Centro Seia

Case summary

Centro Seia is a plant nursery, operating in five locations. This case study concerns the headquarters in Ragusa (Sicily, Italy), and focuses on the grafting unit. To deal with the ban on pesticides and emerging plant diseases, a new certified grafting technique (called Elite) was developed to guarantee a sterile cut. The introduction of this new technique required the use of an IoT-based digital tracking system to ensure traceability of each grafted plant and certify plant quality. Every production process step is monitored in real time via Internet of Things (IoT) technology. By doing so, if infections occur, they can be traced back to specific batches, and the quality, wastage and speed of every step in the process is also documented. As this is linked to the work of each operative involved, their work is traced indirectly. Collected data is fed back into the IoT digital tracking system and is used daily to automatically update production planning. The system entailed a new way of working for those involved in the grafting production process, which was initially experienced by some as challenging and stressful. To support the implementation of the IoT-monitoring system, incentives were introduced for staff who were rewarded with preferred shifts, extended contracts during low season and promotions, with associated financial rewards.

About

Case study name: Digitisation in the workplace (/case-study-names/digitisation-in-the-workplace)

Establishment profile

Centro Seia specialises in the production of young horticultural plants, primarily vegetable crops, grown in greenhouses. The Ragusa production facility features over 6.5 hectares of covered greenhouse space. Core products are high quality plants (disease-resistant grafted plants that grow well with lower-than-normal levels of water and energy), both standard and organic, mainly consisting of tomatoes, peppers, eggplant, melons, watermelons, cucumbers and courgettes.

Founded in 1990, Centro Seia was acquired in 1992 by SIS Spa, and over the years has expanded to foreign markets via acquisitions and joint ventures. Its headquarters are in Ragusa (Sicily), but it also operates from another location in Italy (Cingoli, Marche) as well as from Čapljina Apljina (Bosnia and Herzegovina), Saint Livrade sur Lot (France) and Mills River (North Carolina, USA).

In the Ragusa facility, Centro Seia employs 900 people during high season, of whom 150 are permanent employees and 750 are seasonal workers (operatives) operating over a 9-month season. The vast majority of the workforce consists of low-skilled employees (secondary education qualifications or lower) of various nationalities: the majority (ca. 80%) from the EU, mostly Italy and Romania, although in the past years the share of non-EU nationalities has been increasing. In the grafting unit of the Ragusa facility the employee workforce totals 150 operatives, all of whom are female (as females are believed to possess fine manual skills required for the grafting) and two-thirds of whom are seasonal workers. Their age ranges from 16 to 60 years of age. The majority of these 150 operatives are between 35 and 50 years old, working on average 5–10 years at Centro Seia on a part-time basis in shifts and via seasonal contracts. This has not changed with the introduction of the IoT technology. These 150 operatives are supervised by 20 line managers (called batch supervisors) in the grafting unit. These report to production line supervisors, who report to shift supervisors. The higher management and support staff functions (middle management, including HR and innovation) consists of 50 employees within Centro Seia, with the majority working full time and all via fixed-term contracts.

A third of the workforce in the Ragusa plant is represented by two main trade unions, General Confederation of Labour (CIGL) and Workers' Trade Unions Confederation (CISL). Within the grafting unit the share is smaller as only 10-15% are represented by such trade unions. Digitisation is not seen as a source of concern by trade union representatives, but rather as an opportunity for higher wages or better working conditions. In 2019, several strikes were organised by the trade unions throughout Italy (starting in Milan, Florence and Naples) to stress the importance of increasing investments in innovation and technology in order to be more resilient in the future. The main concern for the trade unions is to negotiate better wages (closing the gap between the north and south of Italy) and ensure equal pay for women.

Technologies adopted and embeddedness in the workplace

The Elite grafting technique consists of two elements: the first is a tool which enables a sterile cut, meaning less waste (infected plants) during the production. The second consists of the digital monitoring system based on IoT. The real time data also enables monitoring employee performance in terms of time spent on handling each batch and the quality of the employee output: the system registers how many plants enter the grafting unit and how many grafted plants come out. Thus, reasons for waste can be traced, for example due to the presence of bacteria or weak plants (which can be detected by operators), or because of cuts gone wrong during the grafting process. Both are indicators of operator's skills, the first links to observational skills the second to manual skills (a combination of accuracy and strength).

The IoT-based monitoring system is an off the shelf product bought in 2013 from a local supplier, who installed the equipment and still conducts regular tool and network maintenance. By contrast, the development of the 'Elite' technology started in-house with the formulated specifications in 2010. Based on tests in Centro Seia's grafting facilities, involving a small test-team of ten experienced operators, the ideal form of the single-use blade took shape. The first order was placed in 2013, in parallel with the acquisition and implementation of the IoT-based digital monitoring system. In 2015, the in-house developed production protocol 'Elite' was patented. Combined with the IoT monitoring system, this technique ensures high standards of plant quality and safety using sterile grafting equipment and a real-time monitoring system based on IoT.

As part of the implementation of the IoT technology, the Key Performance Indicators (KPI) that had been used via the paper-based monitoring system were programmed into the digital interface. These are:

- • the number of grafted plants by operative X (assigned and done)
- • throughput time: sensors detect when operative X starts (input) processing the batch and when they are finished (output). Also, time within one batch and another is monitored
- • plant quality is checked by sensors and enriched via text input by supervisors, indicating reasons for waste
- • technique used for grafting
- • planning versus actual time spent on handling each batch; based on data recorded, the system provides a production planning for the next day which is checked and changed were needed by supervisors.

The KPIs did not change, the only addition to comply with the certification requirements was to ensure quality traceability. Via the paper-based monitoring system, combined with sample analysis and supervisor observations during each shift, data on quality was traceable only at the start and at the end of the grafting production line. Using the digital monitoring system, intermediate plant manipulation steps are monitored and traced in real time.

Drivers to technology adoption

The IoT-based monitoring system was introduced primarily to monitor the production process and trace the quality of products in the context of the adoption of the new grafting technique patented by the company.

The major pull for the company to invest in this new grafting technique came about as a consequence of the French market requesting certified grafted plants. As the French market is an important share of Centro Seia's turnover, it was important to urgently address the need for certification as a way to keep

clients in the market satisfied. With the patented Elite technique, Centro Seia was also able to increase its market share overall, as well as its market value. This improved the profitability of the company in relation to its sales of the grafted plants.

Another important driver to its adoption was the EU ban on the use of methyl bromide as a pesticide, which is commonly used as protection against soil-borne diseases. This pesticide was used in Centro Seia to control diseases in plants grown from seed. Without this pesticide controlling diseases, a bacterium started to emerge in tomato plants. It remained unnoticed in the young plants at Centro Seia's nurseries, but came to light in the older plants at production facilities of growers in France. To manage this risk, these growers started to require guarantees on plant health safety before acquiring young plants from Centro Seia.

These issues triggered an internal research and development process to understand the root cause of this bacterium which was posing a threat to Centro Seia's market share. Analysis conducted at Centro Seia showed that the existing approach to grafting was a possible source of the spreading of infection. To be able to insert a shoot of a plant (scion) into the stem of another plant (graft) the stem needs to be cut to create a groove (or slit). To do this, operatives used their own sharp knives with which they would cut many stems during their shifts. If one stem was infected, the bacterium could be transferred to the next plant via the same knife. Hence the whole batch of plants processed in that shift by a single operative with their own knife could be infected. To mitigate risk, the cutting process was changed to guarantee a sterile cut.

Initial expectations and strategy to technology adoption

The development of the new grafting technique has been a gradual process in which several prototypes were introduced and tested. The entire research and development (R&D) and implementation process was supervised by a team consisting of the R&D manager, the lead supervisor of the 150 operatives and the innovation manager (the inventor and designer of the grafting method, who was also responsible for acquiring the IoT-based monitoring).

Whereas some companies introduce changes in combination with pre-organised courses and schedules, at Centro Seia a more informal process has been followed. No roadmap was in place as upfront it was difficult to estimate how much time operators and supervisors would need to adjust. By allocating extra resources (more personnel in one shift), more time was available to support this transition. Progress was monitored, which enabled allocating additional resources to support employees that were not fully accustomed yet to the new way of working.

No significant tests were run for the IoT system, nor did management formulate a system brief. Reportedly, it was fairly intuitive to work with the digital interface; no formal training programmes have been in place either to support operatives in the change process or to facilitate the acquisition of basic digital skills. Supervisors were briefly instructed by the supplier on how to use the IoT-based monitoring system and its digital interface. Extra time was allocated for learning on the job, and support provided by more experienced users. The focus was on learning basic digital skills (exporting reports and adapting planning schedules), rather than becoming proficient in data analysis and (more) self-sufficient by programming for instance additional KPIs. Supervisors in this context are operatives who have been promoted, for which a three-step promotion is in place: batch supervisor, production line supervisor, and shift supervisor. Only the shift supervisor checks and adapts the programmed production schedule for the next day.

In less than a year, the operators and supervisors were processing the plantlets at the same speed as prior to the introduction of the Elite technology whilst complying with the quality and certification standards. Seeing the results obtained with the grafting method combined with the IoT-based monitoring has stimulated a welcoming change in the employees' mindset towards technological improvements. As expected by the management, no jobs were lost; on the contrary, due to increase in demand of Centro Seia's grafted plants, more low and high-skilled jobs were created.

Impact of the technologies in the workplace

Business model

The Elite technique supported by the IoT-based monitoring made the production of grafted plants cheaper and more efficient. Although the production processes were improved, the sequence of work processes remained the same. One significant change is the way in which quality control is monitored. This was previously done manually and now relies heavily on the IoT-based monitoring system. The Elite technique

also offers new market opportunities for Centro Seia; it is patented for multiple countries where Centro Seia has no establishments as of yet. The vision is to scale the business, possibly via the acquisition of facilities or joint ventures in other countries, to service additional markets. The greatest value and profit margin to date comes from the combination of the new grafting technique and IoT-based monitoring, with Centro Seia being the owner of the first.

Work organisation

Internal organisation and decision-making

The internal organisation has not changed in terms of structure nor in terms of decision-making processes. Although the tasks of the operatives remained the same, the execution of the sequential grafting tasks and each batch was monitored in greater detail in terms of plant health and speed by measuring processing time during each step. The operatives however did not consider this as additional monitoring per se, since monitoring had always been part of the process, albeit on paper. Prior to the introduction of the IoT based real time monitoring operatives would write on paper their start and end time with each batch and possible remarks regarding quality, which would be checked by the batch supervisors whilst adding observations related to plant health and batch waste, all to be checked by production line supervisors. The shift supervisor would keep track of delays in order to reschedule batches for upcoming shifts. The increased quality and richness of the data, as speed and quality can now be easily compared across shifts and in time, facilitated supervisors and management to better plan schedules and target optimisation efforts. For instance, planning the processing of batches with greater accuracy allows for deploying sufficient operatives for the task at hand.

Task definition and content

Both operatives and supervisors benefit from the IoT-based real time data monitoring as they no longer need to manually submit information regarding quality and batch handling time. This is recorded at the time of handling the batches. Supervisors no longer need to check and correct human error and therefore have time available to analyse data and adapt planning of shifts accordingly. For the management, long term planning has become less labour intensive, and it has become possible to more accurately estimate work demand and organise additional hires in a timely manner. The task definition for supervisors was extended, as an important component of their supervisory task involved being able to work with digital interfaces to monitor progress. This was new for all supervisors (batch, production line and shift supervisors), however only shift supervisors perform the data analysis and adapt planning based on the insights gained. Only the shift supervisor checks and adapts the programmed production schedule for the next day. Centro Seia also hired additional ICT staff to handle dashboard programming and maintenance.

Workflows, quality controls and standards

Although plant quality was already monitored prior to the introduction of Elite, quality standards and control via real time monitoring are much more refined, delivering rich and granular data about the production process. The workflow for supervisors has changed as their focus is now on monitoring data and adapting shift planning instead of proofing manual time and quality records submitted by operatives. The paper-based monitoring data is still kept in binders for future reference. Based on the data obtained and analysed, work pace estimates have become more reliable allowing the alignment of labour with actual production levels/numbers of batches. The IoT-based monitoring attached to the workstations and production lines has increased the efficiency of the production process and provided the means to trace and guarantee quality (ISO certified), combined with the implemented grafting tool.

Employee monitoring and control

Operatives and supervisors at Centro Seia were already used to being monitored prior to the introduction of Elite, however, the data obtained in real time is more detailed. The system monitors operatives' work during every step of the grafting process. Operatives consistently delivering high quality (i.e. low waste) at high speed are considered high achievers. These are rewarded with better shifts, financial rewards and possibly promotion to supervisor. Promotion to supervisor occurs after consistent high achievements (compared to peers and compared to target value) observed in the previous 12 months.

In the initial technology implementation phase, employees who were underperforming, according to the real time monitoring, received additional support by allocating extra resources during their shifts. Based on the real time monitoring data after a year no major differences in performance were observed. Operatives are still monitored by supervisors, who offer immediate guidance and support; this was also the case prior to the introduction of the Elite technique combined with the IoT based monitoring. To

comply with GDPR regulations, all employees in the monitoring system are referred to via unique numeric codes, which are not openly shared nor do the names of operatives appear in reports. Nevertheless, supervisors know which number corresponds with which employee.

Job quality

Physical environment

The physical environment of the grafting facilities is organised through different production lines in temperature-controlled environments. These feature two main assembly lines which multiple sub-assembly lines feed into. All assembly lines are now linked to sensors and computers connected to the IoT-based monitoring system. All operatives in each shift have their own workspace, attached to the assembly line and to the sensors (attached to the production equipment) which feed into the data monitoring system. All supervisors see this data in real time at their workstations via dashboards on their own screens, operators can see their performance compared to peers on the dashboards on central screens. Once an operative has grafted all the plants in a batch, the tray is moved on the assembly line to the next station. Each step is scanned by sensors. Therefore, at all times it is known when a batch of plants enters the grafting facility and where it is on the production line. Once grafted, the batches are scanned again and moved from the grafting facility to the nurseries where the plants reach the desired height before being shipped to growers. In short, the IoT technology tracks in real time all plant manipulation steps, the quality and speed of handling each batch.

Another change in the physical environment is the inclusion of printed instruction charts on the walls. These are placed next to the workstations where the operatives do their shifts. The printed instruction charts are updated regularly to reflect changes and improvements introduced in the grafting method or for instance on how to indicate product failures (waste). The Elite grafting technique was introduced without formal courses or manuals. The ‘user-guide’ instructions were visualised rather than written, making them easy to understand step-by-step and easy to produce and adapt.

Social environment

Prior to the introduction of the real time monitoring, supervisors were not used to using computers. The supervisors have since become accustomed to using computers, which are the main interface between the operatives and the data gathered. Although there is still quite some interaction between operatives and supervisors, much of the supervision attention is now reverted to their screens, in particular this is the case for shift supervisors and R&D and HR management as they oversee all data on their screens. Shift supervisors use the data for planning purposes regarding the upcoming shift; management uses this for forecasting and strategic planning purposes, also related to an employee appraisal cycle which can lead to a bonus or a promotion. In the interviews, operatives mentioned how they helped each other to adapt to the new grafting procedure. Interviews gave no indication of an internal competitive culture arising as a consequence of the introduction of the new technology.

As the new grafting method initially slowed the grafting process down, additional operatives were contracted on a temporary basis. Once the team was operating at speed, the market demand also grew, leading to additional recruitment for both temporary and permanent posts. Both at management and operative level it is noteworthy that employee (including seasonal workers) turnover is quite low compared with other local companies operating in the same sector. Many have been working for Centro Seia for more than 10 years, which facilitates an informal communication style as over the years people get to know each other and become, as interviewees phrased it, more like a family.

Working time quality and work intensity

The use of a real-time IoT system decreased work intensity in terms of time pressure for all, in particular for supervisors. The paper-based quality system was labour-intensive for all involved with operatives manually registering the time spent on tasks. In addition, fixing human error in the registrations often could prove to be time consuming, and for management, overviewing quality and speed became easier with the digital system. Complete data is constantly available in the format needed to perform trend analyses. Based on this data, work pace in the short term is determined with greater accuracy as variance is considered and translated into schedules accommodating this variance. This has led to fewer disruptions and contributed to increased predictability of work demand which led to additional temporary hires, both in relation to operatives and supervisors, further decreasing time pressure.

During the adoption and adaptation phase the work intensity of operatives increased, as every graft took more time. Later, as operatives started to master the new skill, Centro Seia was able to process more plants and service more clients. Both developments have stimulated work demand, reflected in the increased recruitment during the year; recruiting twenty more operatives during high season and extending the season for ten more employees, increasing work possibilities for thirty persons. There have been no cases of operatives not coping emotionally with the changes; the informal support and high levels of trust in management may have contributed to this.

Additionally, the incentives partly concerned the organisation of shifts. High performing seasonal workers were rewarded with more shifts (a longer work season) and for those with fixed contracts, shifts could be aligned to their personal needs. In the previous data monitoring setup, without IoT, it was far more complex to provide accurate statistics regarding the performance of all employees, hence incentives were also less targeted: as performance measures were less detailed and timely, as analysing performance data required more time and led to very coarse assessments of performance.

Skills and discretion

Thanks to the IoT monitoring system, supervisors were better able to act upon the data obtained via real-time monitoring, which means they are able to steer operational processes with greater autonomy. By contrast, due to the nature of their work, operatives had a relatively limited level of autonomy to begin with, this has not improved with the implementation of the technology. Even though operatives were being monitored real-time, they did not feel that they had less discretion in their job. According to the management, the combination of tightly knitted work relations and the financial and promotion incentives in place stimulated operatives to improve their performance to produce certified quality products with traceability within all production process steps. This was further enhanced by the peer support from their colleagues. Both operatives and supervisors referred to how the mentoring, via informal communication, facilitated learning without the organisation providing formal training.

The production line at Centro Seia does not demand high-level skills. The skill level is also reflected in the basic way in which the IoT monitoring interface is setup: supervisors are not expected to understand the calculations made from the provided indicators. Their approach to the digital interface is pragmatic; they know where they need to click, check and add eventual entries in order to plan the next shift. The introduction of the IoT-based monitoring system required substantially different skills for the IT infrastructure maintenance and data analysis. Three new employees were hired on a permanent basis to address these new skills needs. High level management, supported by the additional ICT recruits (staff), were able to alter indicators and algorithms to increase predictability of labour needed to meet demand in terms of weeks, months and years.

Prospects and earnings

In terms of prospects, the monitoring of production through IoT has brought positive change: for operatives and supervisors it offered increased financial rewards and opportunities for promotion to higher supervision levels. At operative level it was positive both for new entrants and existing operatives, as high performance was rewarded in multiple ways. Improved profits stimulate job security, which is even more valued in a challenging job market. High performers were rewarded with more or better shifts and sometimes bonuses. Financial rewards were in place before, but due to the rich and granular information available via the IoT-based monitoring system, these rewards are much more specific. To analyse this data and improve working methods accordingly, additional supervisor jobs were created, increasing the likelihood of operator promotions. Supervisors in this context are high performing operatives who have been promoted, for which a three-step promotion is in place: batch supervisor, production line supervisor, and shift supervisor. These rewards were considered valuable to both permanent employees and seasonal workers, as Centro Seia's grafting facilities are all located in challenging job markets.

Employee involvement

The changes introduced at the grafting facility mostly affected the operatives and supervisors. Neither the seasonal workers nor the approximately 50 fixed-term operatives have been involved in the decision-making process nor did they demand to be. As indicated, a team of highly skilled operators was involved in testing and perfecting the Elite system. Employee feedback led to adjusting the shape of the blade and to ergonomic adjustments to the working environment. The test-team also had a role of reporting findings related to speed (for example what slowed the pace down) or quality (what caused the errors in the cut) to the R&D director and innovation manager. This increased the sense of ownership in the process of implementation by the test-team members, as their input was implemented to improve the system. These

testers shared their experiences and the implemented improvements with other colleagues, which in practice resulted in the test-team acting also as 'ambassadors' for the Elite technique, which includes the IoT based monitoring system. This is a product-centred approach rather than a human-centred approach, as communication was primarily oriented towards improving the production process rather than on employee involvement and adoption.

The IoT-based system was not adjusted nor specifically questioned by (fixed or seasonal) staff or union representatives. In general, considering the negotiations which still focus on equalising pay across regions, long term policies and impact regarding digitisation do not seem to be part of the strategic priorities of the trade unions. The primary objective is to ensure job security in a slack job market. In that sense the employment growth (ca. +25%) at Centro Seia is an exception in a regional context where jobs tend to decrease (Istat, undated).

Commentary

- Although the primary purpose of the IoT based monitoring is to track the quality of the production process and to ensure full traceability of the grafted plants, it also enables the monitoring of individual performance of operatives on the shop floor, ultimately enhancing organisational control. The monitoring of data is used to determine financial rewards and as a basis to offer better-suiting shifts, contract extension and promotion.

- In a production setting which is already typified by close supervision, the change from a paper-based monitoring system to an IoT-based monitoring has not been perceived negatively by employees. From the perspective of both operatives and supervisors on the shop floor, the use of the IoT technology has created new opportunities for promotion and incentives as the employee data is used to determine financial and non-financial rewards. Furthermore, with the introduction of the technology, additional operatives and supervisors were hired (on a permanent and seasonal basis) to cope with increasing demand for grafted plants, to stabilise the pace of work, and to reduce the pressure on existing operatives while learning to use the new grafting tool. Therefore, the technology was not perceived by staff as increasing work intensity.

- The introduction of the IoT technology has reinforced the existing task-driven work organisation characterised by limited work autonomy for those working in the assembly line. The technology has however simplified the tasks for batch and production line supervisors as well as operatives, while adding more complexity to the job of shift supervisors. These are assisted by ICT staff who program dashboards for shift supervisors to use. With the introduction of the IoT technology, supervisors are no longer required to handle and process data manually on employee performance and batch quality, and this has also reduced the margin of human error in administration.

- The approach followed for the introduction and roll out of the technology did not involve any formal training or tailored communication to staff to prepare them for the change. The management team in this establishment consists of engineers and agronomists, without any background in change management or human resource management. In the absence of formal training provision, support from colleagues, informal learning and mentoring played an important role in the process of change.

Information sources

Interviews conducted between May and June 2020 with the company's R&D director, an HR supervisor, an innovation manager and two operatives working in the grafting unit, of whom one was just promoted into a supervisory role.

Company web site: https://centroseia.it/en/ (https://centroseia.it/en/)

References

European Commission (2005) *Regulation (EC) No 396/2005 of the European Parliament and of the Council of 23 February 2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin and amending Council Directive 91/414/EECTex.*

ISTAT, n.d. *Dati ISTAT Dati complementari sul mercato del lavoro.*
Available at: http://dati.istat.it/ (http://dati.istat.it/)

Author

Anna Menenti, Technopolis Group

Revision log summary