

How the Different Visual Management Components Have an Impact on Developing a Lean Culture?

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Abstract — *Vulnerable, uncertain, complex and ambiguous environment surrounding companies, makes difficult to ensure business continuity and growth. Many companies have decided to deal with such complexity by pursuing a Lean Culture to drive organization competitiveness and efficiency to fulfil their Vision and Mission Statements. They leverage company's values as foundation to execute their strategic plan and dominate their markets. Many have taken the decision, however not all are successful at sustaining a lean culture. Why is that possible, if most of the companies are following Lean Methodologies and broad or extensive use of Six Sigma tools? There is not a magic formula for a company to create that lean culture; however, the ones that had achieve it, highlight the role of leadership and the deployment plan. This research was intended to evaluate how visual management could take a key role at helping management on creating the desired culture.*

Key Terms — *Continuous Improvement Culture, Lean Culture, Lean Transformation, Visual Management.*

PROBLEM STATEMENT

Many companies start the Lean Journey, by deploying the use of Lean Methodologies, developing standardized work for their processes and organizing their manufacturing facilities leveraging 5S. In addition, they had trained their employees on the belt's programs under Six Sigma to drive continuous improvement projects all around their facilities. Is that enough to create and sustain a Lean Culture? Many companies will see immediate benefits of the deployments of methodologies and tools after the initial resistance

is surpassed by the benefits of the deployment of change management programs, delivering on current year goals through continuous improvement projects. A Lean Culture is a culture that evolves naturally, as a reflex becoming better every single day, the synchronization of every employee, understanding and living the company vision and mission statement using their values as the credo to fulfill that "true north" [1], [2]. The moment of truth, the final test or the "life or death" challenge is what happens overtime; after implementation phase is done, advertising and training efforts starts reducing and more critical leaders starts to move or rotate to new roles while escalating their careers within the organization.

The hypothesis is that a well-designed visual management -that includes the right elements to communicate the information to all levels of the organization- will drive a common language and understanding across the manufacturing facility. A leader's role will be complemented during the implementation and could serve as a way to address the cognitive behavior [3] of the site population to support the organization and transcends the leadership changes, resulting in lean culture creation [4]. The problem statement will be the defined as:

The contribution throughout this research will provide the components to be included on the development of the visual management that creates a direct impact on the creation and sustainment of a Lean Culture as follows:

- Cognitive approach for a learning organization
- Aligned staff to vision and mission elements
- Reduction in non-conformances due to standard work short interval controls
- Motivated and recognized employees

- Cross functional developmental opportunities
- Board and contents flow
- Improved performance.

LITERATURE REVIEW

Visual management is used to track performance, completion of activities, provide communication channels for staff and management and to drive action eliminating obstacles towards the achievement of company's goals [1], [5]. The same situation is sustained by other researchers [6], [7] where they state visual management has been used historically as a method of communication on the shop floor. However, there is limited documentation or guidance on usage on strategy deployment or on broader areas across the organization other than manufacturing. Reference [8] shows the importance of the conduction of Lean Manufacturing Audits, to pursue implementation of lean principles across the whole enterprise not only the shop floor.

Why are visuals on the workplace so important? Visuals play a vital role creating flexibility and integration within the whole operation system [2], creating transparency and commonality between different areas within the organization.[9]. They should serve as self-explaining and self-improving [1], communicating what activities need to happen, by when, and how they should happen [10]. In addition, deviations from the established standards need to be easily identified or perceived from the visuals to clearly drive the improvements and go back to the desired outcome and /or improvement based on new business requirements [11]. Moreover, this continuous process will drive a learning and motivated organization since better outcomes are resulting after problem solving and learning from failure, tied to recognition when challenges are overcome [4], [12].

Managers track process performance to ensure is according to expectations. The process of tracking performance alone will not mean that a

sustainable lean culture is created, as an example a dashboard is different of a communication board [13]. The concept of "Democracy of Information" [7] establishes that to create a culture an environment of mutual respect and sharing of ideas needs to happen across the whole organization. "Without active engagement of employees, lean transitions will fail" [12].

Communication is not simply showing results, there is something else needed, human beings move from the heart and there is a big difference in being driven by obligation from being emotionally attached to a cause. Reference [12] shows there is a strong correlation between employee engagement and Lean sustainability. This connection with the cause, is relevant to the concept of cognitive psychology or the human beings mental process. [13]. Human beings mind works in the following sequence, get attention or get connected, then perceive or understand, activate the creative thinking and then proceed to problem-solving.

The human mind also has limitations, therefore it's important to have the right balance of information to avoid overwhelmed employees. For that reason, the number of elements included on the visual management should be limited since the amount of information by the human mind is limited during the perception phase [13], [14].

Another important factor of the visual management, in addition to the number of elements to include on it, is the flow. The flow implies how the information is presented, this helps eliminate the multiple interpretations and gives the team or group of people a more accurate perception of reality [13], [14]. Flow of information is also a strong component of standardization and subsequently will drive consistency and replicability across the whole organization not just one area. Another component is the use of standardized colors and color meanings to symbols used to delineate status of activities or initiatives. This standardization is not with the intention to be uniform, instead for quick distinction of results within the different areas of the organization which led to culture creation [14]. Reference [4] shows

this will also help to create the corporate identity or branding ensuring consistency across the different sites.

The human being learning process works through thought assimilation. This process is materialized using the five senses; where visual and hearing covers for more than 80% of the assimilation process. For that reason, attitudes and behaviors could be influenced through communication using visual management [3].

One revealing aspect on the research was the approach followed by [4] and [13] where the authors described visual management as the vehicle to introduce Lean rather than visual controls being part of Lean. That perspective is critical since this implies that the visuals are not merely representations of current or past performance, they are in fact key contributors to the deployment of operations strategy with a dual purpose for management and staff communication. Moreover, visual management will serve to motivate employees and connect them with the reason to be there by using slogans, corporate mission and vision statements. Change is external while transformation is internal [12], therefore it is important to have a personal commitment from employees to fulfill the company's, vision, mission and goals.

Fundamentally management and staff have the same understanding [15] therefore the accuracy of operating guidelines is critical. Perhaps the intention of clarity on the instructions and information has always been a priority for management. However, by the time these guidelines hit the floor, they could create doubts or uncertainty on the staff. Well designed and structured visual management plays a key role here closing that gap thus creating a common language and understanding. In addition to clear understanding it's critical to have the right support from management, since this is key to sustain the tool and provide the right coaching and support. Transparency and engagement from staff members to work on the design of how the information is presented creates an environment of pride and

belonging among the staff population, embracing more the success of the visual management implemented [11]. Reference [4] shows visual communications contain four different features: assimilation, for example the use of slogans will help staff to become identified and create a sense of belonging; exposure, creates the stimulus to learn; evoking, triggers emotions resulting in motivation; and unifying, ensures direction where the organization is going. Common language is one of the hardest things to accomplish when driving the creation of a Lean Culture. The main reason for this difficulty is the different levels of education on Lean methodologies and Six Sigma tools and the amount of transformation experience across the organization. Transformations need to be led by visionary people to be able to see the big picture and be five steps ahead, understanding the knowledge gaps in the organization and how to overcome them with clear communication of the reason for change [12], [16].

Reference [15] shows the training system design to attack this situation needs to be dynamic and should create business flexibility and behavioral consistency in the organization by developing the emotional skills along with technical skills within the staff population. Emotional skills as defined by the authors include: the ability to understand the reason why training will help you as a staff to do the job better; how training will help you define the areas of focus; identify what targets need to be met; staff self-assessment when they are becoming better due to the training system; and immediate feedback in terms of additional training or repeats needed. Job complexity which includes demand changes often creates resource constraints. Visual management could take a protagonist role in facilitating the redistribution of tasks among the staff members of a designated area based on cross-training capabilities [14].

METHODOLOGY

The design experiment was determined to be an exploratory research [17] of a lean transformation deployed on multiple sites around the world of the Global Manufacturing Company (GMC). The effort was done to identify the actual state of visual management implementation on each one of the three sites -after general guidance was provided by the corporate centralized support group- and to evaluate the impact or relationship of the visual management approach implemented on each Site and the resulted Site Culture.

The experiment was executed during 2019 including physical visits to three of the Sites of the GMC. During the visit of each location meetings with Site Management were conducted to understand; the overall Site Strategy, the deployment and communication process, the alignment of the lean system, and the visual management approach selected to deliver the expected results based on the location goals. Site tours were conducted including live Work Center Team (WCT) meetings to observe behaviors. Manufacturing, warehouse and back office operations were visited, and respective visual management boards were observed. Data was collected regarding the different components included in each board and the rationale for each one of them. Moreover, focal groups were conducted with site middle management and operators respectively. Among the topics covered during the focal group sessions were strategy deployment, performance measures, leader's purposeful presence on the floor, visual management and problem solving, based on the following combination questions:

- What is the site core mission, the site role on that mission and how the specific area connects to that? What is the business direction and current goals?
- Is visual management right for the specific area? Does it help you to do your job right? Did you were involved on the design?

- How of often the leaders go to the floor? Are they supportive of the visual management? Is feedback been provided timely?
- What are the biggest challenges the area is facing? How can those challenges be problem solved?

Data collected -including meeting notes, focal groups minutes, and visual management boards photos- was then analyzed, and data is presented as the base for the conclusions on the subsequent section.

RESULTS AND DISCUSSION

The company is a pioneer on their manufacturing sector leading the industry for decades with innovative research and exclusive products. Market conditions are changing quickly resulting in increased competition, governmental drug pricing pressures, higher developmental costs, stricter regulatory agencies approval parameters and extensive legal battles for intellectual property before products can be available to treat patients. The response of the GMC to this new dynamic reality had been the pursuit of a Lean Journey to maximize resources use, optimize production and inventory levels to drive productivity to fuel their research, and defend their position on the marketplace. Corporate had established playbooks for deployment of methodologies and tools to drive the transformation, however each facility had the leeway to select their own approach on Lean management system and visual management implementation.

The playbook suggests the use of multiple tiers across the organization. The research process identified consistency on the three sites on the tier definition, where Tier 1 was designed for the visual management used on the shop floor to drive the daily activities delivering production plan. Tier 2 was defined as the middle management where the data is captured and analyzed to understand performance of the functional. The frequency of this discussion happens on a daily or weekly basis depending on the function. In addition, Tier 3 had

been defined as Site Leadership level, discussion happens on a weekly basis to cover the overall health of the manufacturing facility. KPI's are discussed, trends are analyzed, and countermeasures are taken with the proper escalation process and communication cascade.

There are two possible formats. One is the physical board where data is updated manually using designated marks and coded colors to represent status of goals, KPI's, milestones and production. The other is the use of electronic displays or monitors where information is displayed using manual input forms or populated directly from ERP or production systems. The monitors are up and running 24/7 in order to provide the same advantage and visibility of a physical board. Visits to the three locations shows that Location #1 uses the approach of manual physical boards while Location #2 and Location #3 uses a hybrid approach where a combination of physical and electronic monitors are used to display the data during the different WCT meeting across the sites.

While attending the different WCT meetings during our visits we spend time observing the different components on each board utilized to run the WCT's (See Figure 1).

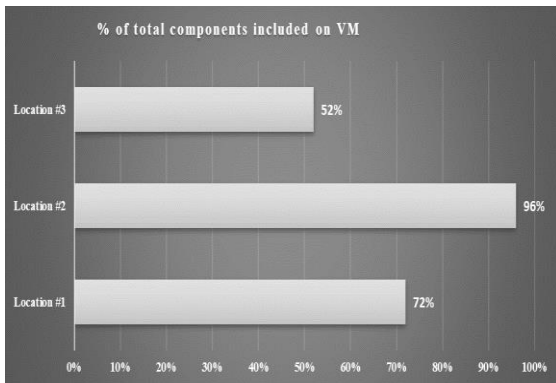


Figure 1
Visual Management Components

A total of 25 different components were identified and then quantified to determine how many of them on were existent each location. Location # 1 uses 18 of the 25 components while Location # 2 had evidence of 24 out of the 25 and Location # 3 13 out of the 25 components. Location

#2 was the most comprehensive facility with 96% of components in place.

We interviewed leadership teams to understand their involvement on the development of the visual management, Gemba walks and problem solving on the manufacturing floor. Focal groups questions were designed to access Lean Cultural Maturity at each Site (See Figure 2) getting an understanding of the feelings of floor staff about site and company mission and vision, current business challenges, goals and how they connect to them.

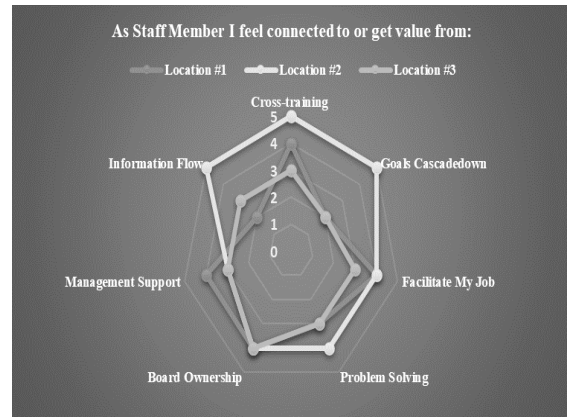


Figure 2
Staff Feelings

It also addresses staff ownership in developing the visual management and the level of support received from top management with the rest of the organization on the day to day operations. From the graph in Figure 1 we can observe bigger value perceived from staff at Location #2 of the implemented visual management. This is supported by the additional components present on the visual management of Location # 2, which are components related to the people or cognitive side. Site leadership shared their operating model philosophy which is the basis or foundation for the culture observed at the site, where different to the other locations Lean is a foundational element of how they run the business. They describe their Culture of Safety, Culture of Quality and Culture of Lean, work together hand to hand as the operating culture segment, on a mutually inclusive environment rather than each culture fighting for its existence or degree of importance versus the others.

In addition, we can observe how the business layer in the culture is not separate from the people side of it, where for the Site leadership the most important thing in addition to the safety of its employees is their development. The site has a robust training system since it is critical to have one on a GMP environment, however they have a comprehensive curriculum to develop the whole organization on Lean Principles. Moreover, for the site it's critical to be a good neighbor with the community surrounding the facility and a good neighbor with the environment. All those elements combined form the winning piece of the puzzle One Team, everybody on the organization with only one mission driven by the collective culture and company values.

The first additional component on the visual management of Location #2 is the use of standardized components. The other two facilities had standardized ways to show on track of track status of key milestones and activities but the level of standardization in Location #2 go way further. When going to board within the facility the feel and sense is the same, according to the leadership team this is key, and the intention is to facilitate the understanding and onboarding of employees. As one of the leader emphasize, "This facility believes in the development of our staff and with the amount of developmental rotations that we have on site will be difficult if the staff have to learn how to read and understand each board every time they move". Standardized components are around the inclusion of a vision statement alignment, this component drives a sense of belonging to each area in the organization. The way the information is structured on the board facilitates the discussion during the WCT's since things are organized from micro, tactical or daily discussion which they call it "keep the lights on" to the trending view which they call it "look ahead" to the macro, strategic discussion which they called it "advance the organization". A goals cascade down section, shows the goals at every level helping staff understand their individual contribution. Lastly a recognition section that exponentially drive the employee's engagement

since it's intended as a peer to peer recognition for collaboration, improvement ideas and others as part of a comprehensive recognition system that goes up to monthly functional recognition, quarterly site recognition and annual submission to global awards.

The component of vision and mission alignment found on Location #2 as the header of each visual management board across the site. Talking to the leadership team this is a key element since it includes on the left corner a logo that summarizes the manufacturing operations division framework, while the logo on the right-hand side describes the One Culture winning formula, that summarizes the way they do business to satisfy their site vision statement. On the middle of the header section resides the local area or subgroup mission statement. This mission statement had been designed using the concept of flight levels had been used to understand what the different areas on the organization need to focus on in order that collectively they deliver the Company Mission and Vision. As one of the leaders said "If we all have our mission at the same altitude, at the corporate level we will never achieve it since is too big, in contrary if we individually focus on what we control collectively we will deliver"

The goals cascade down section found on every board shows in one document on the form of a matrix the interaction of the goals for the whole organization. Starting from the left side shows the operations division or company goals followed next by the Site goals that the Site leadership team has determined to help the Company achieve their goals, the Site contribution. The next section on the right is the functional and sub-function goals, reduced in scope but designed to help the site and subsequently the division and company. The subgroup goals had details of the owners of those goals which are individual staff member who owns the group initiatives. This was very evident on the Focal Group sessions at Location #2 that facilitates the communication of the strategy throughout the organization. Location #1 instead of addressing the strategy deployment using each individual board

uses instead a dedicated set of boards for strategy deployment and tracking of each on the transformational initiatives that will deliver the strategic imperatives. On Location # 3 the strategy deployment element was not visible, according to the leadership team is communicated to staff over all staff meetings.

Another component of the visual management boards of Location # 2 was the recognition section. This element was present on each location visited, nevertheless, what was different on Location # 2 was that the component was standard, but the format varies depending on the subgroup, to have a unique touch of the staff members that comprise the team. Examples of recognition were formatted using format of social media platforms like Facebook, You Tube, Twitter or Instagram to show the appreciation to their colleagues and say David “You Rock!” or you did a “Great Job!”

The last component of the visual management found on Location # 2 that was not present on the visual management of the other two locations was the Cross-Training Matrix. According to the Leadership Team this serves as an essential tool for a dual purpose. For the front-line managers is used on every shift to distribute the resources available based on the qualified skills. The staff utilization percentage is calculated and over or under staff on the shift is flex in the other areas of the manufacturing floor driving agility to cover peaks and valleys on the changes of production volumes. The second purpose of this matrix is to stimulate staff members to pursue developmental opportunities by getting certified in other areas of the organization. The other two locations use similar matrixes to capture staff members skillset, but they are not a component of their visual management.

In addition, Location # 2 had a mandatory comprehensive curriculum program on developing their staff on the operational excellence topics including Lean principles and methodologies, Six Sigma tools, financial education, productivity, error reduction, human error and others. The training consists of 20 courses between web based,

classroom and formal Yellow, Green and Black belts programs. The curriculum uses a ladder approach where the requirements increment with your level. According to Site leaders this approach will ensure that future leaders are in alignment to the Lean Culture they are creating, and the sustainability of the Lean systems is guaranteed. As one of the leaders said “ We cannot guarantee the next leaders will bring transformational experience on their background, we need true believers on Lean to help us advance the organization and lead the organization to the future, therefore we can’t rely on luck, instead we need an ecosystem to create Lean thinkers”. The other locations also have comprehensive training programs but are not mandatory, they instead follow the traditional approach of the different belt programs under Lean and Six Sigma depending on the business needs.

Standard work was observed on the three locations and different stages of maturity. Location #1 has heavy use standards work on their warehouse activities while Location # 3 leverage the use of the standard work for their maintenance activities. On both locations they leverage industrial engineering resources at certain periods during the year to perform time studies and drive projects to eliminate waste for improving those standards over the years. Location # 2 had a different approach where standard work had been deployed broadly across the organization starting with the manufacturing areas, warehouse, maintenance activities and in other support areas like investigations and the project management office (PMO) where a tier approach is used to apply standards work to the projects business case and funding activities defined by the level of complexity low, medium and high. The number of steps on the standard work varies based on that level of complexity. The use of standards follows the PDCA cycle or Plan, Do, Check, Act.

The process of managing the creation of the standard work at each area using a Standard Work Assessment Matrix or SWAM, a document included on the Advance the Organization section of the boards that list all the processes on the area,

the owner of each process and the status of the completion or revision of each document. Standard work documents are approved for manufacturing purposes as soon as the 30 data points are collected and the adequate cycle time for each operation is determined and they are ready to be used on the Short Interval Control Board , for planning and measurement of daily activities. This process had been an effort of multiple years of continued work.

The Standard work sheet for every process lists the correct and most effective sequence of activities and the designated time for each one of them to execute the process the most efficient way to comply with customer expectations. The process lists the number of operators needed for such activity, the protective equipment and tools needed to handle the operation with the level of security required and the flow of movement of the different operations together on the form of an “spaghetti diagram”.

As an example, the manufacturing process X7754 shows that the owner is Staff 1, the process is approved and ready to use and it is on its current version number 2 which means this standard work had suffered improvements since its original implementation. This process X7754 located on binder 37 requires one operator or staff member to perform ten operations for a total cycle time of 300 minutes, and the protective equipment needed is listed at the bottom of the document.

On the overlap period of the shift change, the FLM had a discussion with the exiting FLM of the activities pending or not completed on the previous shift to understand the activities needed to be performed under his shift. The list of activities collected on the Short Interval Control Board or SIC Board and the shift is planned assigning activities by operator or staff member using the standard time for each operation based on each process standard work sheet. They use specific colors to identify activities that are fixed (black), they need to happen at a determined time during the shift or flexible (blue), activities that could happen at any given time. After all the activities are

distributed among the staff, the percentage of utilization of staff is calculated to identify each staff is booked over 85% of utilization, any excess or resource capacity is then broad all FLMs meetings half an hour after the shift had started and resources are flexed based on leveraging the cross-training matrixes on each board knowing immediately who is qualified to work where, creating an agility in the organization. The process is then executed, and the actual times consumed on each operation is collected and tracked against the plan on the SIC board using green color activities terminated within the standard and red for activities that took additional time to complete. The activities that took longer to complete than the standard time are collected on the Countermeasure Board to perform a problem-solving exercise to identify the root cause for the departure and to establish controls to ensure the deviation does not occur again. The accountability of resolving the countermeasure item resides on the owner of the process and the completion of it is tracked at WCT meeting every day.

According to one of the leaders (See Figure 3) the implementation of standard work and the PDCA cycle on the facility had been key, after two years of implementation process lead time had been reduced 20% by waste elimination. Another of the leaders was highlighting “We have seen significant improvement in the last two years that we have been measuring ourselves, however we recognize this evolution needs to continue happen, I hope we can improve as fast enough to overcome future challenges of our dynamic environment”.

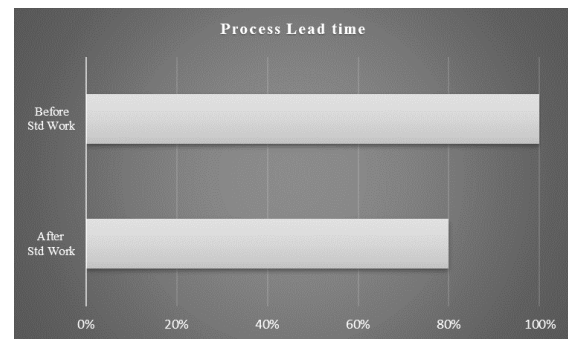


Figure 3
Standard Work Contributions

Formal Lean Maturity Index assessment was performed with the help of the Corporate group (See Figure 4) which shows Location #2 with a higher level of maturity than the other two locations driven essentially by visual management (4/5) and standard work (3.5/5).

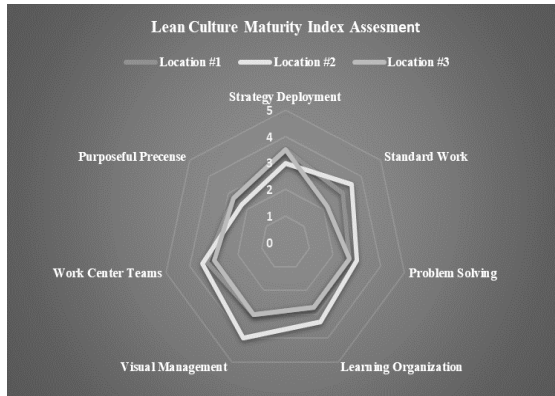


Figure 4
Lean Culture Maturity Index

CONCLUSIONS

The exploratory research was intended to get an answer to the problem statement question: How the different visual management components have an impact on developing a Lean Culture? Literature review identified that design and information included on the visual management are critical for effectiveness of Lean transformation deployment. Sustaining visual management plays a key role on communicating company strategy, engage employees, drive collaboration, measure performance, and stimulate continuous improvement and innovation, which are essential behaviors needed for the sustainment of a Lean Culture and overall financial success. The boards become the glue between the strategy, management, employees and results.

After visiting the three different sites of the GMC, interviewed Site Leadership members shared their experience over different testimonials of the deployment process and how the visual management had helped them in driving performance on their facilities along with their strategy deployment approaches. After the attendance of the different WCT's meetings and

spending additional time with operators during the focal groups we concluded that our hypothesis has been proven. Different approaches on the implementation of visual management will impact the culture maturity. It was demonstrated by the research were similar guidance was provided to each site, all of them had implemented performance tracking, problem solving and monitoring of standards, however the location that had chosen to go an extra step adding cognitive psychology elements on its visual management to engage, motivate, and educate their employees had advance further on a Lean Culture Maturity, creating an environment of pride and belonging among its employees. There is not a magic pill or magic formula to implement the Lean principles and sustain successfully the culture. However, leaders and staff members using visual management as their transparent communication tool can "make it happen".

Future research should occur on the evolution of the visual management to support the quickly changing environment leveraging technology to ensure an environment of collaboration, engagement and performance is not affected by the current challenges the world is facing including natural disasters and pandemics that have change the way we did business yesterday and has forced us to be creative to work from the distance with the challenge to continue being an effective team working from home.

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