Psychological factors affecting the sustainability of 5S lean

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Abstract: At Company X, 5S is being revised due to failure. Rather than focus on the systematic failures, the aim is to psychologically assess the participants involved and how they are affected by lean practices. The literature review establishes that lean manufacturing has failed to consider human aspects in the past, resulting in undesirable working conditions that can negatively affect commitment, and goes on to identify the role human behaviour plays in the performance of operating systems. Through behavioural operations research, it is demonstrated that taking into account cognitive factors can lead to fundamentally different predictions about the performance of operating systems. Furthermore, it is shown how cognitive biases can cloud judgement, and how cognitive repairs may be used to find a remedy to an otherwise misinterpreted situation. The overall purpose of this case-study is to highlight the benefits of behavioural operations research and the need for awareness training amongst managers.

Keywords: lean enterprise; lean manufacturing; organisational behaviour; management; sustainability; psychological; Taylorism; 5S lean; cognitive biases; cognitive repairs; operations management; decision-making; operating systems; commitment; behavioural operations.

Biographical notes: Pat McNamara has been studying and working within the manufacturing industry for over 17 years, starting as an apprentice working in a small made-to-order workshop. After attaining his metal fabrication qualification, he went on to study at the University of Limerick and earned his BSc in Production Management. Since then, he has endeavoured to research systems and processes in the aim of identifying flaws and improving them from a human point of view.

1 Introduction

Since the heyday of mass production, managers have been concerned with the elimination of wasteful activities. As told by Womack et al. (1990, p.26), one of these wasteful activities comes in the guise of motion, highlighted by the introduction of the moving assembly line at Ford's Highland Park plant in 1913, which brought the car past the worker; this innovation cut cycle time from 2.3 minutes to 1.19 minutes. The

difference lay in the time saved by having the workers standing still rather than walking and in the faster work-pace which the moving line could enforce. This innovation was the result of placing production priorities ahead of the workers' emotions as the resulting work was decidedly monotonous. The Toyota production system then paved the way for what is now called lean production, which identifies and eliminates non-value adding activities such as correction, waiting, inventory and motion.

Regardless of whether it is lean or mass techniques, the individual worker is viewed as a factor of production since he/she produces output and is paid for their physical and mental effort. Management's task of identifying and rectifying problems within mass/lean organisations would be less complicated if there was a direct and quantifiable co-relation between pay and employee performance, but this is not the case since the many assumptions about motivation cannot always explain workplace behaviour. So rather than focusing on the possible procedural flaws within such operating systems, it would be more prudent to assess the behaviour of the participants involved in lean systems and their perception of the work-environment, whilst considering the impact of cognitive biases; all of which may unconstructively influence commitment to sustaining lean practices, thus stifling the overall goal of continuous improvement.

1.1 The problem

5S is a lean operating system that is primarily used for eliminating of wasteful activities. However, consequential to the extra duties placed upon employees, implementation may be negatively perceived, which in turn can manifest in a lack of worker commitment to sustain the system. Company X is located in Ireland, and is a US multinational that produces class 2 and 3 medical devices under FDA regulations, and is currently revising is 5S system due to a failure to sustain, mainly as a consequence of tools not being returned to toolboxes, resulting in unchecked redundant motion. Safety procedures are being compromised due to leaving flammable cleaning liquids in dangerous areas, and systematic replenishment of line-supplies is neglected.

The design and implementation of the 5S program is not the issue to be analysed herewith, since there are plenty of visual tools such as signs and notice boards to remind the line-staff of their 5S responsibilities and they all sat through a very detailed presentation on the procedures involved; hence failure to sustain is based on the observations made at the plant and concurs with management's reasons to re-examine the program.

5S consists of fives phases – sort, straighten, shine, standardise, sustain. However, no matter how well implemented the first four steps are, improvement gains will be lost and 5S doomed to failure without a commitment to sustain from both line-staff and management.

What makes 5S so difficult to uphold is that the last discipline in the process: 'sustain' is unique in that it cannot be implemented by a set of techniques, nor can it be measured. However, conditions and structures can be created to help uphold the necessary commitment, such as audits which score each line on their 5S abilities and by using incentives like rewards for the best practitioners of 5S. This may also have a negative impact depending on the level of competition between lines or departments, as the workers may try to sabotage their rival's 5S efforts by stealing tools and supplies from each other's lines, which results in a failure to sustain.

Figure 1   5S circle (see online version for colours)
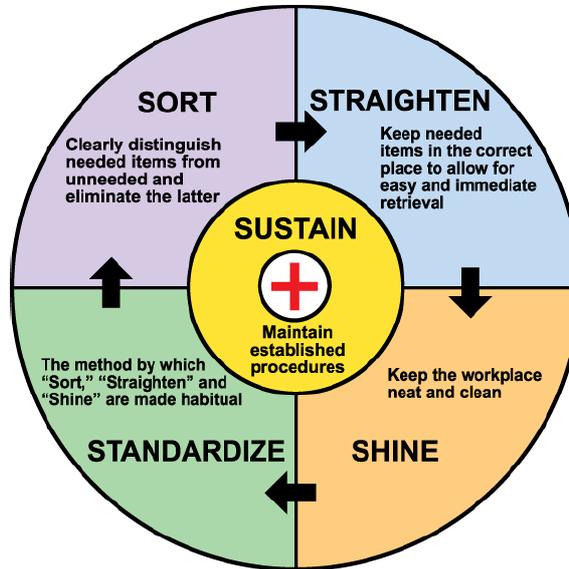
Source: Beyond Lean (2011)

One of the listed benefits from 5S is increased employee morale, but this may not be as the system maybe viewed as extra work by the line-staff. The tools that are used to help sustain 5S are slogans, posters, story-boards, newsletters, pocket manuals and department tours, but these tools are useless if the worker has a negative perception of the system and may even resent it since the tools serve only to remind the worker of the extra-work he has to do on top of his existing duties. Slogans such as "5S means working smarter not harder" and "5S is not something extra; it is part of every day work" are used by many companies to promote 5S in the workplace. Yet how can this be, since practising 5S does require activity; that is, it is not possible to be clean without cleaning or to be organised without putting things away. Nonetheless, there are many well-documented benefits of 5S and such lean practices, but these mainly apply to production and costs, whereas the workers have little to gain except a greater workload and increased responsibility on top of their already existing work. Therefore, it is logical to assume that the workers have a negative perception of 5S and are no way inclined to commit to it, and because all aspects of the decisions that individuals make in and out of the workplace are a direct result of attitudes and perceptions (Stranks, 1994; Morley et al., 2004); it leads to the conclusion that in order to sustain a lean system, management must first consider how the worker perceives it and try to identify any cognitive biases that may presently be obscuring a potential solution; and thus allocate resources or tailor the procedures accordingly to counteract any potential negativity.

So began a literature search of cases not specific to 5S, but to lean operations in general, where operating procedures have failed to consider the human aspect of production practices and what the outcome was from the workers point of view. It is believed that in order to identify the negative aspects, we must assess the system's capability from a behavioural operations view, which starts with grounded assumptions from social and cognitive psychology. It recognises that people have cognitive limits and

as a consequence, their decisions might be hampered by systematic bias (Gino and Pisano, 2006). Cognition is a group of mental processes that includes understanding, learning, reasoning, problem solving, and decision making, but long standing research has shown that human beings are limited in their ability to process information (Simon, 1976). As evidence, various researchers have identified a large number of biases and heuristics over the past 30 years. Biases, which result from cognitive limitations, are systematic errors that affect people's decisions (Gino and Pisano, 2008). So if the line-staff at Company X have a negative perception of the 5S system then their decision to commit to it will be biased accordingly. Through the use behavioural operations theory, the root cause of the problem at hand may be identified; and hence, a suitable remedy offered ('Company X' is not the real name of the organisation involved in this study).

2 Literature review

2.1 The human impact of lean

The Machine That Changed the World is useful for understanding the principles of lean and how they came to be, but there is little consideration for the human aspect of working in a mass or lean organisation. "Their conditions of employment came to seem less and less bearable" [Womack et al., (1990), p.40] refers negatively to mass production and the conditions it imposes upon the worker, whereas there is no negative mention in a human context in lean production and there is not one quote from anyone who worked within the system. Books like *The Machine That Changed the World* focus on numbers without any consideration for the human cost of lean production.

Parker and Slaughter (1988) define lean production as "management by stress" and Fucini and Fucini (1990) condemn lean as "being insensitive to the needs of the worker". Negative aspects of lean are that it can create a low quality of life for workers involved (Biazzo and Panizzolo, 2000); which in turn, can negatively affect commitment to continuous improvement initiatives. Mehri (2006) observed first hand the conditions that lean production forces upon workers by working for three years in Japan. On the topic of Toyota's safety policy he says,

> "I witnessed that it represented little more that a public relations gesture, or worse, a way to shift responsibility for safety onto the workers and away from management. What I learned was about the frequency of injury, the long hours, working conditions, and the pressure placed on production workers soon made the company's official line about safety ring hollow."

He observed welders working without proper protective clothing and inadequate equipment; surely a company as profitable as Toyota can afford to supply its workers with basic safety equipment – such practices can be viewed as anorexic rather than lean. Furthermore, according to Chen and Taylor (2009), extensive amounts of lean can be harmful to the employees' creativity and found that standardised systems and monotonous job routines may lead to decreased levels of commitment and less motivation, and that stress is also created in the work environment from busy schedules and multiple responsibilities expected from the lean workers.

In lean manufacturing, every factory floor responsibility is standardised and regimented (Olivella et al., 2008). Management create and document precise definitions

and procedures such as 5S for cleanliness and organisation of the workplace in the hope of reducing process disruption and worker error. This factory floor documentation is used to facilitate change rather than to prescribe people's behaviour rigidly (Forza, 1996). The importance of people suggests that human behaviour might have a significant influence on the way operating systems work, how they perform, and how they will respond to interventions.

The field of operations dates back to the early part of the 20th century with Frederick Taylor's time motion studies. Since then, much has changed in the environment (technology, globalisation, etc.), and the repertoire of tools available to operating management (capacity planning, inventory models, forecasting methodologies, project management methods, etc.). Yet one thing has not changed: in the vast majority of operation – from manufacturing and services to supply chains and R&D – people are a critical component of the system (Gino and Pisano, 2006). As Hayes et al. (1988, p.242) state:

> "Superior performance is ultimately based on the people in an organisation. The right management principles, systems, and procedures play an essential role, but the capabilities that create a competitive advantage come from people – their skill, discipline, motivation, ability of solve problems, and their capacity for learning."

It has been further concluded by Al-Najem et al. (2012) that organisational culture and leadership are recognised as vital and critical aspects for implementation of lean and other quality systems, and describes lean management as being more philosophical than technical. Therefore, rather than seeking to comprehensively understand the lean system at hand, it may be more beneficial to better understand the people involved.

2.2   Behavioural operations theory

The term 'behavioural operations' refers to an emergent approach in the study of operations which explicitly incorporates social and cognitive psychology theory. A lot of models in operation management assume that the individuals involved in implementing operating systems are rational or can be induced to act rationally, and that their decision making is unhampered by cognitive biases or emotions. Conversely, research in behavioural operations starts with grounded assumptions from cognitive and social psychology. It recognises that people have cognitive limits and as a consequence, their decision might be hampered by a systemic bias (Gino and Pisano, 2006).

Cognitive psychology studies the mental processes that underlie behaviour such as thinking, deciding, and reasoning and to some extent, motivation and emotion which are all directly related to perception. Understanding processes of perception and the ways in which they can develop can help explain how individuals make sense of and act upon the information they receive. Atkinson et al. (1993) define perception as "the psychological process through which people receive, organise and interpret information from their environment"; and so all aspects of the decisions that individuals make, both in and out of the workplace, are a direct result of how the person perceives the specific situation at hand [Morley et al., (2004), p.55].

Gino and Pisano (2006) suggest taking suggest taking into account behavioural and cognitive factors can lead to fundamentally different predictions about the performance of given operating systems. However, organisational behaviour research has largely

ignored the literature on individual cognition, focusing instead on issues of motivation or incentive. This fails to recognise that individuals indeed face cognitive shortcomings and that organisation can provide individuals with norms and procedures that moderate their limitations and reduce their shortcomings. These norms and procedures are called 'cognitive repairs', which act as a kind of 'safety net' for an individual's cognitive shortcomings (Heath et al., 1998).

What is a cognitive repair? Organisational repairs can be divided into two classes, motivational repairs and cognitive repairs. Motivational repairs increase the energy and enthusiasm with which individuals pursue a task and cognitive repairs improve the mental procedures individuals use to decide which tasks to pursue and how to pursue them. Cognitive repairs are organisational practices that may repair the cognitive shortcoming of individuals within the organisation (Heath et al., 1998). Therefore, since it is nearly impossible for people to avoid biases in perception and attitudes (Plous, 1993), behavioural operations research should be looking at ways to create 'cognitive repairs' to overcome the psychological distortions at the root of many operations management problems (Gino and Pisano, 2006).

3 Research methodology

3.1 Qualitative or quantitative?

Researcher Robert K. Yin (1984, p.23) defines the case-study research method as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; in when the boundaries between phenomenon and context are not clearly evident, and in which multiple sources of evidence are used. For this case-study, the sources of evidence will be observations, interviews and questionnaires. A total of 40 hours was spent at Company X over a six-week period working with the in-house 5S task team. The observation period was mainly used to uncover the technical problems as to why the 5S system was failing as shown in Figure 2, thus prompting further investigation.

Figure 2 Fishbone diagram of 5S failure
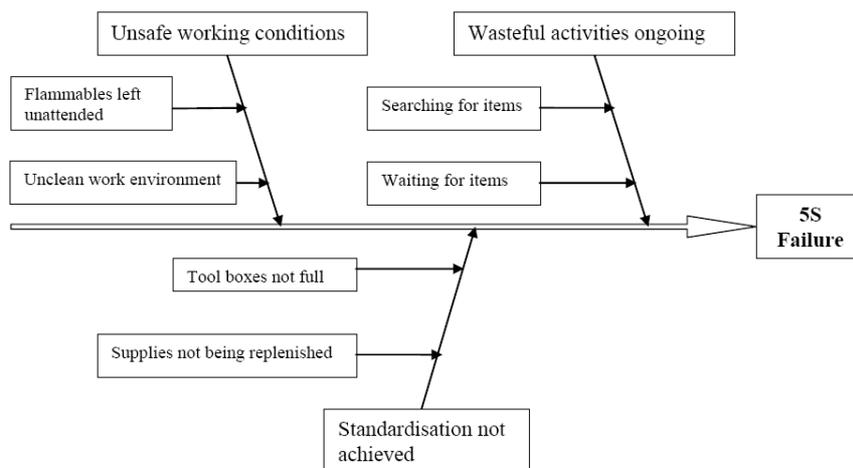
A starting point in performing a situational analysis for research purposes is that there are two broad approaches: qualitative and quantitative research. The early form of research originated in the natural sciences such as biology, chemistry, physics, geology, etc. and was concerned with investigating things which could be observed and measured in some way. Such observations and measurements can be made objectively and repeated by other researchers, and is referred to as 'quantitative research' (Hancock, 1998). This is of no benefit to the case-study at hand, since the sustainability of 5S cannot be measured nor can it be implemented, but relies entirely on the ability of the employee to commit.

Researchers working in the social sciences such as psychology, sociology, anthropology, etc., were interested in studying behaviour within the social construct inhabited by human beings, but found it to be increasingly difficult in trying to explain an individual's behaviour in simple measurement terms. Measurements tell us how often or how many people behave in a certain manner, but they do not adequately answer the question of why things are the way they are in our social world and why people act the way they do (Hancock, 1998). Qualitative research is concerned with uncovering the answers to questions which begin with: Why? How? In what way? and is concerned with the opinions, experiences and feelings of the individuals producing the subjective data.

The goal of this research is to rely as much as possible on the participant's perception of the situation being studied. Worldviews are seen as a general orientation about the world and the nature of the research that the researcher holds. The social constructivist worldview is the perspective that will be adopted for this paper since it is typically seen as an approach to qualitative research. Social constructivists hold assumptions that individuals seek understanding of the world in which they work and live, and also that individuals develop subjective meaning of their experience-meanings directed toward certain objects and things (Creswell, 1994).

3.2   Data collection methods

Qualitative methods are ways of collecting data which are concerned with describing meaning, rather than with drawing statistical inferences. Qualitative methods provide a more in depth and rich description, so this will be the method used to investigate the perception of the employees involved. Primary data will be obtained by the methods listed below.

- *interactive interviewing* – employees asked to verbally describe their experiences with the 5S program

- *written descriptions and questionnaires* – employees asked to write descriptions of their experiences

- *observation* – descriptive observations of workplace activities and non-verbal behaviour.

The questions will be broad and general so that the participants can construct the meaning of the situation, typically forged in discussions or interaction with other persons. The more open-ended the questioning, the better, as the researcher listens carefully to what people say or do in their work setting. The basic generation of meaning is always social, arising in and out of interaction with a human community. The process of qualitative research is largely inductive with the inquirer generating meaning from the data collected (Kraut, 1996).

In order to achieve optimal results the use of a triangulation method will be included by hearing 'both sides of the story'. Management and line-staff alike will be asked the same questions. The responses will be compared as to ascertain whether the 'stories' they tell are close to the reality of the situation at hand. Qualitative studies are tools used in understanding and describing the world of human experience. Since we maintain our humanity throughout the research process, we must be aware of our own cognitive biases as not to influence the response of a worker during an interview or in the construction of a questionnaire. This is best achieved by asking open ended questions such as:

1   Do you feel that 5S has made it easier to locate items such as tools and cleaning equipment, etc?

2   Describe how 5S has affected your daily work routine.

3   Do you feel that 5S places extra duties on you? – In what way?

4   Do you agree with this slogan: "5S means working smarter, not harder"? – Why?

5   Has 5S made your work environment cleaner or safer to work in? – Explain?

6   Are you concerned about the elimination of wasteful activities and why?

3.3   Participants and limitations

Due to time constraints, only a sample population of 50 of the total 500 employees were contacted regarding this situational analysis. Although a larger sample would provide broader picture of the situation at hand, it is not crucial to the objectives of this case-study. To triangulate completely, it would be wise to use multiple researchers to compare results; however, this is not an option and therefore limits the validity of the research, but the overall purpose of demonstrating the use of behavioural operations theory is upheld.

Participants were selected at random by approaching them within the work setting and requesting their time. Twelve line-staff members volunteered to be interviewed privately on-site, and another 18 line-staff completed questionnaires under the name '5S improvement questionnaire' consisting of the ten questions above which were distributed by hand and collected the following week within the facility. The employee's job-title was requested and that approximately 100 words are used for each response. Six managers from the quality, production and engineering departments completed questionnaires out of the ten contacted via e-mail.

	Management	*Line-staff*
Interviews	0	12 process technicians
Questionnaires	2 production managers	18 process technicians
	1 operations engineer	
	2 BPI managers	
	1 unit advisor	

Figure 3   Research methodology flowchart
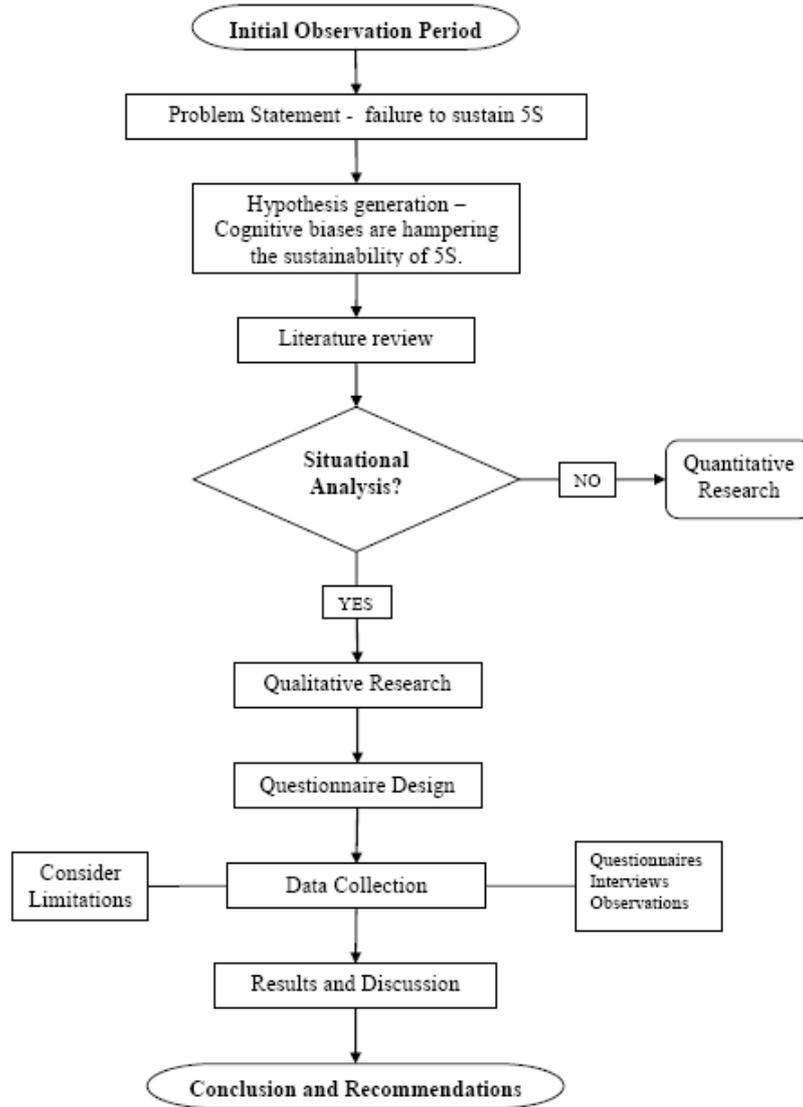
Questionnaire responses and interview notes were then compiled and scrutinised with the aim of identifying psychological trends that may be hampering the sustainability of the 5S initiative. Secondary data will come from the literature already discussed, yet may include further information from books and journals to help explain and clarify statements and observations.

4 Results and discussion

4.1 Line-staff's perceptions

The implementation of 5S is mostly a success at Company X, both managers and line-staff agree with its practical logic, but the failing in the 5S system is that some of the line-staff are not putting tools and cleaning items back to the 5S appointed location. This ongoing flaw in the sustaining of 5S is obvious to both management and line-staff. However, management's reasons for wanting to address this problem stem from performance-based measures, whereas the line-staff are not as concerned, since they seem to be aware that they still have to do a full shift regardless of whether they are looking for a tool or carrying out maintenance work.

It is impossible to understand why someone perceives his/her environment in a particular way unless we consider certain factors relating to that individual. People's expectations, motivations, emotions, and attitudes are characteristics which influence the perceptual process and which must be considered when attempting to understand how the line-staff perceive the 5S system and management. It is important to emphasise that workers are people too and may have emotional issues that result from outside the workplace which cannot be controlled by management. So for this reason the employee's emotions will not be considered for the purposes of this paper.

4.1.1 Individual expectations are influenced by organisational goals

Expectancy theory predicts that employees in an organisation will be motivated when they believe that putting in more effort will yield better job performance, but a statement such as "we still have to do a full shift whether we work harder or smarter", suggests that the expectation does not exist. Our expectations influence our perceptions in powerful ways (Bruner and Minturn, 1955). Management expect that adhering to the 5S system will improve performance; however, the line-staff seem to expect the opposite, since they often sacrifice adhering to 5S in order to fulfil the overall goal set by the organisation, which is maintaining optimal productivity of the lines and reaching set targets, and they do this by not putting tools back to the 5S appointed location on account of being too busy. One type of expectancy is the effort-performance expectancy, trying to perform as requested or required. There is no guarantee that the person will perform as required as it is the decision of the employee to make that choice. Porter and Lawler's (1968) model highlights that before people give their effort and commitment to an activity, they ask themselves, "What's in it for me?" and are constantly examining the value of the rewards or benefits that are associated with the effort involved.

4.1.2 Individual attitudes are influenced by organisational conflict

Some degree of conflict exists between line-staff and management. Thomas (1976) describes conflict as a process which begins when one party perceives that another party has negatively affected something the first party cares about. It is possible that the line-staff feel they are not being treated fairly, and hence will display a negative attitude toward management. Equity theory deals with two questions:

1   What do people think is fair and equitable?

2   How do they respond when they feel they are getting far more or far less from their relationship than they deserve? How do they react when they see their fellows reaping undeserved benefits – or enduring undeserved suffering?

90% of line-staff believe that they are already understaffed, yet management is constantly looking for ways to 'squeeze more out of them'. A formula can be used to define equity and inequity – when people tend to see an action as fair, they agree with it and may be motivated to indulge, as opposed to perceiving something to be unfair, and in which case a person will distance themselves from the unwanted situation. Equity theory seems to deal more with dissatisfaction and the negative attitudes that may result from inequitable actions; therefore, if line-staff feel that they are being treated unfairly then they may respond by reducing productivity or by not committing to managements 5S system. The theory states that if we see positive inequity, we will increase our productivity or quality of output, but this is not the case, as stated by one line-staff member. He describes 5S as "another scam to give managers something to do, but we are responsible for it". A statement like this suggests a negative attitude towards management. People develop attitudes at work that can affect and influence their behaviour. Attitudes whether positive or negative in orientation are acquired over time and can be very difficult to change.

### 4.1.3   Individual motives are influenced by organisational rewards

Individual motives can have a significant effect on the way in which people perceive the environment around them. Self-set goals are frequently more desirable than assigned goals because they automatically engender high commitment (Hinze et al., 1997). The main goal of an employee is to earn money and this is why one shows up for work each day; this is evident at Company X, since line-staff are well aware of the fact that they get paid for being at the place of work rather than working to 5S standards. They view instances like going to the store as 'a change of scenery', and are in no hurry to rush back to their work-station unless they have to. 90% of the line-staff stated they would welcome a reduction in job activities, which reinforces the theory that some employees are not motivated towards the company's goals of increased productivity, but are simply doing what is expected of them at a particular time which is reaching the production targets set by management. 70% of line-staff are concerned about the elimination of wasteful activities believing that it will help the keep their jobs during the current economic crises, thus showing that their motives are self-interested as they do not want to lose their income.

4.2   Factors affecting commitment

System factors are relevant to commitment, as without the necessary skills, abilities and training, one would be ambiguous as to where their focus should be. As shown in Figure 4, the human factors – expectations, motives and attitudes all compliment the system factors and vice-versa, but in this particular case study, it was observed that the underlying flaw in the sustaining of 5S does not come from the line-staffs expectations, motives or attitudes. The line-staff are doing what they believe is expected of them, which is maintaining optimal productivity and are motivated to do so. Blockages to the performance-effort expectancy are such individual blockages as skills, abilities, task

assignments are in no way present since the line-staff are very capable of maintaining optimal productivity which is what they believe management requires of them. Their motivation stems from the perception that their job is valuable to them; especially now given the current economic situation in Ireland. Their workplace attitude seems to have little impact on whether they adhere to 5S or not, since 80% of the line-staff agree with it practicality and logic. So we must now consider organisational blockages that may exist such as available resources and to identify the cognitive shortcomings of management as to why they are failing to identify the root cause of the problems.

Figure 4 Factors affecting commitment (see online version for colours)
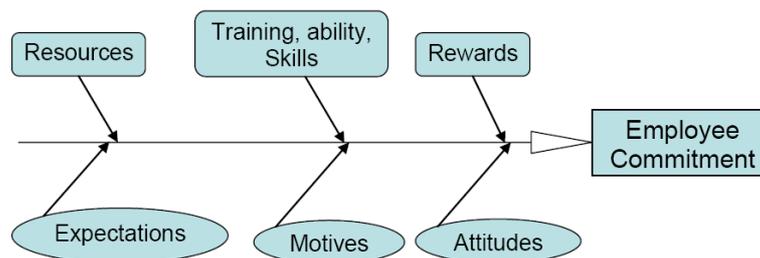
4.3 Cognitive biases

Management may be influenced by cognitive biases and making the wrong assumptions about why the 5S system difficult to sustain. Biases are systematic errors affecting people's decisions or judgments, and they stem from cognitive limitations.

4.3.1 Self-serving biases

Individuals often conduct shallow searches when they try to explain success or failure because they search in a self-serving way (i.e., in a way that allows them to feel good about themselves). Comments such as "once the mind set has changed then working to 5S standards can be easier", and "the only thing is the work attitude and the culture must be changed to sustain 5S", suggest that management is not responsible for 5S failures. Mullen and Riordan (1988) have shown that individuals typically conclude that their successes result from stable, internal factors (e.g., ability), but their failures resulted from unstable environmental factors such as work attitude and culture. However, this is not the case as most line-staff agree with 5S system, and are doing what they believe is required of them.

4.3.2 Fundamental attribution error

People's actions are frequently more obvious than their situations. Therefore, individuals generate hypotheses about why an event occurred, such as a missing tool. Their first hypothesis is that someone caused it (Ross and Nisbett, 1991). A manager stated that "if one person does not follow 5S practices then it definitely makes more work for everyone else". This is true but the manager has not considered the situational context of why the worker is not following 5S practices. Line-staff have reiterated that the lines are under-staffed and that they are constantly busy, and so simply may not have time to

return it to the 5S appointed location. Organisations might repair the fundamental attribution error by reminding individuals to consider causes other than people, especially the people who are likely to be closest to the problem as the line-staff workers are. For example, an old military adage says, "There are no such thing as bad troops, only bad officers" [Cohen and Gooch, (1990), p.228].

4.4   Cognitive repairs

Cognitive repairs are organisational practices that may repair the cognitive shortcomings of individuals within the organisation. These norms or procedures are called cognitive repairs which act as a sort of 'safety net' for an individual's shortcomings (Heath et al., 1998). Cognitive repairs research has identified the '5 whys' as a cognitive repair which can be applied to the 5S situation in an attempt to counter-act the existing cognitive biases. Self-serving biases and the fundamental attribution error are special cases of a much broader tendency: individuals tend to stop searching for a cause as soon as they locate a plausible hypothesis (Gregory et al., 1982; Hoch, 1984).

4.4.1   5 whys?

To counter this general broader tendency, organisations have developed some repairs that are widely applicable across a number of domains. In one technique known as '5 whys', workers at Toyota learned to ask 'why?' five times before they stopped generating hypotheses. When they did so, they were more likely to find a root cause rather than a superficial one.

Example:

- *Question 1:* Why did the technician leave the line?

  Answer 1: Because he was looking for a tool.

- *Question 2:* Why was he looking for a tool?

  Answer 2: Because the required tool was not at the 5S appointed location.

- *Question 3 :* Why was the tool not at the 5S appointed location?

  Answer 3: Because the person who used it last did not return it.

- *Question 4:* Why did this person not return the tool?

  Answer 4: Because they were too busy to return the tool.

- *Question 5:* Why were they too busy to return the tool?

  Answer 5: Because the lines are under-staffed.

The five why's typically refers to the practice of asking 'why?' a number of times. Employees at Company X are aware of this technique for solving technical issues but management might find this technique useful for situational problems as demonstrated in the above example. Cognitive repairs are organisational practices that may repair the cognitive shortcomings of individuals within the organisation (Heath et al., 1998). In an organisational context, generally root cause analysis is carried out by a team of individuals related to the problem, but most of these repairs are difficult to execute by the

individuals themselves and should come from people outside of the organisation, making it a rather rare event.

4.4.2 Empathic involvement

Empathy can be classified as a cognitive repair that may also help identify the root cause of situational problems. Empathy is generally defined as the extent to which one has the ability to understand and accept another's feelings and emotions. Some view empathy simply as ones ability 'put themselves in another's shoes' or view an issue from another perspective. A person who is skilled at empathising makes others feel respected and worthy of attention. The development of this skill requires effective communication; thus, training managers in qualitative research techniques and situational analysis may contribute to building empathic competence and increase one's ability to view situations from their staff's perspective. For optimal empathic involvement, managers need to aware of the aforementioned cognitive biases.

4.5 Lean or too lean?

Lean manufacturing places great importance on maximising productivity. It does, however, transfer the Tayloristic workforce principle which aims at the total productivity of each individual member, to the organisation of the whole company (Forza, 1996). Company X places great importance on the productivity of each individual worker, but in doing so it was found that management have gone too lean by not providing enough resources to maintain optimal productivity whilst adhering to 5S. The lean model is of course far more superior than the Tayloristic models of the past, both from a production point of view, since it becomes more flexible and gains in quality, and from a human point of view, where worker involvement takes the place of bureaucratic controls (Forza, 1996). Nevertheless, this does not mean that the work become freer or more relaxing; on the contrary, the constraints imposed by standardisation and the increased reduction of work-time mean that line-staff are always busy maintaining optimal production targets.

5S is a type of management control system for ensuring that the line-staff's busy time is productive time, but such has back-fired at Company X due to being overly busy. Lean systems such as 5S originated in Japan and Mehri (2006) believes the reason the Japanese workers are so diligent and disciplined, is not because they feel obligated toward a company that provide them with many benefits, but because they are working within rules that tightly control every aspect of their behaviour. One observation he made at the Toyota plant in which he worked was that line-speeds are so fast that the workers do not even have time to wipe the sweat from their faces. It was found similar conditions exist at Company X where line-staff have stated that they are constantly overwhelmed with job activities and believe they are understaffed.

Management's overall lean strategy of the increased productivity of each individual line-staff member whilst simultaneously reducing costs, conflicts with 5S sustainability by not allocating necessary resources, such as time or man-power to enable line-staff to return the tools to the designated location. Ideally, instead of tools being misplaced due to the hectic nature of the current work environment, it would be beneficial to all if when a worker needs a tool, it will be in the first place he looks; therefore, eliminating potential redundant motion of having to look in multiple places before finding the required tool.

The below example was used in Company X's 5S employee presentation to demonstrate the effect of motion waste:

- Imagine spending 5 minutes of every hour,
    a   searching for items
    b   looking for paperwork
    c   looking for tools, lockout keys, whiteboard pens, etc.
    d   moving other people stuff out of the way.

$$\frac{5 \text{ minutes} * 12 \text{ hours/shift} * 2 \text{ shifts} * 7 \text{ days} * 50 \text{ weeks} * 500 \textit{ employees} * 16 \text{ Euro/hour}}{60 \text{ minutes per hour}}$$

$$= 5,600,000 \text{ Euro is wasted each year.}$$

We should turn these 5 minutes into value added time!

The above example demonstrates the potential cost of not adhering to the 5S system. At Company X these costs are being incurred due to a recognised failure to sustain. By employing additional line-staff, it would ensure a slightly more relaxed work-pace and it would give the necessary time for the line-staff to commit sustaining the 5S system; thereby, increasing overall productivity and providing a platform for continuous improvement. The cost of employing an additional 50 line-staff working a 40 hour week, 16 Euros/hour and working 50 weeks of the year would be *1.6 million Euros* annually. At Company X, if these 50 new line-staff were to ease the problem of redundant motion from 5 to 3 minutes by not having to search for misplaced items as frequently, then the cost of employing the additional 50 is justified:

$$\frac{3 \text{ minutes} * 12 \text{ hours/shift} * 2 \text{ shifts} * 7 \text{ days} * 50 \text{ weeks} * 550 \text{ employees} * 16 \text{ Euro/hour}}{60 \text{ minutes per hour}}$$

$$= 3,696,000 \text{ Euro is wasted each year,}$$

and coupled with the additional man-power cost of 1,600,000 Euro – it gives a reduced cost of 5,296,000 Euro, whilst providing a platform for further savings through the sustainability of 5S.

5   Conclusions

1   Behavioural operations theory suggests that taking into account behavioural and cognitive factors can lead to fundamentally different predictions about the performance of management control systems (Gino and Piano, 2006). Initially, it was assumed in Section 1.1 that the line-staff were in no way inclined to commit to sustaining 5S, since it may be viewed as extra work on top of their already existing duties. However, after considering the line-staff's motives, attitudes and expectations, it was concluded that although a few have negative perceptions and opinions of management, nearly all the line-staff agreed with the practicality and logic of the 5S system, but simply did not have the necessary resources to commit to

it. Once the behavioural aspects were taken into account, the predictions of the 5S system and presumptions change. A better understanding of human behaviour and how it comes to play in an operations management context might indeed lead to predictions of the actual workings of the operating systems people have to design, implement and use.

2   Behavioural biases are not just noise; they systematically affect and distort people's judgement and decision making (Gino and Pisano, 2006). It was found that management had been making the wrong assumptions as to why the line-staff were failing to commit to 5S and it was demonstrated how the use of cognitive repairs may be useful in attempting to discover the root cause of lean operating systems failings. Thus, behavioural operations should be looking at ways to create 'cognitive repairs' to overcome the psychological distortions at the root of many operations management problems (Gino and Pisano, 2006). By focusing on the interaction and feedbacks among technical, organisational and behavioural features of the 5S system through basic qualitative research, it has been shown that behavioural operations theory can be a valuable tool when evaluating the flaws within lean operating systems.

3   Once again, it has been shown that lean manufacturing is far from perfect. Negative aspects of lean are that it can create a low quality of life for workers (Biazzo and Panizzolo, 2000), which in turn negatively affects worker commitment. Parker and Slaughters (1988) define lean production as "management by stress" and Fucini and Fucini (1990) condemn lean work as "being insensitive to the needs of the worker". More recently, Chen and Taylor (2009) suggest that stress is created in the work environment, inflicted by busy schedules and multiple responsibilities that are expected from the lean workers. Although, this case-study only consists of one subject company, based on observations and the general attitude towards management as told by the line-staff, statements such as these bear some truth – prompting the warning that excessive lean practices can be contradictory to the overall philosophy of continuous improvement.

5.1   Recommendations for management

In the past, most economists assumed that individuals act rationally in their economic choices and decisions. The work of Simon (1956, 1957) and Tversky and Kahneman (1974) showed that human beings are limited in their capabilities to learn, think and act, and these limits had important implications for economic theory. Research has found that human beings are limited in their ability to process information (Simon, 1976). For instance, investors often fall prey to herding behaviours and decide based on what others have chosen. They are fooled by randomness and underestimate its impact on their financial decisions (Shiller, 1984; Olsen, 1996).

Likewise, management in all its forms should be made aware of cognitive biases and their effects on decision making; hence, relevant psychology training programs need to be created. All individuals who make decisions in an organisation are subject to biases; therefore, management and those who make the most important decisions should be especially aware of the different types of biases that affect their own personal decision making capabilities. Above all else, management should be aware of cognitive repairs

and how they can help improve the decision making process, such as engaging in qualitative surveys to enhance empathic involvement as mentioned in Section 4.4.2.

Economists have long been paying attention to the role that psychology plays in describing and explaining consumer behaviour with regards to marketing; and similarly, so should management, especially when they are considering an intervention or the implementation of a lean operating system; after all, it is the line-staff that are the main consumers of such practices.

Acknowledgements

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