing images. The tea industry in India is in a consolidation phase with the plantations suffering from yield decline and quality. Tea is affected by a plethora of factors including age, environment and management. Therefore, monitoring and analyzing growth of tea plantations over space and time is a very important aspect. Remote sensing offers an efficient and reliable means of collecting the information required, in order to map tea type and acreage. Through the use of satellite imageries, information on the health of tea plantations can be extracted. The spectral reflectance of a tea field always varies with respect to the phenology, stage type and crop health and these could be well monitored and measured using multispectral sensors. Information from remotely sensed data can be integrated into GIS by combining with ancillary data which can provide insights to the cultural practices being implied into the cropping system. It will also help farmers identify areas within a field which are experiencing difficulties, so that they can apply, for instance, the correct type and amount of fertilizer, pesticide or herbicide. Using this approach, planters will not only improve the productivity of their land, but will also reduce farm input costs and minimize environmental impacts. Based on this, a stepwise approach has been designed to assess and monitor tea plantations in Northeast India.

Monitoring tea replantation/rejuvenation: Tea replantation is a stepwise process. There are eighteen steps that the replantation process has to undergo, starting from uprooting to fertilizer application to the young plants. The replantation process generally starts from the month of October in those sections where the plantations are more than 40 years old and where there is a decline in yield and quality of tea. During replantation, the tea plants are uprooted from the sections and the land is ploughed, followed by planting of Guatemala grass. After 18 – 24 months stand in the field, the Guatemala grasses are removed, and the land is ploughed for new plantation followed by leveling and manuring. Once ready, the seedlings are planted from the nurseries.

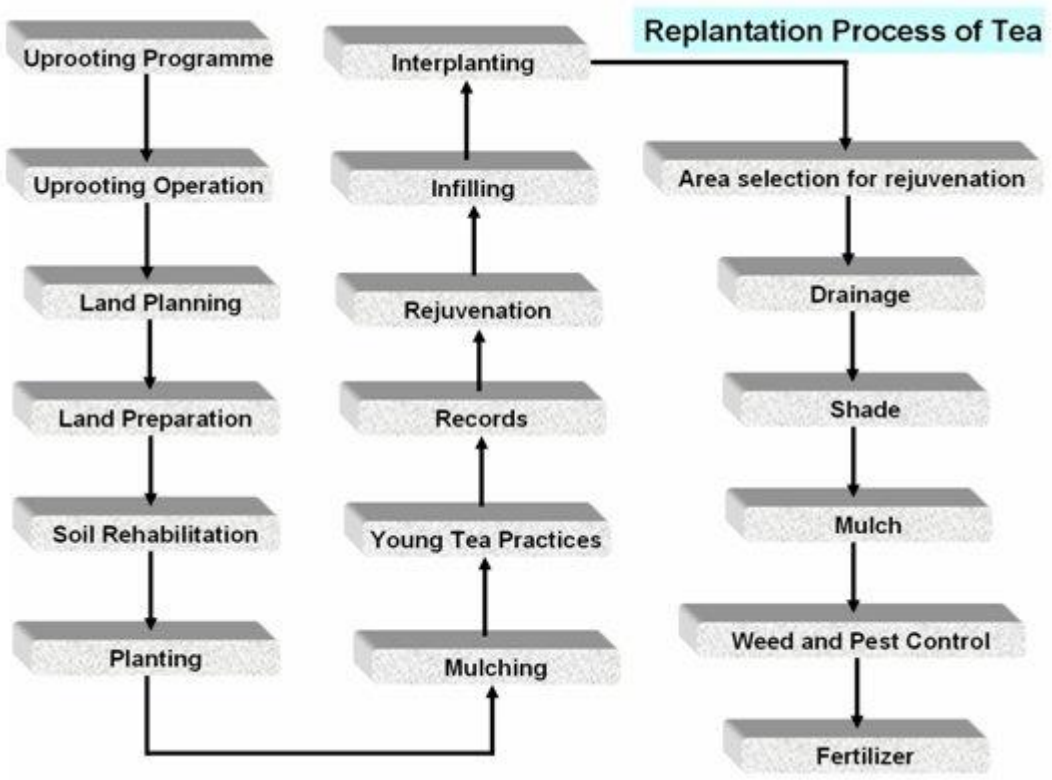


Figure 2: Diagram showing the different steps of replantation

Image processing, reconnaissance and survey: Once the images are procured, they would be geometrically, radiometrically and atmospherically corrected and the noise in the images would be removed, followed by the generation of false color composites (FCC) and its interpretation.

The image interpretation will involve the identification of tea patches using shape, size, color, tone, texture, etc. It will also involve monitoring of uprooted and replanted tea garden sections. The identified patches in the images require verification through visual interpretation and field visits which would involve visiting the area, identifying the patches, ground truthing and collecting relevant garden data for carrying out both image processing and statistical modelling.

TGB Process map of Tea Factory (Sampla, Haryana)

S&OP Planning

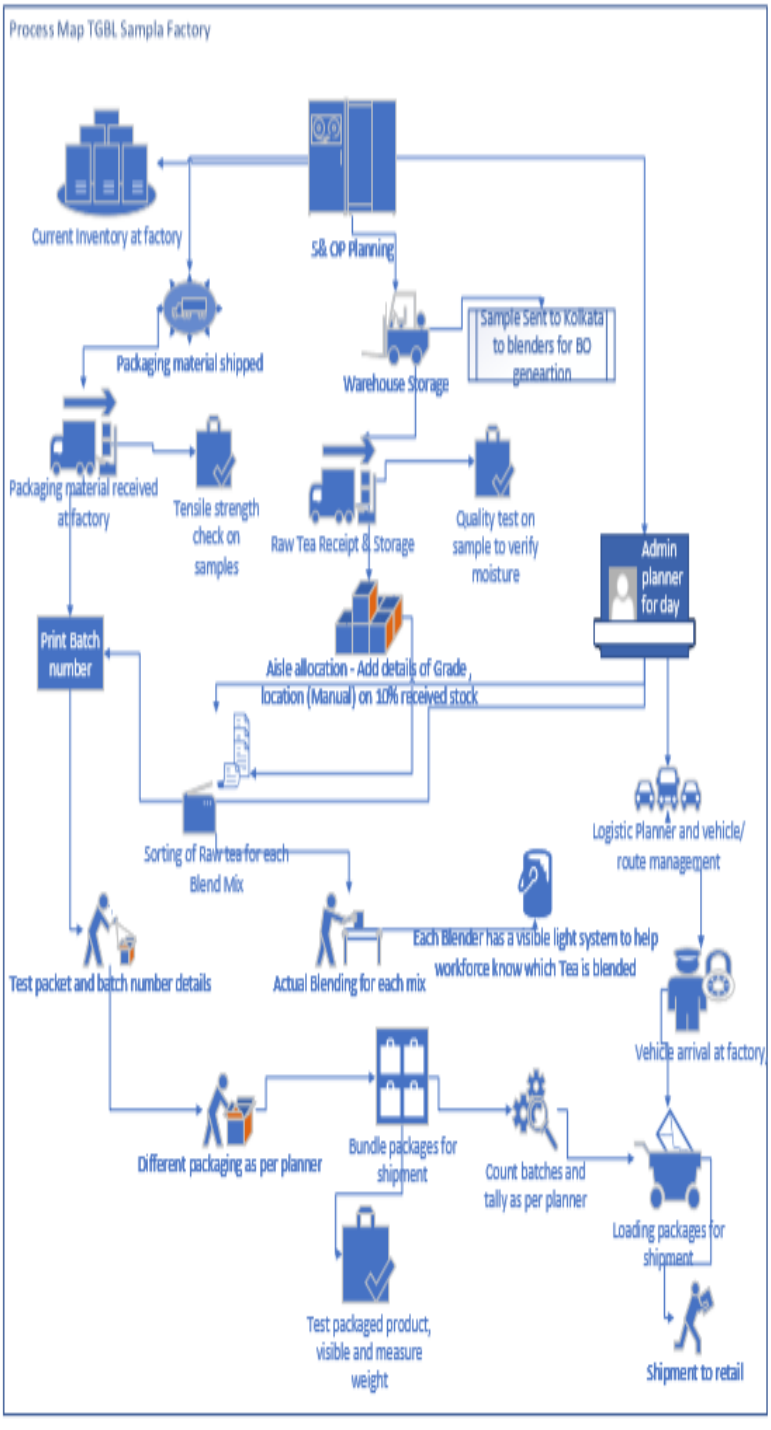
Warehouse Storage

Factory Operations

Blending Tea

Quality Check

Shipment



Sales and operations planning process

S&OP consists of several steps, usually carried out in monthly meetings. The names and numbers of the steps in each company's planning process vary, but all have the following in common, in order:

1. **Data gathering:** collecting existing forecasts and information on key variables, such as inventory, recent sales and cash on hand;
2. **Demand planning:** processes for analyzing, forecasting and influencing demand, including demand sensing and demand shaping;
3. **Production (supply) planning:** assessing production and distribution capacity and constraints;
4. **Reconciliation:** aligning demand and production plans, ensuring that they meet financial requirements and company objectives and preparing recommendations; and
5. **Executive meeting**: receiving final input from the S&OP team, reviewing the plan and approving a final version.

S&OP is closely related to, and often a component of, integrated business planning (IBP), a more comprehensive and long-term planning process that collects the plans of every department and ties them to the company's financial performance and strategy.

Benefits of S&OP

Besides improving forecast accuracy, S&OP can cut inventory costs, which, in turn, can boost working capital by tying up less money in inventory. S&OP can also increase revenue and market share by improving the effectiveness of new products and marketing initiatives.

The improved on-time delivery rates made possible by S&OP can lead to increased customer satisfaction and the further benefits that arise from it, such as higher sales.

Better visibility into sales, marketing, operations and finance data is another benefit touted by S&OP proponents. In addition, using specialized S&OP software to automate the process can shorten planning cycles, thereby reducing labor costs and boosting productivity as employees are relieved of the cumbersome, often manual work involved in preparing forecasts and collaborating on a unified plan.

S&OP software

While S&OP is first and foremost a process, not a technology, several types of software often play important roles in automating the process and facilitating collaboration among sales, marketing, finance and operations, making relevant data more accessible and providing analytics and simulation of what-if scenarios. The sales forecast might be prepared in specialized analytics or forecasting tools, or in demand planning software, but many companies still handle this stage in spreadsheets. Production planning is often handled in a dedicated module in ERP or material requirements planning (MRP) software.

However, because much of this specialized software exists in silos and doesn't necessarily connect data, plans and departments, some vendors offer S&OP software for handling all of the steps in an integrated system. S&OP software is often sold as an optional module of an ERP suite, though there are some stand-alone products.

Some ERP vendors, including Infor, Oracle and SAP, offer S&OP modules or support S&OP in IBP or supply chain management (SCM) products. Many ERP systems provide the function by integrating with S&OP software sold by third-party developers. Some demand management software also comes with S&OP functions.

TEA BLENDING AND ADDITIVES

Tea blending is the blending of different teas together to produce a final product. This occurs chiefly with black tea that is blended to make most tea bags but can also occur with such teas as Pu-erh, where leaves are blended from different regions before being compressed. The aim of blending is to create a well-balanced flavour using different origins and characters. This also allows for variations in tea leaf quality and differences from season to season to be smoothed out. The one golden rule of blending is this: Every blend must taste the same as the previous one, so a consumer will not be able to detect a difference in flavour from one purchase to the next.

There are various teas which have additives or different processing than "pure" varieties. Tea is able to easily receive any aroma, which may cause problems in processing, transportation or storage of tea, but can be also advantageously used to prepare scented teas. Tea can be flavoured in large blending drums with perfumes, flavourants, or essential oils added. Although blending and scenting teas can add an additional dimension to tea, the process may also sometimes be used to cover and obscure the quality of sub-standard teas

Quality check in tea plant

There are many ways to judge the quality of tea. Among all, I would like to introduce one method: to check the unrolling speed of brewed leaf. The high-quality leaf unrolls very fast, while the poor quality leaf takes a long time to unroll, or sometimes it does not perfectly unroll. I would like to explain why this phenomenon occurs.

Nitrogen boost the growing speed of tea

Regardless of tea or other agricultural plants like fruit and vegetable, the plants must grow slowly in order to produce thick, smooth and strong after taste. The natural plant does not grow as fast as the artificial plant. If you look at the natural plant, you may notice that the colour of leaves is not very green; it's yellowish. If nitrogen-based fertilizer is added, plant grows quickly. When plant grows faster, it forms more cell walls and the cells become bigger. It also forms other necessary constituents, e.g., the quantity of chlorophylls increases and leaf becomes green in colour. When leaf grows excessively, the tea leaf becomes bigger size not because it increases the number of cell, but the size of cell. Eventually, tea leaf contains very less constituents, and the tea processed from the big leaf tastes very light and flat.

the tea grown under the harsh environment without fertilizer or pesticide produces very small leaf; leaf is thick, elastic and yellow in colour. Despite tea leaf is so small, it consists of a huge number of tiny cells. One of the processing steps of tea is rolling. After the rolling process, there is a noticeable difference between large-dark green leaf and small-yellow leaf. The large leaves are easily cracked as each cell is too big. If the cells are so big, it is mechanically weak. It is just like a building with pillars that are too long. The that is grown with a lot of fertilizer. The dark spots on the ground is the organic fertilizer.

On the contrary, the naturally grown leaf is very elastic and strong as it consists of a huge number of tiny cells. The cells of small leaf never get cracked no matter how much it is rolled. In fact, big tea leaf is very weak even when it is fresh; it easily cracked when I rolled it on my palm. As for the yellow and small leaf, it is very elastic and strong. I can hardly crack it and it's like a rubber.

Besides, the elasticity of tea leaf is related to the amount of dust generated during tea processing. If tea leaf has a huge number of tiny cells, it generates very less dust during processing. Most of the tea leaves remain intact due to its elasticity.

The leaves on the left: grown with a lot of fertilizers
You can see many broken leaf. (The one on the right is the last year crop. So please ignore that the colour of leaf is slightly more yellowish)
You can see that for the leaf on the right, there is no broken leaf, thick and looks so elastic; its quality is much better than the tea on the left.
The cell wall of poor tea is cracked during rolling process. When it is brewed, it does not unrolled swiftly since it is cracked. It takes a long time to unroll or sometimes it doesn't fully unroll even after several brewing.
The cracked leaf cannot reverse just like it is no use crying over spilt milk.
As for high quality leaf, once the hot water is poured onto the leaf, it unrolls briskly to its original leaf shape. This is one of the important indexes to observe the quality tea.
The only exceptional is the heavily-roasted tea. Regardless of high or low quality tea, the leaf takes a longer time to unroll as it has been deeply-heated during baking.

Sampla Plant Assessment Objective

1. Defining vision with key business stakeholders for TGB Sampla plant.

2. Functional assessment of Sampla plant operations.

3. Finalizing use case and MVPs.

4. Assessing Machine connectivity and Data Enablement.

5. Analysis of IT landscape for application.

6. Create Strategic Roadmap, identify PoC use case and asset for implementation.

High Level Plan for TGB Smart Plant Assessment

Preparation– Obtain high level understanding of the corporate / plant, current pain points / business challenges, gather plant specific process/operational/financial data and key performance measures.

Assessment Phase – Study the current state blueprint, plant walk-throughs, visual observations, interviews, workshops

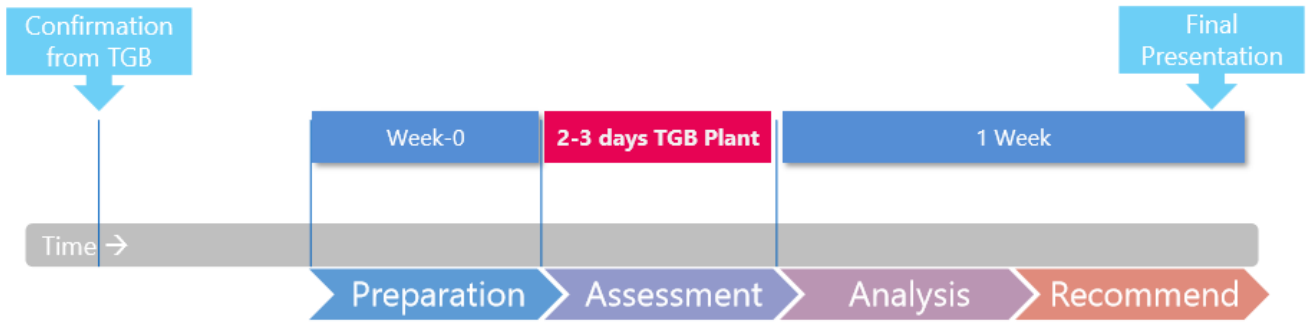
and gather relevant information / data elements.

Analysis Phase – Leverage Industry Best Practices, Standards, TGB Plants to identify the gaps in current systems and

processes that are limiting the plant to reach the desired level of throughput, yield / set improvement targets

Recommend Phase – Develop a Smart Plant roadmap consisting of recommended use cases to realize the vision / goals

and thus, achieve the desired business outcome.

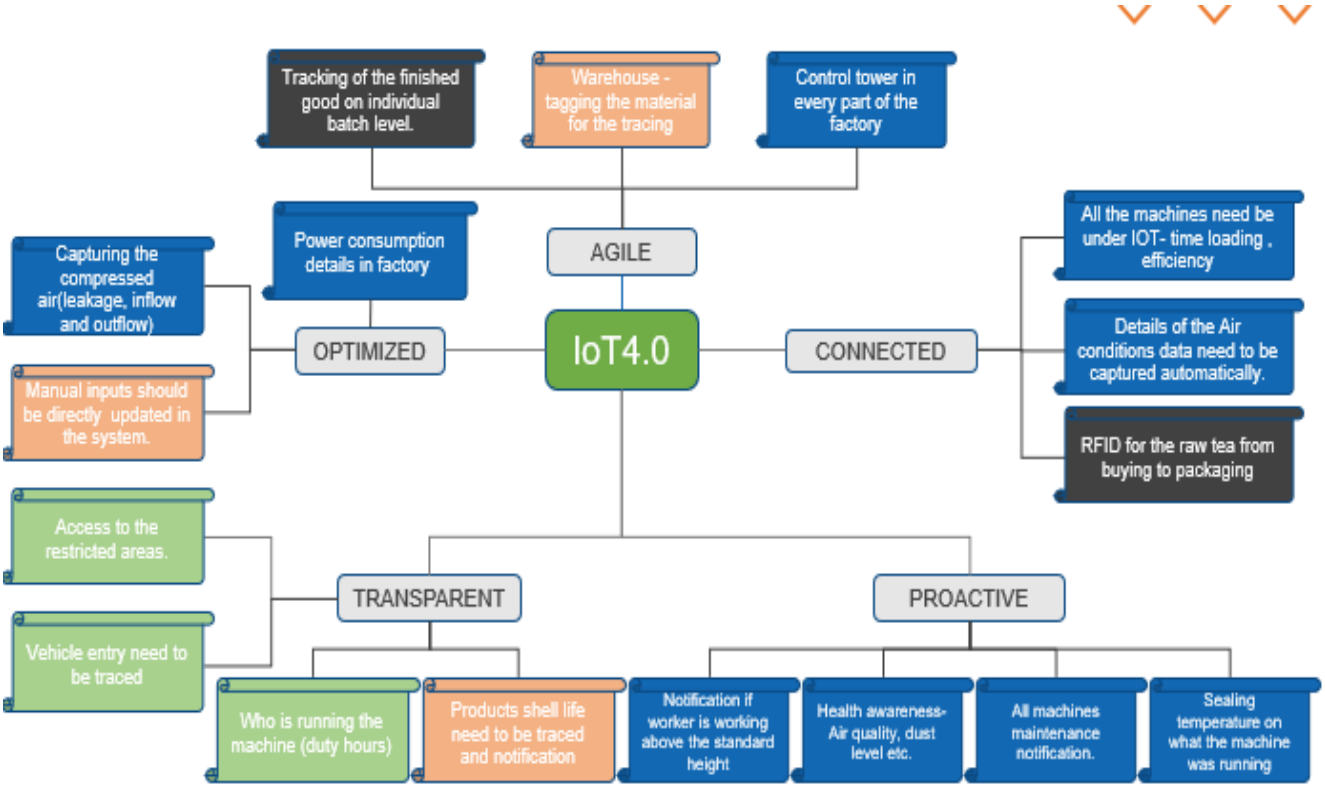


Proposed Activities at TGB Sampla

S.No	Workshop Name	Time needed (Min)
1	Plant Leadership Vision & Objectives of the Program	45min
2	Plant & Process walk-thru (Understanding production, warehouse and quality process, data capturing needs, understanding control system maturity etc)	120 min
3	**Workshop with Production team** (Gather requirements for digital initiatives, prioritize requirements, Understand production planning, execution process , Labour management etc.)	90 min
4	**Workshop with Maintenance team** (Gather requirements for digital initiatives, prioritize requirements, understand maintenance planning, execution process, shutdown management process, Understanding of utilities management etc.)	120 min
5	**Workshop with Quality team** (Gather requirements for digital initiatives, prioritize requirements, understand quality management , audits, deviation process, Certification requirements etc.)	60 min
6	**Workshop with Warehouse team** (Gather requirements for digital initiatives, prioritize requirements, understand warehousing operation like receiving, storage material transfer to blender, FG storage and dispatches etc.)	90 min
7	**Workshop with IT team** (Gather requirements for digital initiatives, prioritize requirements, understanding of IT infrastructure, and security needs etc.)	60 min
8	**Closing meeting with plant leadership team**	45 min

* This is tentative schedule, will be firmed in consultation with TGB before starting the assessment

Business Process identified for IoT Enablement



AUTOMATION MOTION CONTROL TO RAISE PRODUCTION FOR TEA PACKAGING MACHINE (FACTS):

Rexroth controls 400 bags per minute Tea pack fulfills this production flexibility with its current machine, Perfecta. It consists of a basic machine with optional modules that can be added to fasten the thread to the bag and the label with knots, or tack them together with a metal clamp. The modules also can pack the individual bags in aroma-proof paper envelops or heat-sealable foil depending on the requirements. Tea pack includes the modules in the machine with the Bosch Rexroth automation concept Packaging with decentralized control and servo technology.

With this automation concept, the Perfecta consistently keeps a cycle time of 0.15 seconds, or 400 bags per minute.

All of the recipes, procedural processes, visualization and a PLC according to IEC 61131-3 standards, are saved on an industrial PC by Tea pack.

Rexroth Indra Motion for Packaging with the drive-based Indra Motion MLD ensures the decentralized synchronization of the servo drives for the individual modules. It controls up to eight servo axes in real time via SERCOS III without any necessary additional hardware. The open control is based on Indra Logic, a run time system which also corresponds to IEC 61131-3.

Numerous functionalities that are common in packaging machines are already pre-configured in the control by Rexroth via the PLC open motion modules.

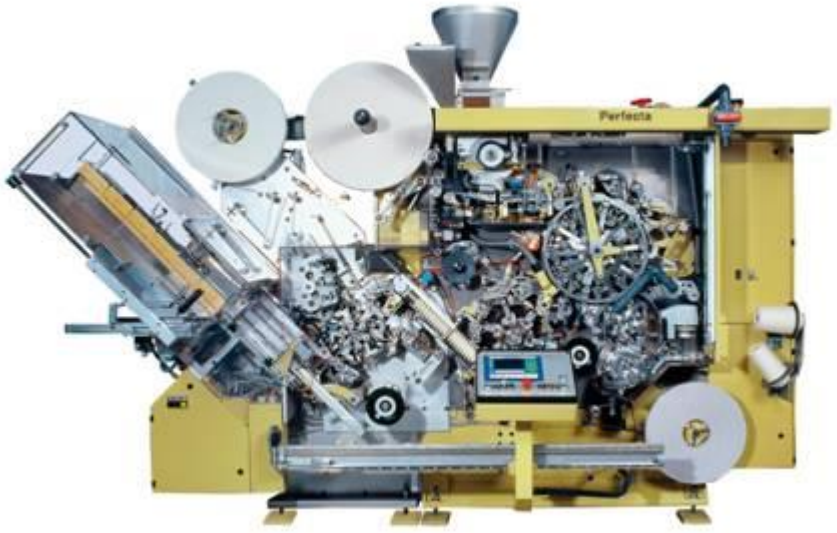


Figure 1. Using a Rexroth automation system, the Perfecta can fill and produce bags at a rate of 400 per minute with thread and label, or with an outside paper protection. A highlight of the automation system is Rexroth's integrated safety technology.

Safety up to date With motion control from Rexroth, Tea pack pursues a clearly defined goal.

The motion control synchronizes the individual modules with the cycle of the Perfecta, and it automatically takes over format and recipe changes from the main control without any necessary additional control intervention.

A particular highlight of the automation is Rexroth's integrated safety technology, Safety on Board. It's comprised of several certified safety functions, such as safe stop/operation stop and safe movements in the form of reduced speed, maximum torque or turning direction. The safety functions directly in the drive shorten the reaction times to below two milliseconds. With other safety solutions, a machine cycle has to be interrupted for a coercive dynamization of up to eight hours in order to detect "dormant bugs." Now, the tests automatically run online in the background during processing with Rexroth Safety on Board, and without any required intervention by the user. This creates the prerequisites for a continuous 24/7 operation.

Figure 2. With the two machines Perfecta and Zenobia, Tea pack counts on the Rexroth automation solution Indra Motion for Packaging.

Different machine – same automation Tea pack has also extended its product range with the newly developed, vertical tubular bag machine, Zenobia. The new machine fills block-bottom bags with little air inside. For automation, it uses Indra Motion for Packaging in the controller-based version Indra Motion MLC, which is able to control up to 64 servo drives.

With compact hardware, users can even use robotics functions via the motion control and PLC functions.

In both operation modes, the machine can produce “Air Free” bags with little air inside in one step, and thus replaces a second machine that had been necessary to utilize until now. Thanks to the continuous process, the machine achieves a performance increase of up to 20 percent. Additionally, the products are filled in a more gentle way so the bags have a better quality and the machine runs more smoothly. This machine is not only designed for tea packers but also for users who pack frozen food, pasta and fresh goods, leguminous plants or other food and non-food products. These capabilities are new for Tea pack.

In comparison to the Perfecta, Tea pack only changes the hardware platform of the automation system in order to control a larger number of servo axes. Engineering tools, the run time system and the motion modules remain the same and reduce the time required for the implementation of new concepts.

With this, the software developers can even copy program modules that have been written between the individual machine ranges, since the Rexroth system solution uses the same software for all hardware versions. Tea pack modularly includes additional units and modules in the open automation architecture, as is the case with the tea bag machines.

Figure 3. The drive-based IndraMotion MLD controls up to eight servo axes in real time via SERCOS III without any necessary additional hardware.

Open interfaces All of the system solutions from Rexroth support connection to the most diverse control communications and automation environments with open interfaces. With the Zenobia, the user only enters the thickness and length of the bag when it is time to weld, and then the PC control uses these as a basis to calculate the optimum motion profiles of the individual axes, and sends the data to the motion control via TCP/IP. The motion controller controls the overall machine cycle with a capacity of up to 200 bags per minute. Also, Tea pack uses leading, state-of-the-art safety with Safety on Board from Rexroth.

The folding parts of the tubular bag machine adapt to the individual filling level of the bags, and thus consider variations of the filling height. The scanning of the filling height takes place during the welding of the head and/or bottom seam. The head seam, which is made by the transverse sealing jaws, is also the bottom seal of the following bag so that no projecting packaging material occurs.

Results:

- The Perfecta keeps consistent cycle time of 0.15 seconds, or 400 bags per minute
- Continuous process leads to performance increase of up to 20 percent
- Safety tests automatically run online in the background, creating prerequisites for continuous 24/7 operation
- Ability to control up to 64 servo drives in the Zenobia

Figure 4. The Zenobia machine uses Rexroth's IndraMotion MLC controller-based system which can control up to 64 servo drives, and also includes robotics.