Lean implementation: analysis of individual-level factors in a biopharmaceutical organisation

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Abstract

Purpose – An understanding of the motivation of individual employees to adopt lean practices is fundamental to successful lean implementation. This study aims to investigate the adoption of lean practices and provides an analysis of the individual-level factors necessary for lean implementation. This study presents a method for assessing the impact of individual-level factors in a company deploying lean within a biopharmaceutical manufacturing subsidiary.

Design/methodology/approach – The case study explores the attitudes of individuals within a functionally structured organisation undergoing a lean implementation initiative. A quantitative data collection approach was used to capture data from employees in a medical device manufacturing organisation.

Findings – The study found that personality and affective organisational commitment positively affects an individual's intention to adopt lean practices. Employees with greater levels of affective commitment are more likely to partake in lean-related practices. Individuals in functions that directly support the production process, as opposed to those in functions that indirectly support production, are more likely to participate in lean practices. Finally, individuals in supervisory roles are more likely to adopt lean practices than those in non-supervisory roles, and management should involve top performers in lean.

Originality/value – There is a paucity of case study research in the area of individual-level factors for lean practice adoption. The findings of this study offer practical guidance on individual-level factors for lean practice adoption and illuminate new avenues for future research. This analysis also makes a practical contribution to the literature. From a managerial perspective, understanding why certain employees are more willing to adopt lean practices contributes to an overall lean organisational readiness and implementation framework. This insight enables the development of carefully tailored communication and training programs for managing employee motivation for and receptivity to lean.

Keywords Lean individual-level factors, Perception, Individual decision-making, Learning, Motivation, Organisational commitment

Paper type Case study

1. Introduction

Despite the number of methods and tools available, many companies have not succeeded in their attempts to imitate lean systems (Yadav *et al.*, 2017; Pakdil and

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Leonard, 2017). There is a substantial body of literature examining how lean adoption presents numerous technical and cultural challenges to organisations and why companies struggle to implement best practices. According to the extant literature, success factors crucial to lean implementation include management buy-in, education and training, resource commitment and links to compensation (Antony *et al.*, 2005). Henderson and Evans (2000) cite the importance of efficient organisational infrastructure to hold employees responsible for those specific roles and responsibilities necessary for implementation. Bhasin (2012) proposes that a consistent vision coupled with a clear objective and implementation plan are also essential factors for success. In addition to managing technical factors, an organisation's ability to adopt good production practices previously developed in different sectors and cultural locations is also crucial to proper lean implementation (Psychogios and Tsironis, 2012). For example, according to Pakdil and Leonard (2017), firms might adopt the structural element of lean that proved successful in other environments but may not gain the desired improvements unless a level of adaptation to the local culture and mindset is simultaneously considered. Similarly, Moosa and Sajid (2010) discuss how the capacity of an organisation's cultural environment to adhere to systems and routines can have a significant effect on the success of management programmes such as lean. Essentially, the implementation of lean involves a fundamental shift in an organisation's work practices and culture.

While there is extensive research on lean implementation at the organisational and environmental levels, the discussion at the individual level is limited. Prior work typically focuses on how human resource management practices impact employee performance (Tortorella and Fogliatto, 2014; De Menezes *et al.*, 2010) or the changes in working conditions and outcomes for employees (Bamber *et al.*, 2014; Perez Toralla *et al.*, 2012; Danford *et al.*, 2010). Other studies have examined the role of learning factors. For example, Kim (2005) analysed individual learning factors in government organisations, and Tortorella and Fogliatto (2014) analysed organisational learning factors in an automotive manufacturer. Some studies emphasise learning at multiple levels (individual, team and organisation (Alagaraja and Herd, 2021), whereas Tortorella *et al.* (2020) discussed the importance of identifying the relationship between lean production practices and the learning organisation dimensions. However, very few studies focus on factors that affect employees' lean disposition (Tortorella and Fogliatto, 2014). Notable exceptions include Anderson-Connolly *et al.* (2002), whose work considered employee enthusiasm for lean practices concerning their hierarchal position in an organisation (supervisory or non-supervisory), and Tata and Prasad (1998), who analysed how cultural differences can impact adherence to Lean. Therefore, there is a need for practical research that analyses individual factors exclusively to discover how an individual employee's role and responsibilities within an organisation as well as their personal disposition towards lean can potentially impact the overall adoption of lean practices.

To address this need, our research aims to investigate the following questions:

Q1. What key factors contribute to the success of lean manufacturing implementation according to the literature?

Q2. What are the attitudes of individuals within a functionally structured organisation undergoing a lean manufacturing implementation initiative?

Q3. Do certain personality traits or combinations of traits affect an individual's disposition toward lean?

Q4. Is there a relationship between lean disposition and an employee's level of organisational commitment?

2. Literature review

2.1 Factors crucial to successful lean implementation

There has been an extensive contribution to the literature on lean implementation in terms of what an organisation is required to do, if capable, to be successful. Among the critical success factors identified, recurrent themes such as management commitment and support, clear communication, provision of key resources and training, a positive organisational culture are identified (Antony *et al.*, 2012; Antony and Snee, 2010).

Critical failure factors (CFF's) for lean implementation have also been researched (Albliwi *et al.*, 2014; Sunder M and Prashar, 2021) and lack of top management attitude, commitment and involvement, lack of training and education and poor LSS project selection and prioritisation. Sunder M and Prashar (2021) highlighted the importance of understanding the causal relationship between CFF's and continuous improvement (CI) methods deployment within organisations to save time and money in lean investment and increase implementation success. There has been little literature on lean deployment and CFF's within pharmaceutical and other highly regulated industries (Brown *et al.*, 2008), (Iyede *et al.*, 2018). However, some studies by McDermott *et al.* (2022a, 2022b) on the barriers and CSF's for lean deployment within highly regulated pharma and medical device industries have highlighted the regulatory oversight as a barrier to lean deployment.

Readiness factors for CI initiatives such as lean have been defined as "essential ingredients which will increase the probability of success of any CI initiative before an organisation invests its resources heavily on the initiative" (Douglas *et al.*, 2017). Authors have defined these factors as leadership support, communication, organisational culture, employee knowledge, employee motivation, employee empowerment, resources and training (Antony, 2014; Antony *et al.*, 2019; Lim and Antony, 2019; Rodgers and Antony, 2019).

Within an organisational structure, employee motivation is crucial to the successful implementation of lean. Psychogios and Tsironis (2012) propose that employee opposition has a detrimental effect on lean implementation. Motivation is consistently cited as a priority for organisations when implementing lean (Laureani and Antony, 2017; Perez Toralla *et al.*, 2012; Bhasin, 2012). Sunder M and Prashar (2021) highlighted the importance of behavioural factors in lean deployment and the relationship between management commitment, employee involvement, supplier, customer focus and change management under an underlying common feature of human behavior as a CFF for lean deployment and success.

To determine what factors may pre-dispose employee motivation toward lean adoption, Anderson-Connolly *et al.* (2002) examined the effects of workplace transformation on employees at different levels in an organisation in the context of the application of lean manufacturing methods. They differentiated between managerial and non-managerial staff and found that certain aspects of lean implementation affect the two groups differently and certain aspects affect them in the same way. The authors associate lean with an increased workload for both groups, doing more with less and so find that intensity negatively affects the psychological health of both groups. Other aspects such as increased teamwork have detrimental effects on non-managers, as it increases job ambiguity while having a positive effect on managers who benefit from greater social and organisational support. Conversely,

increased autonomy has a detrimental impact on managers who may feel further isolated but a positive effect on non-managers. Beale (2007) examined the effect of personality on employee motivations to adopt lean but did not conclude that it was a significant factor. However, there is limited literature on the specific employee characteristics that are considered to be most favourable toward lean practice adoption (Bortolotti *et al.*, 2015; Dubé and Paré, 2003). To further develop this concept, we drew from theoretical discussions beyond that of previous lean-focussed research relating to practice adoption. In particular, we deployed personality trait theory and organisational theory, as well as organisational commitment and job satisfaction.

2.2 Organisational functions

Psychogios and Tsironis (2012) argue that the primary concern in lean implementation is not whether the technical elements of lean can be introduced but also whether they can be successfully implemented in a variety of organisational contexts and cultures. Many other authors have emphasised the importance of organisational culture in lean (Alkhoraif and McLaughlin, 2018; Paro and Gerolamo, 2017). The culture of an organisation is categorised according to work-related categories such as professions or industries, for example, medicine. The term "organisational field" can be used to define a group of people who interact more frequently with one another than with those outside the field. Members frequently develop a shared set of systems, routines and assumptions as a result of work they perform or their training. Engineering can be considered to be an organisational field comprising individuals who have received similar technical training (Johnson *et al.*, 2014). Additionally, there are also normative expectations within a field. Organisations must adhere to these expectations to be considered legitimate and secure approval and support for their initiatives (Johnson *et al.*, 2014). Glynn and Abzug (2002) emphasise the importance of conforming to field interpretations to increase the likelihood of product and practice adoption. As a result, this study examines the role of organisational functions in implementing lean initiatives.

2.3 Personality traits

Culture has been identified as a key factor in lean implementation (Sahoo, 2021). Hofstede (1984) defines culture as the mental programming a person acquires as a result of their national origin, which can obstruct or facilitate collaboration with persons who have a different or comparable mental programming. Many scholars have used Hofstede's dimensions of national culture to study individual disposition (Taras *et al.*, 2009; Kirkman and Shapiro, 1997; Cox *et al.*, 1991; Thomas, 1999). Based on these studies, it has been argued that enough variation occurs at the individual level of analysis to suggest that personally held cultural beliefs can affect behaviours (Kirkman *et al.*, 2000). However, Hofstede (1980) developed the original cultural dimensions based on the cultural value variation found between countries rather than within (Kirkman *et al.*, 2000). It is argued that in studying culture, a comparative analysis must be drawn between societies rather than between individuals. Although the data may have been collected from individuals, the same tools cannot be used in the study of the self, the argument being that different processes occur at the group and individual levels (Hofstede and McCrae, 2004). A study conducted by Blodgett *et al.* (2008) found that Hofstede's framework lacks validity at the individual level of analysis, despite numerous studies having used the framework. Instead, at the individual level, Hofstede and McCrae (2004) argue that analysing personality traits is a more appropriate way of determining individual disposition.

Aij and Teunissen (2017) as well as Steed (2012) have discussed important leadership attributes such as emotional intelligence, and personality traits can have effect successful lean implementation, change management and process improvement. To influence change, leaders must appeal to both the emotional and the rational intellects of a person (Dick *et al.*, 2018). Many studies have focussed on the use of personality traits to assess suitability for recruitment, but more recently studies have analysed how individual personality traits and team personality traits can positively impact change management initiatives (Church *et al.*, 2015), Burke and Noumair, 2002).

Accordingly, national culture continues to be a significant component in determining employee traits, as it describes group-level behaviours; nevertheless, different processes occur at group and individual levels and hence personality is an important element to consider in this study. Individuals' personality traits and culture interact to shape their behaviour (Hofstede and McCrae, 2004) and personality has long been demonstrated to affect behaviours and has even been demonstrated to affect job performance as per the landmark study completed by Barrick and Mount (1991). Logically, if personality affects behaviours, it is reasonable to assume that it influences lean practice adoption.

One of the most widely accepted models for studying personality traits is the Five-Factor Model (Major *et al.*, 2006). Raymond Cattell, recipient of the Gold Medal Award for Life Achievement in Psychological Science, proposed that only when a person's traits, the elements of their personality, are known can predictions be made on how they will behave in a given situation (Schultz and Schultz, 2008). Throughout the 20th century research into personality traits centred on five basic factors (Digman, 1990) which McCrae and Costa (1987) identified and analysed (Table 1). The five factors and associated traits have been observed consistently across different cultures and have been demonstrated to be stable over time in longitudinal research (Schultz and Schultz, 2008). It is proposed that the degree to which individuals possess each trait or factor will affect their predisposition to lean practice adoption.

2.4 Organisational commitment and job satisfaction

Organisational commitment has long been considered to be an important aspect of employee rapport, which has strong implications for work behaviour (Mowday *et al.*, 1979). As mentioned previously, gaining employee commitment and motivation (Albliwi *et al.*, 2014; Antony *et al.*, 2021) is a key organisational readiness factor for a lean deployment and for enabling a CI and change management culture (Antony, 2014; Antony *et al.*, 2021). Therefore, organisational commitment and by extension job satisfaction are integral to any successful change management process.

Organizational commitment is usually limited to the extent to which employees are loyal to the organization and job satisfaction is recognized as an element of organizational commitment. Employee's emotions, however, are much stronger in the case of organizational

Table 1. McCrae and Costa's (1987) Big five personality factors

Factor	Description
Neuroticism	Worried, insecure, nervous, highly strung
Extraversion	Sociable, talkative, fun-loving, affectionate
Openness	Original, independent, creative, daring
Agreeableness	God-natured, soft-hearted, trusting, courteous
Conscientiousness	Careful, reliable hardworking, organised

commitment, and it is characterized by the attachment of the employee to the organization and readiness to make sacrifices for the organization.

There are three main facets to commitment:

(1) attitudinal (feelings of attachment, identification and loyalty to the organisation);

(2) continuance (feelings of commitment to the organisation as a result of the costs that members feel are associated with leaving the organisation); and

(3) normative (the sense of obligation an employee has to an organisation) (Meyer and Allen, 1991).

Resistance to change, low job satisfaction and overall intentions to quit all have a strong correlation with lower levels of organisational commitment (Oreg, 2006). According to Meyer *et al.* (2002), attitudinal and normative commitment have strong correlations with attendance, organisational citizenship behaviour and job performance.

Organ *et al.* (2006) define organisational citizenship behaviour (OCB) as making discretionary contributions to the effective and efficient functioning of an organisation. It relates to the spontaneous contribution of employees rather than their actual job performance and can be categorised as a dispositional variable. The contributions, therefore, are of a social nature, specifically cooperation and interpersonal support (Organ *et al.*, 2006). It follows that individuals with higher levels of OCB are more likely to support new initiatives such as lean implementation. Job attitudes, specifically organisational commitment and job satisfaction, are among the most strongly correlated antecedents of OCB (Podsakoff *et al.*, 2000; Organ *et al.*, 2006).

Job satisfaction is also fundamentally linked with organisational commitment and attitudinal commitment in particular. According to the literature, there is no agreement on the causality of arrangement of job satisfaction and organisational commitment and therefore the two should be viewed as interconnected (Meyer *et al.*, 2002; Mathieu and Zajac, 1990). Job satisfaction is a key indicator of employee behavioural intentions according to Judge and Larsen (2001) and correlates with organisational citizenship behaviour such as unpaid overtime (Feather and Rauter, 2004). In light of these findings, this study incorporates both job satisfaction and organisational commitment, as they relate to the individual attitudes towards lean implementation.

3. Research methodology

The key factors that contribute to the success of lean manufacturing implementation have been addressed in the previous section. This section examines the attitudes of individuals within a functionally structured organisation undergoing a lean manufacturing implementation initiative. We also seek to ascertain whether certain personality traits affect an individual's disposition toward lean and whether there is a relationship between lean disposition and an employee's level of organisational commitment.

A case study analysis was undertaken to help examine these issues. This approach was deemed the best method to examine the adoption of lean practices at an individual level in a specific context of a single organisation. Case studies are particularly appropriate when the issue under investigation is exploratory and when there is a dearth of knowledge on the subject (Yin, 2003). Additionally, a single site case study is appropriate when the phenomenon under investigation is unique, critical and revelatory (Dubé and Paré, 2003), as it does not separate the issue under investigation from the context. The organisation analysed is a global biopharmaceutical drug company that employs 28,000 people worldwide. The organisation researches and manufactures biopharmaceutical drugs for a

range of illnesses including autoimmune diseases, hepatitis and Parkinson's diseases. As this research focuses on the motivation and involvement of the entire team as a single case study in one organisation, representatives from a variety of functions in the company were included in the study. A single-case study can capture and suggest explanations for interdependencies and interactions within a particular context as highlighted by Retolaza and San-Jose (2017). Single-case researchers can craft the case and matching it to the emerging theoretical framework. This is carried out to make sense of the empirical data and develop theory. Developing theory based on single-case research provides the researcher with rich opportunities to ground the meaning of concepts in empirical observation and description (Anderson *et al.*, 2020). The organisation analysed is a global biopharmaceutical drug company that employs 28,000 people worldwide. This organisation was chosen as a suitable single case study, as there was an opportunity to gather information from a large team of cross functional departments within the company would aid the research objective (Retolaza and San-Jose, 2017).

Gaining physical access to potential respondents is crucial to research (Saunders *et al.*, 2017); hence, this organisation was approached to aid the research and achieve access. The organisation selected research's and manufactures biopharmaceutical drugs for a range of illnesses including autoimmune diseases, hepatitis and Parkinson's diseases. As this research focuses on the motivation and involvement of the entire team as a single case study in one organisation, representatives from a variety of functions in the company were included in the study. A survey aligned with the literature reviewed and structured to investigate the research questions was decided to be the most appropriate method of investigating and obtaining results for the research questions. Case study survey research is advantageous when a survey is administered to a case, either a small sample or an entire population of individuals (in this case the biopharmaceutical organisation under study) to describe an aspect or characteristic of that population (Mills, 2010). The further advantage being that the responses are analysed to describe population trends or to test research questions or hypothesis.

A structured data collection instrument was used to collect data. An online questionnaire was developed to analyse various variables including organisational functional and hierarchical position (e.g. function, length of time with company, title etc.), variables from the literature that affect lean adoption and therefore measure lean disposition, personality traits, job satisfaction and organisational commitment (Table 2). The advantages of online questionnaires include speed and reach, ease, cost, flexibility and automation (Ball, 2019; Couper and Miller, 2008). Likert scales were used to assess respondents' attitudes towards these questions. The use of these scales ensure that the questioning and responses were reliable, valid and directly comparable (Bell *et al.*, 2018; Joshi *et al.*, 2015; Saunders *et al.*, 2016).

To determine a respondent's disposition towards lean, a list of standard practices based on the existing literature on human resource management concerning lean was included. The literature revealed several significant themes, including cross-functional teamwork, employee empowerment, assuming more responsibility, continuous learning, work standardisation, CI and job flexibility (De Menezes *et al.*, 2010; Bamber *et al.*, 2014; Tortorella and Fogliatto, 2014; Danford *et al.*, 2010; Perez Toralla *et al.*, 2012). Lean disposition questions are as follows:

- How likely are you to voluntarily participate in cross-functional work teams, such as Kaizen and Continuous Improvement project teams?
- How likely are you to take more responsibility, such as in making quality and process-related decisions, or leading tiered meetings?

Areas under investigation	Sources
1. *Organisational functions*. Respondents were asked to provide details of the function they serve within the organisation and whether their position is a supervisory role in which people report to them. The data collected here provides information on the hierarchal position and organisational function	(Psychogios and Tsironis, 2012), (Scott, 1995)
2. *Variables from the literature that affect lean adoption and therefore lean disposition.* To determine a respondents level of Lean disposition, a list of standard practices was included based on the literature that exists around human resources management concerning Lean. The main themes found in the literature are cross-functional teamwork, empowerment/taking more responsibility, continuous learning, work standardisation, continuous improvement and job flexibility	(De Menezes *et al.*, 2010), (Bamber *et al.*, 2014), (Tortorella and Fogliatto, 2014), (Danford *et al.*, 2010), (Perez Toralla *et al.*, 2012)
3. *Personality Traits.* The Five-Factor model of personality trait was used to capture empirical data on personality. Here, the Big Five Inventory (BFI) personality test is employed. The BFI is a 44-item scale that utilises short phrase based on traits associated with Openness, Neuroticism, Conscientiousness, Agreeableness and Extraversion. It has been tested for reality, stability over time and validity	(McCrae and Costa, 1987), (John *et al.*, 1991, 2008)
4. *Job satisfaction*. Items from the Andrew and Withey Job Satisfaction Questionnaire were used to measure job satisfaction	(Rentsch and Steel, 1992)
5. *Organisation commitment.* Affective and normative attachment were used in the survey to assess commitment. In this view employees with high affective work for an organisation because they wish to do so, in contrast with normative attachment which indicates they feel an obligation to do so	(Meyer and Allen, 1991, 1993)

Table 2.
Research themes informed by the literature

- How likely are you to participate in training and up-skilling to increase job flexibility? Examples include participation in Six Sigma Green Belt training and Risk Management training.
- How likely are you to participate in creating and maintaining standardised work practices such as 6S projects and audits, GEMBA walks and Visual Performance Boards?
- How likely are you to continually challenge established processes to gain improvements, such as leading or participating in A3 problem-solving and Green Belt process improvement projects?

Respondents were asked how likely they are to adopt each practice using a seven-point Likert scale ranging from "Not at all" to "Extremely likely".

The Big Five Inventory (BFI) personality test (John *et al.*, 1991) was used to assess respondents' personality traits. This is a 44-item scale that uses short phrases based on traits associated with personality which has been tested for reliability, stability over time

and validity (John *et al.*, 2008). Respondents were asked to rate themselves using a five-point Likert scale against statements such as "I am someone who is talkative". Each statement relates to a particular personality trait: openness, neuroticism, conscientiousness, agreeableness and extraversion.

Organisational commitment was assessed using affective and normative attachment. Employees with high levels of affective attachment work for an organisation because they wish to do so, whereas normative attachment indicates they feel an obligation to do so. Questions relating to continuance commitment were omitted as an individual's level of continuance commitment is unlikely to predict disposition towards lean behaviours and therefore does not impact this study. The validity of the affective and normative commitment scales has been demonstrated by Meyer *et al.* (1993). A list of the 12 items used can be found in job satisfaction items (Meyer *et al.*, 1993):

(1) I would be very happy to spend the rest of my career with this organisation.

(2) I really feel as if this organisation's problems are my own.

(3) I do not feel a strong sense of "belonging" to my organisation.

(4) I do not feel "emotionally attached" to this organisation.

(5) I do not feel like "part of the family" at my organisation.

(6) The organisation has a great deal of personal meaning to me.

(7) I do not feel any obligation to remain with my current organisation.

(8) Even if it were to my advantage, I do not feel it would be right to leave my organisation now.

(9) I would feel guilty if I left my organisation now.

(10) This organisation deserves my loyalty.

(11) I would not leave my organisation right now as I have a sense of obligation to the people in it.

(12) I owe a great deal to my organisation.

Respondents were requested to answer six items in each using a seven-point Likert scale ranging from "strongly disagree" to "strongly agree".

Van Saane *et al.* (2003) reviewed job satisfaction instruments for reliability and validity. They reported that the Andrew and Withey Job Satisfaction Questionnaire (Rentsch and Steel, 1992) met their quality criteria for reliability and validity. This is a five-item test in which responses are given on a seven-point Likert scale that ranges from "delighted" to "terrible" and was used in this study [see Job satisfaction items (Rentsch and Steel, 1992)]:

- How do you feel about your job?
- How do you feel about the people you work with your co-workers?
- How do you feel about the work you do on your job – the work itself?
- What is it you like where you work – the hours the amount of work you do, good supervision?
- How do you feel about the resources you have available for doing your job – the equipment, information, the psychical surroundings?

This study employed non-probability sampling; specifically purposive sampling in which the researchers determined which participants would best serve the research's purpose. This is typical in studies where the sample size is small (Nueman, 2005). Participants were chosen

to ensure data was collected from all functions within the organisation and hierarchal levels. All respondents were directly involved in the lean implementation initiative and therefore were familiar with the concepts outlined in the questionnaire. The questionnaire was pretested and piloted and after some minor revisions sent to 52 potential participants (Boynton and Greenhalgh, 2004).

4. Results

A total of 42 respondents voluntarily participated in this study resulting in an 84.6% response rate representing operations (25%), engineering (20%), quality (16%), supply chain (11%), maintenance (9%), facilities (7%), finance (7%), measurement systems and test (MS&T) (5%), projects (2.5%) and IT (0%). Certain functions have lower proportional response rates as there are less personnel within these functional areas. A total of 29.5% of the respondents across the functions had a supervisory role.

4.1 Lean disposition and function

Five questions were asked to assess respondents' lean disposition. Figure 1 below shows the average scores for lean disposition concerning each function. The data includes both supervisor-level and non-supervisor-level respondents. The graph is sectioned by three lines which represent the average if all responses were scored by "Quite likely" (57%), "Moderately likely" (71%), "Very likely" (86%). Each data point is shaded corresponding to where it falls between these representative lines. Figure 1 illustrates that only the Measurement Systems and Test's (MS&T) average score falls between the "Quite" and "Moderate" scoring range. The Engineering, Supply Chain, Finance and Facilities functions fall between the "Moderate" and "Very" range, whereas the operations, quality and projects functions fall between the "Very" and "Extremely" range.

Figure 2 below shows the lean disposition scores by function when the supervisor scores are removed. With the exception of quality and projects functions, scores from all other functions drop but remain within the same range.

4.2 Lean disposition and personality

Personality constitutes five traits, extraversion, conscientiousness, openness, neuroticism and agreeableness (Ameer *et al.*, 2021). Respondent scores for each of the five traits are

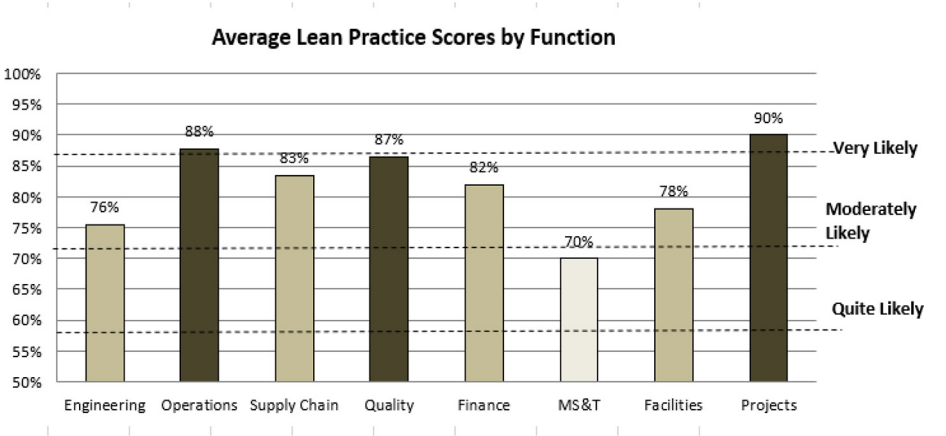

Figure 1.
Average lean scores by function

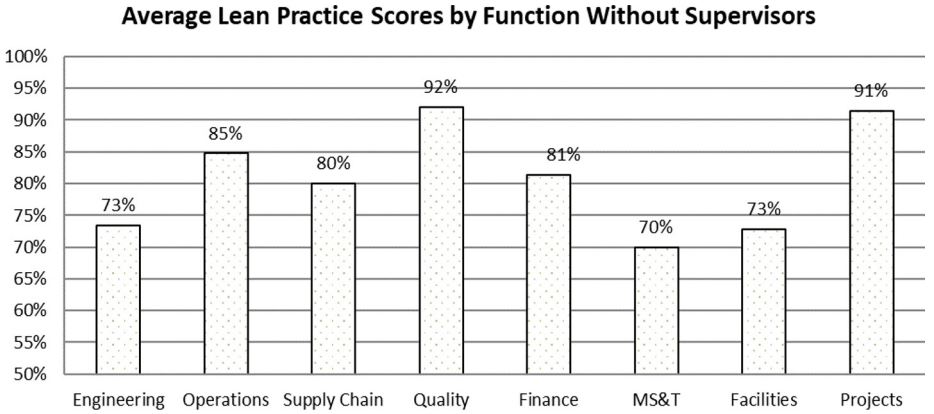

Figure 2.
Average lean scores by function without supervisors

computed using the scoring method prescribed by the BFI authors (John *et al.*, 1991). For analysis, a respondent's score is converted to a percentage based on the total possible score for each trait. These scores are then compared to the data on lean disposition.

A regression analysis was then conducted to determine whether certain personality traits or combinations of traits may affect an individual's disposition toward lean. Regression models characterise the relationship between two or more variables within a sample set of data (Robson and McCartan, 2016). Within any regression analysis, there are pre-requisite assumptions: the Quantitative Data Condition; the Straight Enough Condition (or "linearity"); the Outlier Condition; Independence of Errors; Homoscedasticity; and Normality of Error Distribution (JMP, 2021). To determine whether there was a statistically significant relationship between each of the personality traits and lean disposition, the p-value, the level of significance at which the null hypothesis is rejected (Montgomery, 2013), or the likelihood of detecting a relationship due to chance variation (Robson and McCartan, 2016) is determined. An analysis of combined supervisor and non-supervisor personality trait data determined that extraversion, conscientiousness and interaction of extraversion and conscientiousness were related to lean disposition, e.g. Extraversion (P = 0.002), Conscientiousness ($P<$ = 0.001) and Extraversion and Conscientiousness interaction (P = 0.123).

For this analysis, the continuous predictor variables were standardised by assigning +1 and −1 values to the high and low levels which are standard practice when interactions are included in a regression model (Seber and Lee, 2012). This minimises multicollinearity within the model which in turn reduced the risk of failing to identify statistically significant terms. The variance inflation factors (VIFs) associated with multicollinearity are all approximately 1 which is acceptable (Minitab, 2021). The R^2 adjusted value or the level of variance the regression model can account for is 36.3%. It is worth noting that openness, neuroticism and agreeableness did not have a statistically significant relationship to lean disposition.

The results of the main effect plot analysis (Figures 3 and 4) indicate that the effect of conscientiousness was slightly more significant than extraversion. In terms of both of these personality traits, the results suggest that individuals are more likely to indicate a willingness to adopt lean practices as these traits increase. The interaction plot for extraversion and conscientiousness indicates that there is a significant effect on lean disposition.

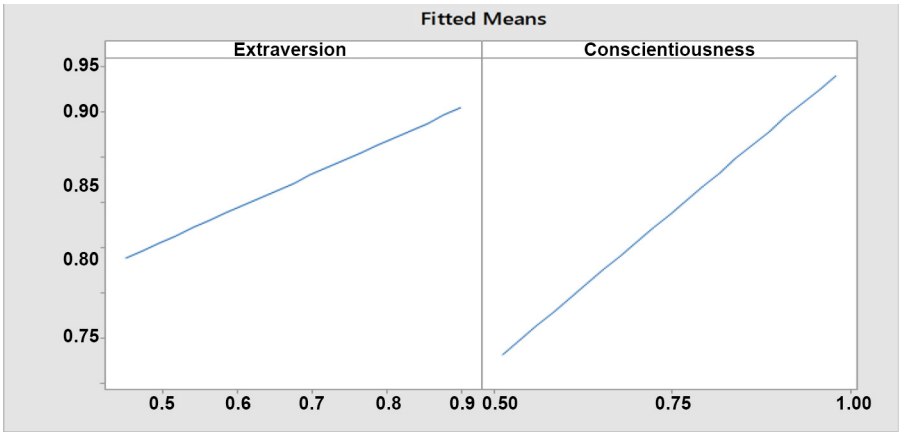

Figure 3.
Main effects plot for lean scores

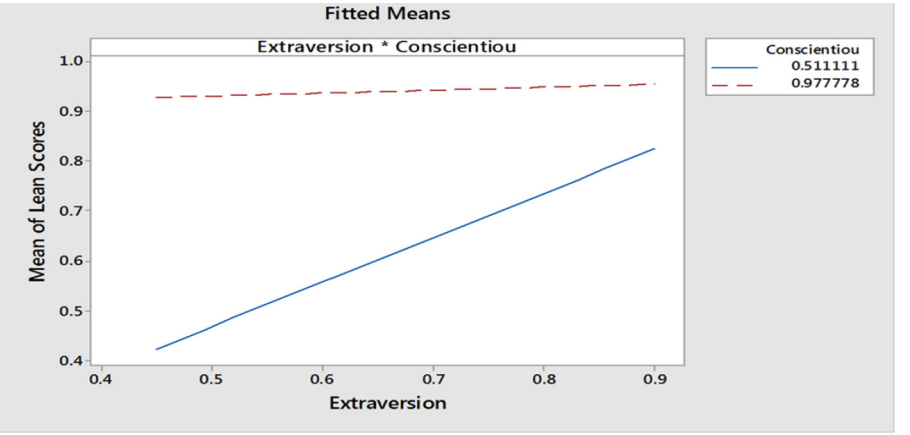

Figure 4.
Interaction plot for lean scores

The solid line represents the relationship between lean disposition and extraversion coupled with a low level of conscientiousness. The dashed line represents the relationship between lean disposition and extraversion coupled with a high level of conscientiousness. Both data sets show that lean disposition increases as the interactive effect of both traits become larger. The results also indicate that extraversion has a greater effect on lean disposition when conscientiousness is low as the slope of the solid line is greater than that of the dashed line.

4.3 Lean disposition and organisational commitment

The data presented in this section relate to affective and normative commitment. In both subsections, responses are rated using a seven-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree". Respondent scores are converted to a percentage based on the total possible score in each subsection and compared to the data on lean disposition. The mean value of normative commitment across all functions and levels is lower than affective commitment. These values are 67% and 80%.

Figure 5 shows a scatter plot of affective commitment and lean disposition. Both supervisor and non-supervisor responses are included in this data. This shows a significant correlation between lean disposition and an individual's level of affective commitment to the organisation. The results show that the correlation value between these two variables on a scale of zero to one is 0.559 with where $P <= 0.001$ showing that the result is statistically significant (Figure 6). The greater the absolute value of the correlation coefficient, the stronger the relationship. This data shows that as affinitive organisational commitment increases lean disposition also increases. In other words, the sample data support the notion that the relationship exists in the population.

4.3.1 Affective, normative and job satisfaction correlations scores. Figure 7 illustrates the lean disposition scores by function and the functional affective commitment scores. The graph illustrates how affective commitment follows the same trend as lean scores by function and further demonstrates the correlation between these two variables as described above.

4.3.2 Normative commitment. A scatter plot of normative commitment and lean disposition illustrates that there is no correlation between lean disposition and an individual's level of normative commitment to the organisation. The correlation value

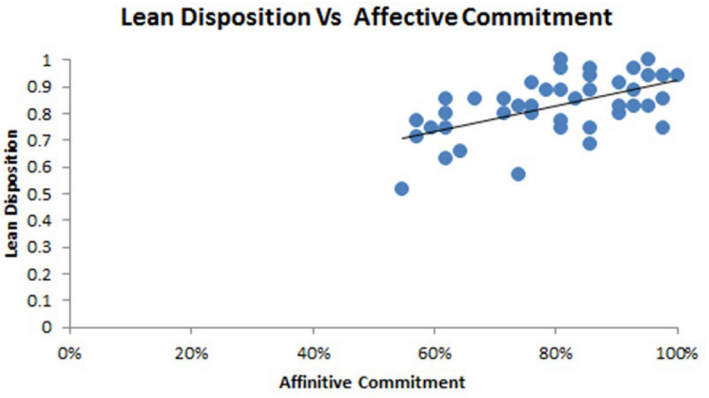

Figure 5.
Lean disposition plotted against affective commitment

Correlation: Lean Scores, Affinitive Org Commitment

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Pearson correlation of Lean Scores and Affinitive Org Commitment = 0.559
P-Value = 0.000
```

Correlation: Lean Scores, Normative Org Commitment

```
Pearson correlation of Lean Scores and Normative Org Commitment = 0.250
P-Value = 0.111
```

Correlation: Lean Scores, Job Satisfaction

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Pearson correlation of Lean Scores and Job Satisfaction = 0.343
P-Value = 0.026
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Figure 6.
Pearson correlation of lean scores for affinitive, normative and organisational commitment

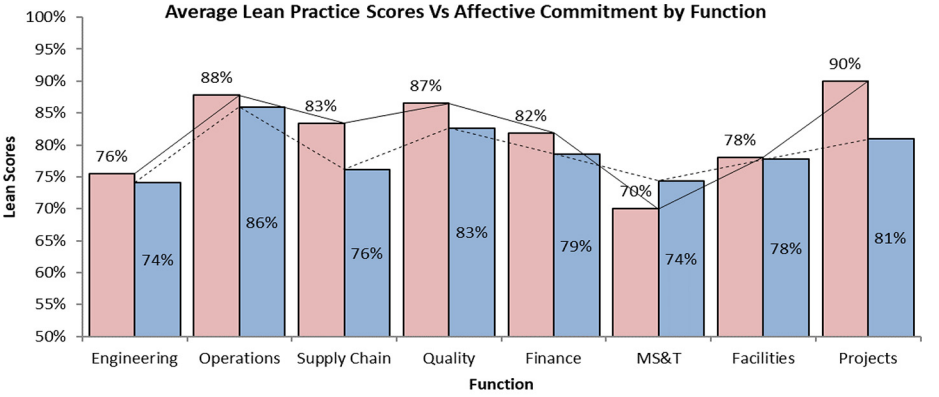

Figure 7.
Lean scores and affective commitment by function

Note: Supervisor and non-supervisor data included

achieved was 0.250 where $P = 0.111$ (Figure 6); therefore, the result is not statistically significant.

Lean disposition scores and normative commitment scores by function are demonstrated in Figure 8. The graph shows that the normative commitment score trend does not follow the lean scores by functional area which concurs with the lack of correlation between these variables.

4.4 Lean disposition and job satisfaction

The data presented in this section focuses on respondents' levels of job satisfaction. Here, individuals were asked to rate their responses using a seven-point Likert scale ranging from 1 ("Terrible") to 7 ("Delighted"). Respondent scores are converted to a percentage based on the total possible score and compared to the data on lean disposition (Figure 9).

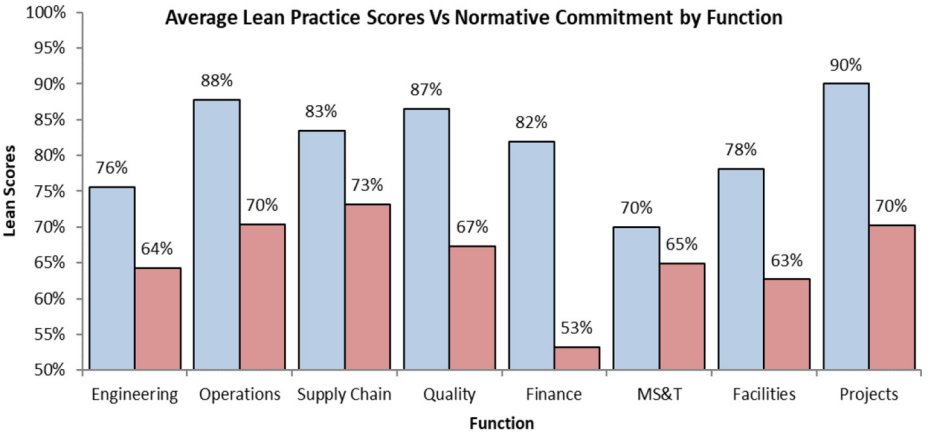

Figure 8.
Lean scores and normative commitment by function

Note: Supervisor and non-supervisor data included

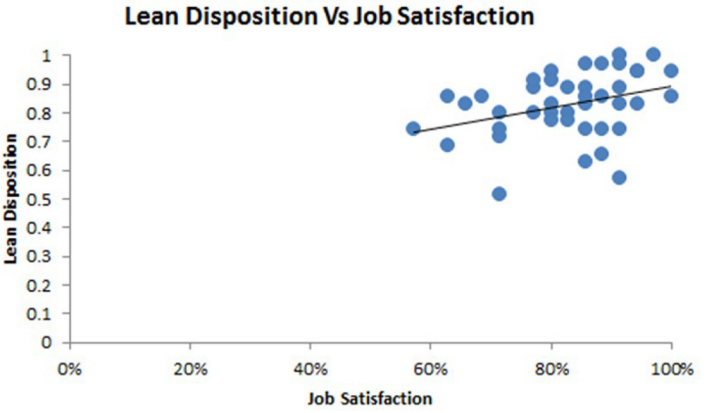

Figure 9. Lean disposition plotted against job satisfaction

Note: Supervisor and non-supervisor data included

There is a low level of correlation between lean disposition and job satisfaction in the sample data. The correlation coefficient was 0.343 (Figure 6), where $P = 0.026$ which is statistically significant. The data indicates that as job satisfaction increases lean disposition increases. Figure 10 below illustrates lean disposition scores and job satisfaction scores by function. The graph shows that job satisfaction scores are generally high and do not follow the same trend as lean disposition scores by function. This data concurs with the low correlation values between these variables as discussed above.

4.5 Lean disposition, personality and affinitive commitment

Based on the regression results achieved which highlights extraversion and conscientiousness as significant trait factors for lean disposition, as well as the correlation result between affective commitment and lean disposition, a second regression analysis was carried out (Figure 11). This analysis combines extraversion, conscientiousness and affective commitment. As previous mentioned with any regression analysis the pre-requisites for a regression model area:

- The Quantitative Data Condition;
- The Straight Enough Condition (or "linearity");

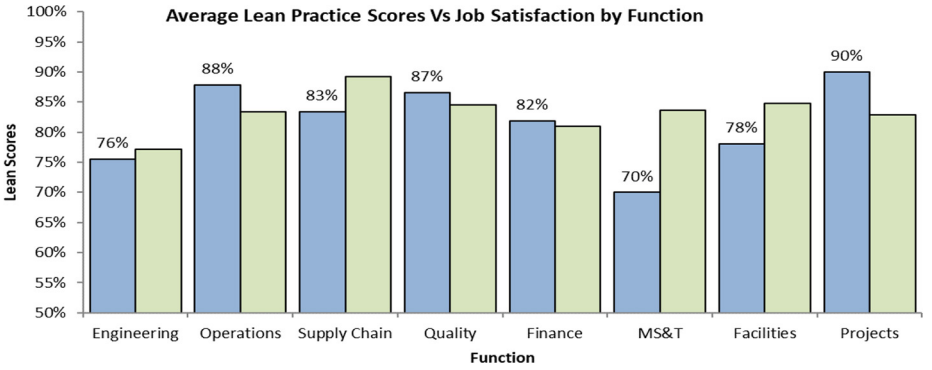

Figure 10. Lean scores plotted against job satisfaction by function

Regression Analysis: Lean Scores versus Affinitive Org C, Extraversion, Conscientiousnes

Method

Continuous predictor standardization
Levels coded to −1 and +1

Predictor	Low	High
Affinitive Org Commitment	0.619048	0.976190
Extraversion	0.450000	0.900000
Conscientiousness	0.644444	0.933333

Backward Elimination of Terms

α to remove = 0.15

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	3	0.15637	0.052122	8.31	0.001
Affinitive Org Commitment	1	0.04638	0.046377	7.39	0.013
Extraversion	1	0.08672	0.086721	13.82	0.001
Conscientiousness	1	0.02931	0.029312	4.67	0.042
Error	21	0.13176	0.006275		
Total	24	0.28813			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.0792118	54.27%	47.74%	42.25%

Figure 11.
Regression analysis: lean scores versus organisational commitment, extraversion, conscientiousness

- The Outlier Condition;
- Independence of Errors;
- Homoscedasticity; and
- Normality of Error Distribution (JMP, 2021; Glen, 2014).

Supervisor and non-supervisor data are considered, and statistical significance for each factor is based on the P values achieved. Again, predictor variables were standardised by coding the high and low levels as +1 and −1, respectively, which is standard practice when interactions are included in a regression model (Seber and Lee, 2012).

All P values for extraversion, conscientiousness and affective commitment are below 0.05 meaning they are statistically significant factors (Figure 12). The VIFs associated with multicollinearity are all approximately 1 which is acceptable (Minitab, 2021). The R^2 adjusted value, or the level of variance the regression model can account for, is 47.74% which is an improvement on the previous regression model that considered extraversion and conscientiousness only and where the R^2 adjusted value achieved was 36.3%. R^2 values lower than 50% are acceptable (Seber and Lee, 2012). There is no universal rule on how to incorporate the statistical measure in assessing a model. A low R^2 figure is generally a bad sign for predictive models. However, in some cases, a good model may show a small value. Some fields of study have an inherently greater amount of unexplainable variation. In these areas, your R^2 values are bound to be lower. For example, studies that try to explain human behavior generally have R^2 values less than 50% (Mintab, 2016). Peoples behaviours are just harder to predict than things like physical processes (R-squared in Regression Analysis, 2017). Fortunately, if you have a low R-squared value but the independent variables are statistically significant, you can still draw important conclusions about the relationships between the variables as is the case in this research (Seber and Lee, 2012), (Mintab, 2016).

Coded Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	0.7960	0.0172	46.33	0.000	
Affinitive Org Commitment	0.0642	0.0236	2.72	0.013	1.03
Extraversion	0.1128	0.0303	3.72	0.001	1.02
Conscientiousness	0.0788	0.0364	2.16	0.042	1.04

Regression Equation in Uncoded Units

Lean Scores = -0.259 + 0.359 Affinitive Org Commitment + 0.501 Extraversion
+ 0.545 Conscientiousness

Fits and Diagnostics for Unusual Observations

Obs	Lean Scores	Fit	Resid	Std Resid	
1	1.0000	0.8063	0.1937	2.50	R
13	0.5714	0.7681	-0.1967	-2.58	R

R Large residual

Figure 12.
Regression equation and VIF values

The VIF and R^2 adjusted values (Figure 12) show the individual effects of extraversion, conscientiousness and affective commitment on lean scores. The results indicate that individuals are more likely to adopt lean practices, as these traits increase as determined previously in the analysis of lean disposition and personality. In addition, as affective commitment increases lean practice adoption intentions tend to increase also (Figure 13).

5. Discussion and implications

The following discussion is divided into the three central themes that emerged from the findings of this study. Each theme is discussed concerning existing research in the field of organisational theory and personality trait theory.

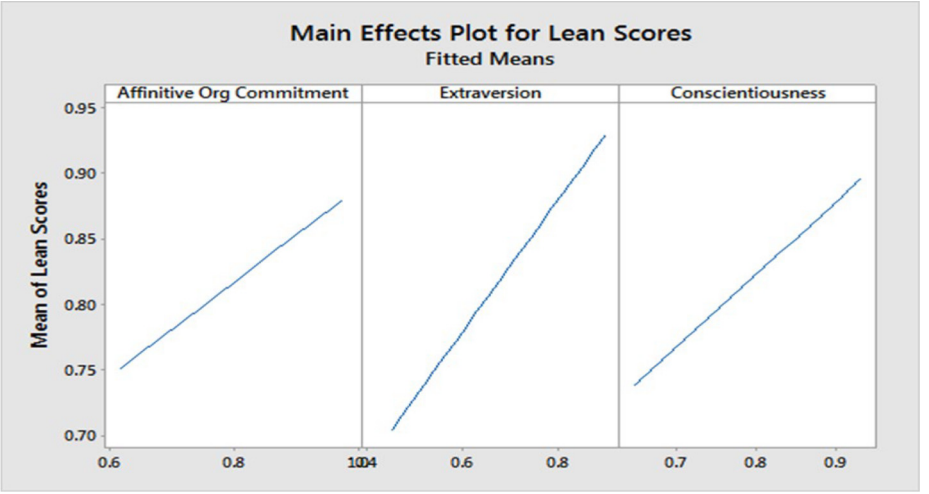

Figure 13.
The effect of lean score averages as a result of affective organisational commitment, extraversion and conscientiousness

5.1 Hierarchal position

The findings of our analysis reveal that supervisors' disposition towards lean is generally greater than those of non-supervisory personnel. The range of data for supervisors scores is also narrower indicating a greater consensus among this group about lean practice adoption. This confirms the research proposition that an individual's level within the organisation can affect lean disposition. It is consistent with the findings of Anderson-Connolly *et al.* (2002), who found that supervisors and non-supervisors have different outlooks on lean practices. The finding also correlates with Ameer *et al.* (2021) findings that managers have a positive impact on project success in the context of professional commitment. Anderson-Connolly *et al.* (2002) also discovered that increased autonomy improved non-supervisor job satisfaction but also increased supervisor stress, whereas increased levels of teamwork had the opposite effect. It is therefore logical that individual dispositions, as determined in this study, and their impacts on satisfaction differ depending on an individual's level in the organisation.

5.2 Organisational function

According to the study's findings, certain functions have higher average scores for lean disposition than others. The data presented shows that, for example, employees working in operations and quality have higher levels of lean disposition on average than those working in engineering and product development. This data suggests that organisational function influences lean disposition. We argue that higher lean disposition scores are associated with functions that directly support the production process than with functions that provide indirect support. Although most functions will engage in both direct and indirect production support activities, they are predominately focused on one or the other.

Additionally, we claim that the split in lean adoption between direct and indirect functions has to do with what Johnson *et al.* (2014) refer to as legitimacy within organisational fields. DiMaggio and Powell (1983) consider professions to be organisational fields, and these professions are exposed to normative pressures to conform to established methods and practices within the field. They argue while the professions within an organisation may differ, they are comparable to those in other organisations. As such, these distinct fields within organisations arise from formal education and the establishment of professional networks. We, therefore, claim that the various functions within organisations have varying perceptions of lean practices because of their differing normative expectations. Individuals working in functions such as quality and operations, as seen in the data presented here, believe that lean practices conform highly to their expectations of work practices. This is not to say that lean practices are incompatible with certain functions or professions, but that there will be differing degrees of conformity between functions. This may or may not be exacerbated by organisations that are functionally rather than value stream orientated, as is the case with the case study. In contrast, Kostova *et al.* (2008) argue that the traditional concept of organisational fields does not apply to multinational companies (MNCs) and instead they propose that an intra-organisational field is more applicable. In other words, all sub-elements of the MNC constitute a single field. They argue that this situation arises because of the parent organisation's heavy reliance on the MNC for resources and the transfer of core competencies. However, the results presented here contradict their proposal about lean practice adoption based on the evidence of contrasting functional legitimacy.

5.3 Personality and affective organisational commitment

Our study found that personality traits such as extraversion and conscientiousness influence lean disposition. The more prominent each trait is, the more inclined an individual

is toward lean. Similarly, it is evident that affective organisational commitment has a positive effect on lean disposition. Extraversion, conscientiousness and affective organisational commitment all have a statistically significant and positive effect on lean disposition according to our regression analysis.

Our findings indicate that personality also affects an individual's intention to adopt lean practices. We found that respondents with higher levels of extraversion and conscientiousness traits are more likely to answer positively to the questions posed relating to lean practice adoption. It is proposed that it is logical for more conscientious individuals to adopt standardised work practices, including 5S housekeeping systems (made up of sort, set in order, shine, standardize, and sustain steps), GEMBA walks (a Japanese term meaning to go to or look at "the real or actual place") and visual management boards, all of which demand attention to detail as well as commitment and organisation. Individuals high in conscientiousness tend to be reliable, responsible, punctual, efficient and dependable (Schultz and Schultz, 2008), whereas individuals with high levels of extraversion are typically more sociable and talkative. Logically, this type of individual would be more receptive to practices such as cross-functional teamwork.

Extraversion is also associated with a level of ambition (Barrick and Mount, 1991) and earlier research has established a link between conscientiousness and achievement (Conner and Abraham, 2001). The landmark study completed by Barrick and Mount (1991) showed that conscientiousness was consistently correlated with high levels of job and training proficiency across multiple disciplines. It is therefore entirely possible that a certain level of ambition contributes to the correlation between these personality traits and lean practice adoption. Employees surveyed for this case study may see the lean initiative as a vehicle for organisational and personal advancement. Supervisors demonstrated a higher degree of lean disposition, which supports this argument. Supervisors are a naturally ambitious cohort in any organisation. Interestingly, the findings of this study contradict those reported by Beale (2007), who concluded that personality is not an influential factor in the lean implementation processes. However, Taylor *et al.* (2021) found that emotions concerning personality can be a factor for lean success.

The finding that an individual's level of affective commitment positively impacts lean disposition is not a surprising outcome. It is proposed that positive motivation for the adoption of new practices requires a degree of organisational citizenship behaviour, which has been found to be positively influenced by affective commitment (Pattanayak and Chhabra, 2014; Feather and Rauter, 2004; Cullen-Lester *et al.*, 2021). This finding also corroborates Meyer *et al.* (2002) and Kundi *et al.* (2021) who discovered that affective commitment has the strongest correlation with desirable work behaviours such as job performance and organisational citizenship behaviour. Interestingly, the results of the regression analysis determined that job satisfaction had no significant impact, contrary to Beale's (2007) assertion.

As a result, we argue that this finding is consistent with practices applied at the organisational level rather than the functional level. An individual who is less satisfied in their role but who has a solid affective commitment to the organisation is still likely to adopt organisational practices. They will do this if they see them as beneficial to their advancement and to the company in which their role may change. In the converse situation, individuals are perhaps less likely to comply with organisational initiatives. The fact that job satisfaction does not necessarily affect lean disposition justifies the approach taken in this study to analyse organisational commitment as a separate variable. This concurs with the findings of Meyer *et al.* (2002) who proposed that both should be considered when analysing employee behaviour.

5.4 Summary

It is important to note that a degree of overlap exists between these findings. As the data suggests, lean disposition varies by function. At the same time, affective commitment is generally higher for certain organisational functions, and lean disposition scores correlate strongly with affective commitment. As a result, it is argued that both variables have an effect on lean disposition, illuminating the effect of organisational field legitimacy as proposed by Johnson *et al.* (2014). Similarly, supervisors demonstrate higher levels of lean disposition, and supervisors are perhaps more likely to be extraverted in nature and therefore more likely to be favourable towards the implementation of lean practices.

This study has practical implications for any organisation embarking on a lean initiative and facilitating the essential cultural transformation required to implement lean. To guarantee successful implementation, we advise senior managers to carefully assess the individuals that they assign to lead the endeavour. The findings of this study show that certain personality traits may indicate whether a person is more pre-disposed to lean practice adoption. Managers, therefore, must look to staff who exhibit higher levels of extraversion and conscientiousness to lead the implementation initiative. Schultz and Schultz (2008) refer to a study by Digman (1997) in which it is proposed that agreeableness, conscientiousness and emotional stability are more socially desirable traits. Individuals with a high level of extraversion and a low level of neuroticism are more pre-disposed to emotional stability. Notably, two of the traits highlighted in this study are also advocated by Digman (1997). The message to senior management is that the top-performing employees should be tasked with implementing Lean. This is supported by Henderson and Evans (2000), who emphasise the importance of placing key people in senior positions to support the implementation effort. Many researchers also stress the importance of leadership (Suresh *et al.*, 2012; Timans *et al.*, 2012; Antony *et al.*, 2018). An initiative led by the most suitable people is more likely to yield positive results.

For functionally structured organisations, the findings of this study suggest that senior management must accentuate the elements of lean that are most relevant to each function. Not all functions will adopt lean methods at the same rate, and managers will need to consider how to legitimise lean practices in different ways for different departments. Managers must also note the influence of affective commitment on their employee's level of lean disposition. Meyer and Allen (1991) and Meyer *et al.* (2002) convey the importance of carefully managed work experiences within the organisation as a key antecedent to affective commitment.

6. Conclusion

The goal of this study was to ascertain the overarching factors that affect lean implementation at an individual level, to assist organisations that wish to undertake a lean initiative. Particularly, we sought to empirically assess the antecedent factors that affect an employee's disposition towards the adoption of lean practices and the research aims were achieved.

6.1 Theoretical implications

There is a dearth of research on individual dispositions toward lean practice adoption. This study adds to this body of knowledge, as the findings presented indicate that certain personality traits, specifically extraversion and conscientiousness have a positive effect on an individual's disposition toward lean practices. The findings also indicate that affective commitment can impact lean practice disposition. These findings reveal new areas for lean implementation research.

6.2 Practical implications

Finally, organisational function and hierarchal position also impact lean disposition. We propose those employees working in functions that directly support the production process generally have a higher lean disposition than those working in functions that are not directly related to production. In addition, employees who are in supervisory roles are more likely to have a stronger disposition toward the implementation of lean than those in non-supervisory roles. The contribution of this study is to highlight the individual-level factors that organisations must consider while implementing lean and how they can use staff more effectively to ensure successful implementation. This study provides guidance to managers planning for lean implementation in companies of comparable size and field of work to the organisation under study. To conclude, the contribution of this study is to highlight the individual-level factors that organisations must consider while implementing lean and how they can use staff more effectively to ensure successful implementation.

6.3 Limitations

A limitation is that future research on employment status and its positive and negative effects on lean practice adoption is another avenue for investigation. Also conducting a more longitudinal study within the organisation would enhance the findings and conclusions.

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