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Antecedents of Bottom-Up Operations Strategy Formation*

Cem Mercikoğlu[1], Arnd Huchzermeier[1], Serden Özcan[1]

ABSTRACT

Purpose: This paper's purpose is to deepen our understanding of what drives bottom-up operations strategy formation – that is, continuous improvement activities at the front line – with a particular focus on operations strategy understanding. That way, it aims to contribute to the awareness of management quality in manufacturing – a cornerstone of national competitiveness.

Methodology: We examine the antecedents of individual Kaizen generation by frontline employees, drawing on the well-established Motivation-Opportunity-Ability framework and focusing on the dimension of ability – that is, understanding operations strategy. Survey data on 217 frontline employees, working in 17 teams on 11 different production lines, were "triangulated" with their team leader assessments and the plant's archival records. We tested the hypothesized relationships via analyses that incorporate both structural equation modeling and multiple regression techniques.

Findings: Our results suggest that employees typically overestimate their understanding of the plant's operations strategy and that productivity is driven more by an objective than a subjective understanding of that strategy. We also find that incremental innovation is facilitated by supervisor support, employee engagement, and an employee suggestion scheme; in contrast, neither autonomy nor selected control variables (e.g., age or seniority) has a significant effect.

Originality: Our findings and the unique metrics we developed for better management of strategy understanding should help managers increase the productivity of their operations and thus the competitiveness of their respective firms.

Keywords: Operations Strategy Understanding, Supervisor Support, Employee Engagement, Continuous Improvement.

JEL Codes: M11, M54, J24.

Aşağıdan-Yukarıya Operasyon Stratejisi Oluşumunun Öncülleri

ÖZET

Amaç: Bu makalenin amacı, özellikle operasyonel strateji anlayışına odaklanarak aşağıdan yukarıya operasyon stratejisi oluşumunun – yani ön cephedeki sürekli iyileştirme faaliyetlerinin – öncüllerine dair anlayışımızı derinleştirmektir. Bu şekilde, ulusal rekabetçiliğin temel taşlarından biri olan üretimde yönetim kalitesi konusundaki farkındalığa katkıda bulunulması amaçlanmaktadır.

Yöntem: Bu çalışmada, Motivasyon-Fırsat-Yetenek teorisinden yararlanarak ve yetenek boyutuna, yani operasyon stratejisini anlamaya odaklanarak, üretim hattındaki çalışanların bireysel Kaizen üretiminin öncülleri incelenmiştir. 11 farklı üretim hattında 17 ekipte çalışan 217 üretim çalışanından elde edilen anket verileri, ekip liderlerinin değerlendirmeleri ve fabrikanın arşiv kayıtları ile "üçgenlenmiştir". Varsayılan ilişkiler hem yapısal eşitlik modellemesi hem de çoklu regresyon tekniklerini içeren analizler yoluyla test edilmiştir.

Bulgular: Sonuçlarımız, çalışanların fabrikanın operasyon stratejisini anlama derecelerini olduğundan fazla değerlendirdiklerine ve üretkenliğin bu stratejinin öznel olarak anlaşılmasından ziyade nesnel olarak anlaşılmasıyla sağlandığına işaret etmektedir. Ayrıca, artımsal inovasyonun amir desteği, çalışan bağlılığı ve çalışan öneri sistemi tarafından kolaylaştırıldığı; buna karşın ne otonominin ne de seçtiğimiz kontrol değişkenlerinin (örneğin, yaş veya şirket kıdemi) önemli bir etkiye sahip olmadığı tespit edilmiştir.

Özgünlük: Bulgularımız ve strateji anlayışının daha iyi yönetilmesi için geliştirdiğimiz özgün ölçütler, yöneticilerin üretim operasyonlarının verimliliğini ve dolayısıyla şirketlerinin rekabet gücünü artırmalarına katkı sağlayacaktır.

Anahtar Kelimeler: Operasyon Stratejisi Anlayışı, Amir Desteği, Çalışan Bağlılığı, Sürekli İyileştirme.

JEL Kodları: M11, M54, J24.

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[1] WHU - Otto Beisheim School of Management, Vallendar, Germany

Corresponding Author: Cem Mercikoğlu, cem.mercikoglu@whu.edu

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1. INTRODUCTION

An important change in the global economic landscape in recent decades is that the world's economic center of gravity has shifted eastward. The shift is expected to continue. Dobbs et al. (2012) from McKinsey Global Institute predict that by 2025 it will be in Central Asia – just north of where it was in 1 AD and in 1000 – coming full circle. Huang (2021) from Allianz Research also reports that the destination is to the east – and will remain so during the decade (Figure 1).

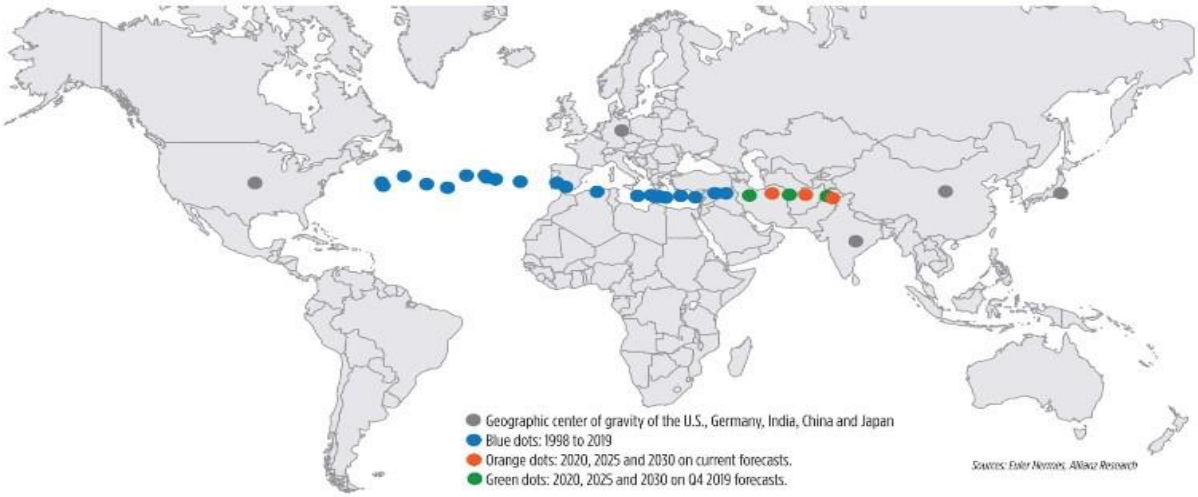


Figure 1. World Economic Center of gravity (Adapted from Daughters, 2021)

Other sources report similar expectations. For example, PwC (2017: 5-6) forecasts that the E7, the group of seven largest emerging economies, could grow on average twice as fast as the advanced economies (G7) by 2050 and increase their share of global GDP from 35 % to almost 50 %, while the shares of G7 and EU-27 will decline significantly. Similarly, Orlik and Van Roye (2020) argue that emerging economies will overtake advanced economies in 2042 and that 60 % of global GDP will be generated by them by 2050. Business intelligence firm CRU Group (2020) believes that the world in 2050 will be largely unaffected by the COVID-19 pandemics and that Asian economies will grow the most in the next 30 years, while Europe will shrink in relative size. So there seems to be a consensus that the East will become significantly more important in the foreseeable future. This will force Western executives engaged in international business to adjust their overseas strategy accordingly, or to begin developing such a strategy if they have not already done so. Ultimately, it is likely to be difficult – if at all possible – for a Western company to achieve high growth rates in the West alone without having a foot in the emerging economies, particularly in the East.

Türkiye is one of these emerging economies. As is the case in many countries around the world, its economic agenda focuses on productivity and innovation. Improved productivity in Türkiye benefits not only the national economy but also many other countries around the world, including the EU, which are increasingly looking to the country as a manufacturing hub – especially in the post-pandemic world where supply chain resilience is more important than ever. A natural consequence of this is that the competitiveness of European firms will depend more on Turkish productivity. Therefore, any contribution to increasing Turkish productivity directly benefits the European economy – the largest consumer of "Made in Türkiye". In addition, smarter use of resources benefits the "green transformation", an issue that will remain on the agenda for decades to come – with Türkiye aiming for net-zero emissions by 2053. In view of all these considerations, our attention turns to the question of how to further increase Turkish productivity.

In essence, productivity and innovation are interrelated, and the former – especially *labor* productivity – becomes evident as a result of the latter – especially *process* innovation. Greenspan (2013: 164) interprets innovation as a key determinant of productivity's growth rate. Owing to the increasing pace and complexity of business environments, organizations no longer compete on processes per se but rather on the ability to improve processes continuously (Anand et al., 2009). That development explains the strong relevance of a focus on continuous improvement, known as Kaizen. The Japanese word Kaizen is defined as a "company-wide process of focused and continuous incremental innovation" (Bessant et al., 1994) and is usually considered the opposite of Kaikaku, or radical change. In Japanese management philosophy, Kaizen is an "umbrella" concept that encompasses a unique set of management methods and involves the participation of everyone with the goal of continuous improvement. The prevailing mindset is that nowhere in the organization should there exist a place where some kind of improvement does not occur on any given day (Imai, 1986: 5). In that sense, human capital plays a big role in moving the business forward.

Nonetheless, many executives immediately associate productivity enhancement with tangible assets (e.g., physical assets or technology), which are necessary but not sufficient. For such assets to be fully utilized, they must be complemented by the intangible assets to which our work is dedicated. Despite these assets being no less effective, they are underutilized: factors such as management support, workers' understanding of operations strategy, and employee engagement merit great attention. This is succinctly highlighted by Peters (2010: xxi) with the words "Hard is soft. Soft is hard". Our work is an endeavor to raise awareness of the overlooked soft levers of productivity.

One way to increase productivity is to improve the quality of management. Two prominent studies in this area are World Management Survey (Bloom and Van Reenen, 2007) and Organizational Health by McKinsey (Gagnon et al., 2017). The former study, which measures the quality of management practices in different countries and industries, found that differences in management practices accounted on average for about 30 % of the total factor productivity differences both between countries and within countries across firms (Bloom et al., 2016), and that one standard deviation increase in management quality is associated with about a 10 percent increase in productivity (Scur et al., 2021) – a good figure for many economies around the world. Similarly, the latter study concluded that health, which is a measure of an organization's performance on 37 different management practices, explains up to 50 % of performance variation between companies, and healthy companies deliver a threefold total return to their shareholders (Dagan et al., 2020). In short: management practices play an important role in an organization's performance – and ultimately in a nation's competitiveness.

Unfortunately, Türkiye scores relatively poorly on management quality (Carpio and Taskin, 2019). More specifically, more than half of Turkish manufacturing firms were found to be worse managed than firms in even the lowest quartile in the United States. Perhaps even worse is the finding that, compared to managers from all other countries, Turkish managers are the least aware that their management practices are poor (Carpio and Taskin, 2019).

The main objective of our work is to contribute to Turkish productivity. What motivated us to do so have been the facts that (i) Turkish industry is a laggard in terms of management quality – as mentioned above – and is currently unable to capitalize on the resulting productivity gains, (ii) only 11% of Turkish executives in a survey stated that their strategies are being executed as planned (Aki, 2016), resulting in lower value creation in around 90 % of companies, and (iii) there is a large productivity gap between KOBIs (small and medium-sized enterprises in Turkish parlance) and large firms, with the former, which accounts for 99% of Turkish industry, being only about one-sixth productive as the latter, which accounts for a mere 1 % of the industry (Dünya, 2017) – an imbalance that is a big obstacle on the road to becoming a global economy and should definitely be addressed. We aim to tackle all these problems by focusing attention to the soft side of productivity.

Our research deals with antecedents of bottom-up operations strategy formation, i.e., continuous improvement activities on the shop floor, with a particular interest on *operations strategy understanding at worker level* – a management practice that is in most cases neither appreciated nor properly measured. In regard to such understanding, workers can be classified into one of the four possible groups (Figure 2).

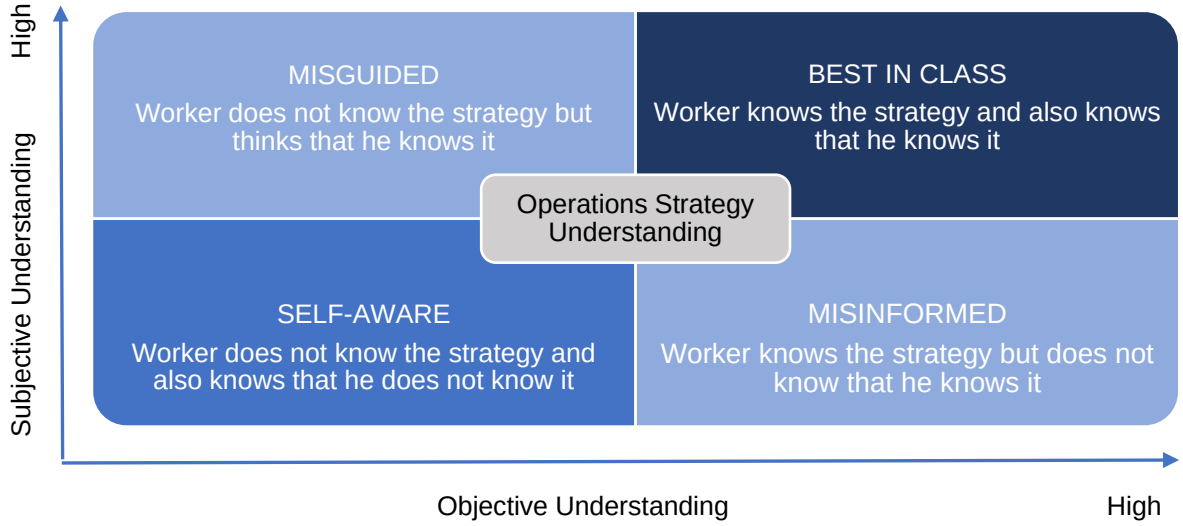


Figure 2. Clusters of strategy understanding (Huchzermeier et al., 2019)

There are a number of studies in the literature that have investigated the role of the same and/or similar constructs to ours, such as managerial support and autonomy, on organizational performance, including innovativeness and entrepreneurship in the Turkish context (e.g., Bulut et. al., 2009; Fis and Cetindamar, 2009; Gümüslüoglu and Ilsev (2009); Ulusoy et. al., 2015). However, this study is unique in the sense that it goes beyond the constructs already studied and brings a new one, namely operations strategy understanding, to the scene. To the best of our knowledge, this is the first study to empirically investigate the effects of objective and subjective operations strategy understanding on incremental innovation, i.e., individual Kaizen performance, in the Turkish manufacturing industry.

The rest of this paper proceeds as follows. Section 2 addresses the background and the research model; literature review and our methodology are presented in (respectively) Sections 3 and 4. In Section 5 we present the analysis and the findings, and Section 6 addresses workers' understanding of operations strategy. We conclude in Section 7 with a summary discussion of our results, managerial insights, limitations of the study and avenues for future research.

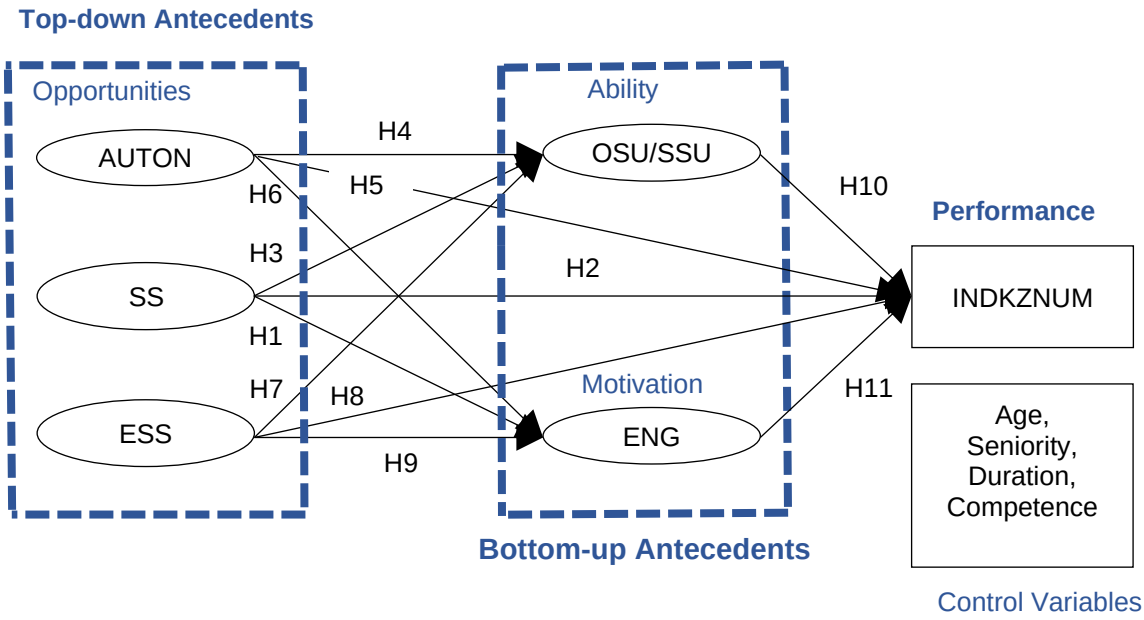
2. THE MODEL

A widely used theory to explain behavior or performance at the individual level is the MOA model. The basic idea of the model is that performance is a function of motivation, opportunity, and ability. That is, P = f (M, O, A) holds. The origins of the model go back to Vroom (1964: 197-199) who contented that performance is a function of ability and motivation. Later, Blumberg and Pringle (1982), arguing that existing theory does not provide a strong and consistent prediction of job performance, added "opportunity to perform" as a third dimension and replaced the other two dimensions with "capacity to perform" and "willingness to perform" which have a broader scope. According to the authors, capacity to perform refers to the "physiological and cognitive capabilities that enable an individual to perform a task effectively" and includes the effects of individual's knowledge, skills, intelligence, age, state of health, level of education, endurance, energy level, and similar variables. The second dimension, willingness to perform, consists of "psychological and emotional characteristics that influence the degree to which an individual is inclined to perform a task" and includes the effects of motivation, personality, attitudes, values, task characteristics, job involvement, perceived role expectations, need states, self-image, and related concepts. The proverb referred to by Purcell et al. (2003: 6) underscores the willingness aspect perfectly: "You can lead a horse to water but you can't make him drink". The third and newly added dimension, opportunity to perform, goes beyond the individual's immediate task environment and "consists of the particular configuration of the field of forces surrounding a person and his or her task that enables or constraints that person's task performance and that are beyond the person's direct control". Thus, to perform well, employees need resources such as information and technology, and their potential is limited by the level of support they receive from other key people, including colleagues and supervisors (Sterling and Boxall, 2013). Overall, performance is collectively shaped by the partial contributions of these three dimensions (Blumberg and Pringle, 1982).

The MOA framework has been used, inter alia, as a basis for explaining work performance and has been utilized in knowledge sharing in Operations Management (Siemsen et al., 2008). In our proposed research setting, the synthesis of "opportunities", which we measure through autonomy, supervisor support, and employee suggestion system, and "motivation", which we assess through employee engagement, along with "ability", which we evaluate through operations strategy understanding, culminates in behavior that supports the strategy in a bottom-up manner and that we quantify by the number of individual Kaizen contributions. In this regard, our conceptual framework looks as illustrated in Figure 3, with an overview in Table 1. Top-down antecedents are contextual, i.e., environmental, factors provided to employees by management, while bottom-up antecedents consist of personal antecedents brought by employees. In this sense, performance is the result of collaboration between both parties.

Table 1. Model content at a glance

Inputs	*Construct(s)*	*Data source*	*Data type*
Opportunity (O)	Supervisor Support	Employees	Primary
	Autonomy	Employees	Primary
	Employee Suggestion System	Employees	Primary
Motivation (M)	Employee Engagement	Employees	Primary
Ability (A)	Objective Operations Strategy Understanding	Team Leaders	Primary
	Subjective Operations Strategy Understanding	Employees	Primary
Output	*Metric*	*Data source*	*Data type*
Performance (P)	Individual Kaizen numbers	Archival records	Secondary
Control Variables	*Variables*	*Data source*	*Data type*
Variables	Age, Seniority, Duration, Competence	Archival records	Secondary



AUTON: Autonomy, ENG: Employee Engagement, ESS: Employee Suggestion System, INDKZNUM: Individual Number of Kaizens, SS: Supervisor Support, OSU: Objective Operations Strategy Understanding, SSU: Subjective Operations Strategy Understanding

Figure 3. Conceptual framework of hypotheses (Adapted from Scholz et al., 2021: 9-10)

3. LITERATURE REVIEW

The causal link between HR practices and performance outcomes is often referred to as the "black-box problem" because it is not actually known just how and why HR practices affect performance (Purcell et al., 2003: 3). A basic component of the HR–performance link is line management, or team leaders. Almost all HR policies and practices are implemented by and through team leaders, and there are differences in how they are implemented by those leaders (Purcell et al., 2003: 74). What Purcell et al. (2003: 75) refer to as "front-line leadership" – such team leader behaviors as sharing information with employees, responding to their suggestions, being fair, and addressing operations problems – makes the job and workplace both satisfying and motivating, which in turn leads to discretionary behavior and better performance (Purcell et al., 2003: 39-71). The importance of line managers is highlighted also in some other sources. Holbeche and Matthews (2012: 79) argue that employees' relationship with their supervisors determines how committed and willing they are to make discretionary effort, while immediate managers, who most workers view as their employers (Wong et al., 2010: 27), influence work life and play an important role in the level of engagement a worker has (Robinson et al., 2007: 19; Macey and Schneider, 2008). In addition, Maslach et al. (2001) contend that social support plays an important role in engagement and its absence is associated with burnout – with lack of support from the supervisor being particularly important. Using the Job Demands-Resources (JD-R) model and considering supervisor support as a job resource, Hakanen et al. (2006) find that job resources are positively related to engagement. Our first hypothesis is accordingly as follows.

Hypothesis 1 (H1): Supervisor support is positively correlated with employee engagement.

Supportive supervision – whereby leaders are responsive to employees' feelings and needs, provide informative feedback, promote skill development, and encourage employees to voice their concerns – is expected to increase creative achievement; in contrast, controlling or restrictive supervision is likely to reduce it (Oldham and Cummings, 1996). According to the componential theory of creativity (Amabile, 2012), creative responses require a social work environment characterized by (among other things) supervisors who encourage the development of ideas. In a similar vein, employees' ratings of supervisory encouragement are significantly linked to creativity (Amabile and Gryskiewicz, 1989). There is ample empirical evidence that better management enhances productivity. For example, Bloom et al. (2017) found that management practices used on the frontlines matter for productivity, and that every 10 % increase in a plant's management score calculated based on a particular set of practices – which they call "structured management" – was associated with a 14 % increase in the labor productivity. In a similar vein, a 1-point increase on a 5-point management score, equivalent of moving from the bottom third to the top third of the sample, corresponded to a 23 % increase in productivity (Bloom et al., 2012). Further evidence comes from Loch et al. (2003: 198) who showed that firms with management quality have higher production

improvement rates including unit cost. In their study of the effect of supervisors on worker productivity, Lazear et al. (2015) found that supervisor quality varies widely and that the effects of supervisors on worker output are large and significant. According to the authors, if a supervisor who is in the bottom 10 % of supervisor quality is replaced by a supervisor who is in the top 10 %, a team's performance increases by more than when a team of nine employees is expanded by one. Finally, management support was found to have a positive impact on innovative performance in a sample of Turkish firms (Alpkan et al., 2010). We are motivated to form our second hypothesis.

Hypothesis 2 (H2): Supervisor support is positively correlated with continuous improvement activities.

Not every generated idea is relevant to operations strategy. For employees to generate strategically relevant ideas, i.e., those that can at least be accepted as Kaizens, they need to know where to divert their efforts – especially mentally. This is where the line of sight comes into play. "Line of sight (LOS) is an employee's understanding of the organization's goals and what actions are necessary to contribute to those objectives. To translate strategic goals into tangible results, employees must not only understand the organization's strategy, but must also accurately appreciate the actions aligned with realizing that strategy" (Boswell et al., 2006). If employees do not understand the company's strategic goals, they may develop their own goals, which might lead them to work on objectives that are less important or even antithetical to the company's strategy (Boswell et al., 2006). A lack of commitment to the strategy by teams at the middle and lower levels is often why strategy implementation fails (Ateş et al., 2020). A prerequisite for employee commitment is a good understanding of the organization's goals and of individuals' responsibilities for achieving them (Kumar and Pansari, 2016) – a point Pietersen (2010: 157) highlights by referring to Nietzche's saying "People will do almost any *what* if you give them a good *why*". Therefore, organizations must create both an understanding of and a commitment to the strategy among those tasked with implementing it (Ateş, 2014: 52). It is the responsibility of especially middle- and low level managers to communicate and clarify the strategy to subordinates and interpret it as part of their daily operations (Ateş, 2014: 52). Boswell and Boudreau (2001) state that "supervisors play a crucial role in the communication of group, division, and organizational goals to their employees, as well as managing their performance toward those goals. Thus it would seem that supervisor-subordinate relations have an influence on developing line of sight". Studies confirm the importance of supervisory communication. If the organization fails to communicate the strategy to the employees, and if this communication is not received and accepted on their part, perception gaps occur, leading to poor execution (Cocks, 2010). Loch (2008) considers under-communication to be the most common weakness, noting that strategy cascading – dialogue on the business strategy and breaking it down into smaller sub-goals and sub-objectives – makes goals and objectives clearer and more meaningful to employees, which increases motivation and commitment. Finally, supervisory communication and training facilitate a better understanding of strategic principles (Parker et al.,1997). These considerations lead to the next hypotheses, as follow.

Hypothesis 3a (H3a): Supervisor support is positively correlated with objective strategy understanding.

Hypothesis 3b (H3b): Supervisor support is positively correlated with subjective strategy understanding.

In this study, we adopt Hackman and Oldham's (1975) definition of autonomy: "the degree to which the job provides substantial freedom, independence and discretion to the employee in scheduling the work and in determining the procedures to be used in carrying it out". Pfeffer (2018) contends that autonomy serves as a kind of learning mechanism: when people have freedom in the work they do, they can learn better when seeing the connection between their actions and the consequences. In this way, employees gain a degree of mastery over the work and thereby come to understand better what they must do in order to achieve desired results. With regard to the subjective dimension of strategy understanding, Biggs et al. (2014) show that the construct of job control – which includes autonomy – is highly correlated with perceived strategic alignment, which in our case corresponds to subjective strategy understanding. In addition, Scholz et al. (2021: 21) report a statistically significant effect of autonomy on perceived strategic alignment. In light of all these studies, we hypothesize as follows.

Hypothesis 4a (H4a): Autonomy is positively correlated with objective strategy understanding.

Hypothesis 4b (H4b): Autonomy is positively correlated with subjective strategy understanding.

Autonomy is a factor known to influence business outcomes. Unlike corporate strategy, operations strategy can be shaped more by operational, i.e., shop floor, staff than by managers (Wheelwright, 1984). It is formed through an iterative process that integrates competitive priorities, objectives, and action plans, some of which are brought about in top-down planning and some of which emerge bottom-up (Kim et al., 2014). According to Sting and Loch (2016), operations strategy involves multiple initiatives – related to both technology and process development – simultaneously and is inherently complex. Such complexity cannot be managed by a single person who understands all the decisions. Therefore, decisions and innovative

activities must be distributed among several actors in the organization, each of whom has only partial knowledge (Sting and Loch, 2016). Mintzberg and Van der Heyden (1999) view top management as a metaphor and argue that top management stands on top of nothing more than an organization chart. In their view, good management operates in a web, that is, an interconnected network of functions, and in a web anyone can be the management. This way of thinking is similar to the concepts of "X-teams" (Ancona and Bresman, 2007: 222), which argues that any specific leader is incomplete, and "Blue Ocean Leadership", which favors distributed and empowered leaders at all levels of the hierarchy (Kim and Mauborgne, 2014), as well as "emergent strategy", which is defined as realized strategies from lower levels that were never intended in the beginning (Mintzberg, 1978). In this sense, autonomy can be expected to contribute to improvement. A relation is observed between autonomy and employees' inclination to improve operations (Kim et al., 2014; Sting and Loch, 2016). And according to Amabile et al. (1996), people work more creatively when they are free to decide *how* to do their work. All this accounts for our next hypothesis.

Hypothesis 5 (H5): Autonomy is positively correlated with continuous improvement activities.

The Job Characteristics Model is a work design theory which posits that jobs can be redesigned to enhance employee motivation and productivity (Hackman and Oldham, 1975). It focuses on five core job dimensions: skill variety, task identity, task significance, feedback, and *autonomy*. These dimensions create the three psychological states, which in turn, influence personal and work outcomes, including internal motivation and satisfaction – which are closely related to engagement. Thus, autonomy makes work internally motivating.

In his seminal book entitled *Drive*, Pink (2009: 110-112) argues that "control leads to compliance; autonomy leads to engagement" and "Living a satisfying life requires more than simply meeting the demands of those in control. Yet in our offices and our classrooms we have way too much compliance and way too little engagement. The former might get you through the day, but only the latter will get you through the night". Gino (2016) reaches a very similar conclusion about the prevalence of compliance: only less than 10 percent of more than 1,000 employees she surveyed from a variety of industries reported working in companies that regularly encourage nonconformity – in addition to another survey's finding that nearly half of 2,000 employees working in a wide range of industries said they regularly feel they have to conform, while more than half of them said that people in their organizations do not question the status quo. According to her research, when employees express their authentic selves at work, i.e., when they are provided with autonomy, employee engagement increases. As a proponent of employee rebellion, she argues that leaders should allow and even encourage "constructive nonconformity" in their organizations – a term she defines as "behavior that deviates from organizational norms, others' actions, or common expectations, to the benefit of the organization".

The benefits of autonomy are also presented in some other sources. According to a study conducted by Chirkov et al. (2003), there is a correlation between autonomy and overall well-being in some countries, including Türkiye. Similarly, declining job satisfaction in the United Kingdom is reported to be mainly due to the lack of individual autonomy at work (Krueger, 2005), while Baard et al. (2004), who studied first-line employees at an investment bank, found that (i) employees whose supervisors provided "autonomy support" had greater job satisfaction and (ii) this higher job satisfaction translated into better job performance. Pfeffer (2018) states that low job control leads to job stress and anxiety, which are causes of burnout, which is the opposite of engagement (Schaufeli et al., 2002). Especially striking in Pfeffer's (2018) paper is the "MBA" style of management used by one company: "management by absence". Bakker et al. (2004) find that job resources, including autonomy, are *negatively* associated with *disengagement*, and Gallup (2020: 16) reports that employees are 43% less likely to suffer from high levels of burnout when they have job autonomy (although too much autonomy can also be a burnout risk by leading to excessive ambiguity). The cited findings give rise to the following hypothesis.

Hypothesis 6 (H6): Autonomy is positively correlated with employee engagement.

An organization's journey to full continuous improvement capability is a learning process (Bessant and Francis, 1999) consisting of six levels, with level 0 being "no continuous improvement activity" and level 5 being "the learning organization". Establishing a structured idea management system is a behavior for level 2 - "structured and systematic continuous improvement". The transition from level 2 to level 3, "strategic continuous improvement", is crucial (Bessant and Francis, 1999). In this regard, it can be argued that the employee suggestion system is an important practice on the way to becoming a learning organization.

A well-designed suggestion system is characterized by a variety of features, such as encouraging the submission of suggestions, a fair evaluation process, a quick response to submissions, and appropriate rewarding. An effective employee suggestion system helps align employees' goals with the organization's priorities (Fairbank and Williams, 2001). Feedback on employee suggestions serves as an opportunity for employees to identify and correct errors, thereby improving the quality of future ideas (Verdinejad et al.,

2010). In a similar vein, Bassford and Martin (1996: 6) claim that the employee suggestion system is a win–win–win–win situation for the parties involved: the company, employees, customers, and investors. One of the benefits is increased communication, since a formal employee suggestion system encourages employees to talk to their supervisors and colleagues about the tasks they perform and how they can improve on them – which should contribute to a better objective strategy understanding. Therefore, we hypothesize as follows.

Hypothesis 7a (H7a): An employee suggestion system is positively correlated with objective strategy understanding.

As mentioned above, setting up an employee suggestion system is a key practice for companies that aim to become a learning organization (Bessant and Francis, 1999). Bell (1997) mentions that "the real goal [of an employee suggestion system] is to generate as many ideas as possible, and, over time, to improve the quality of the suggestions through feedback and encouragement." Feedback helps "reduce the discrepancy between current and desired understanding" (Hattie and Timperley, 2007). Hence an employee suggestion system can be expected to increase subjective understanding of strategy. In addition, Scholz et al. (2021: 21) find a statistically significant relationship between structured idea management processes and perceived strategic alignment. Thus we posit the following variant.

Hypothesis 7b (H7b): An employee suggestion system is positively correlated with subjective strategy understanding.

An employee suggestion system is an effective tool for creating a lean culture, and its absence can result in management forgoing enormous improvement potential – as much as 80% (Robinson and Schroeder, 2009). Companies without such a system thus settle for a relatively small portion of their total improvement potential. Furthermore, companies that have implemented a suggestion scheme frequently find that suggestions markedly improve both the quality and quantity of production (Frese et al., 1999). Hence we formulate the next hypothesis.

Hypothesis 8 (H8): An employee suggestion system is positively correlated with continuous improvement activities.

The closeness of frontline employees to operational problems and their knowledge of operations give them an edge in providing the best possible solutions (Deming, 2000: 79-82; Tucker, 2007). To exploit workers' knowledge and to tap into their creativity, an infrastructure, such as an employee suggestion system, must be in place which makes it possible for employees to voice their ideas (Loch, 2008; Anand et al., 2009). An effective suggestion system signals management's interest in creative ideas and helps companies retain their most creative workers, who might otherwise leave the company or establish their own businesses (Fairbank and Williams, 2001). In terms of the JD-R model (Bakker and Demerouti, 2007), the suggestion system can be viewed as a job resource; and job resources enhance engagement. We accordingly propose the following.

Hypothesis 9 (H9): An employee suggestion system is positively correlated with employee engagement.

Shop floor workers cannot engage in bottom-up operations strategy formation without an understanding of that strategy (Loch, 2008). Huckman and Staats (2011) provide anecdotal evidence that workers who are not aware of the strategic goals of their work unit cannot contribute to those goals, while Gagnon et al. (2008) provide empirical evidence that strategically knowledgeable workers demonstrate strategic commitment and engage in strategically supportive behaviors. These considerations lead to our next hypothesis.

Hypothesis 10a (H10a): Objective strategy understanding is positively correlated with continuous improvement activities.

In their study on the alignment between students' perceived understanding of some technical biological terminology and their performance – defined as the ability to provide correct and complete definitions of the terms – Zukswert et al. (2019) find that students overestimated their understanding. Along the same lines, Caspi et al. (2006) cite studies (e.g., Gordon, 1991; Ward et al., 2002) that cast doubt on self-assessment as a good predictor of true competence. For instance, Khan et al. (2001) find a weak relationship between participants' self-assessed knowledge and their test scores. Young et al. (2002) likewise report that physicians' self-assessed understanding of seven terms used in evidence-based medicine was noticeably different from an objective assessment, with an 8% predictive value of a positive self-rating for one term but 0% for the remaining six terms. In light of these negative findings, we hypothesize as follows.

Hypothesis 10b (H10b): Subjective strategy understanding is *not* positively correlated with continuous improvement activities.

Schaufeli et al. (2006) find that engagement is positively associated with innovativeness. Bailey et al. (2015) observe that many studies examine the link between engagement and performance; overall, researchers conclude that there is a positive relationship between engagement and the outcomes of individual-level performance. Some example studies to mention, all conducted using the UWES-9 instrument, include Agarwal et al. (2012), who found a positive relationship between engagement and innovative work behavior, Bakker and Bal (2010), who demonstrated that engagement was positively related to weekly job performance, Gorgievski et al. (2010), who demonstrated that engagement was positively associated with task performance and the innovativeness level of employees, Bakker and Xanthopoulou (2013), who provided support for the positive association between engagement and creativity of principals as assessed by their teachers, and Shimazu et al. (2012), who demonstrated a positive relationship between engagement and changes in job performance (Bailey et al., 2015). Hence we offer our final hypothesis.

Hypothesis 11 (H11): Employee engagement is positively correlated with continuous improvement activities.

Boudreau et al. (2003) contend that Operations Management and Human Resources Management are closely related and cannot exist without each other at a fundamental level. They argue that better integration brings greater value and point to the value of connecting the two disciplines. Utilizing the Human Resources Management literature helps to expand knowledge in the field of Operations Management by shedding light on issues that tend to be treated as “black box” in Operations Management. Our research is an endeavor to illuminate this black box (Boudreau et al., 2003). In that regard, we responded to their call for further research by focusing on human resource-related determinants of operational performance, which we measured by the number of voluntary process improvements made by shop floor employees at an award-winning Turkish furniture manufacturer.

4. METHOD

4.1. Measures

We use a shortened version of the Utrecht Work Engagement Scale (UWES-9) to measure employee engagement. The Turkish version of that scale is publicly available on Schaufeli’s official website (wilmarschaufeli.nl). We measured autonomy using Spreitzer’s (1995) self-determination scale. To measure subjective operations strategy understanding, we used Biggs et al. (2014). To assess objective operations strategy understanding, we asked workers to write down three goals of their lines for 2019. To measure supervisor support, we followed Frese et al. (1999) and Madjar et al. (2002). Questions related to employee suggestion systems were adapted from Konecny and Thun (2011). Data on our model’s dependent variable (viz., the number of individual Kaizens due to employees from the beginning of the year until the survey date), as well as on the control variables (i.e., age, seniority, duration, and competence), were extracted from the plant’s archival records by the lean office director. All items were measured on a 7-point Likert-type scale, and none was reverse-coded.

4.2. Data

Workers and team leaders provided our primary data: the worker survey and team leader evaluations. The worker survey included workers’ self-assessments of how well they thought they understood the operations strategy – what we call *subjective* operations strategy understanding – as well as handwritten responses to the open-ended question of what three goals of their lines are. Based on the latter responses, we then asked the corresponding team leaders to anonymously rate the actual, or *objective*, operations strategy understanding of workers to whom those leaders had directly communicated the lines’ goals. So as not to violate the principle of anonymity, we removed all other data and showed the leaders only the goals that the workers had written. The secondary data we use were provided by the lean office director; he provided us with archival records of workers’ Kaizens and all other worker-related data on age, seniority, duration, and competence.

We used the so-called forward-backward translation method (Brislin, 1970) to translate – from English to Turkish – the scales of autonomy, employee suggestion system, supervisor support, subjective strategy understanding, and objective strategy understanding. No translation was needed for the engagement scale because we used the original Turkish translation provided by Schaufeli. The translated draft was then reviewed by the lean office director, who suggested a few small adjustments (reflecting the plant’s internal jargon) to help better convey the intended meaning. The survey’s final version was informed by a pre-test involving three workers. Following agreement on that version, the lean office made hard copies for distribution to the workforce. The three workers who participated in the pre-test were excluded from the survey.

The data were collected between August 3 and August 7, 2019. That time window was chosen mainly to avoid stopping production at the plant – though it also served as a prudent ex ante measure to mitigate

common method bias, as explained later. Thus, workers were given the survey questionnaire at the end of their shift on August 2 (Friday) and were asked to fill it out at home over the weekend. Some workers were unable to finish within that time frame, so the deadline was extended to August 7. The completed questionnaires were delivered by the workers themselves into a closed drop box placed (on August 5) in the middle of the shop floor by the lean office, which then returned all documents to the researchers via ground mail. Apart from this operational support (the distribution and collection of questionnaires), the lean office was not otherwise involved in the survey process. At the time of the survey, there were 453 workers on the payroll, 395 of whom participated in the study; thus 87% of the shop floor workforce was covered. Datapoints with deviant components (blank responses, two different responses for any given question) were eliminated. The result was 235 datapoints that could be used for analysis, and all 15 of the plant's lines were represented. At this stage, we took the additional step of examining the *distribution* of the average number of individual Kaizens across the lines. We found that three lines – machine maintenance, quality, and product development – were outliers (see Figure 4). The workers on these lines are arguably "specialists" and thus differ from ordinary frontline workers – whom we should prefer to survey – in the sense of performing some kind of expert work. We therefore considered these three to be "expert lines" and so the analysis excludes all the experts (15 workers in all) on those lines. In addition, we excluded the plant maintenance line because all three of its workers had, by design, *not* been given competency grades by the plant management. (The practice of not grading competencies applied also to the machine maintenance line, which we had already excluded.) These steps yielded a final set of 217 datapoints from 17 teams working on 11 different lines under the supervision of 17 team leaders. According to Boomsma (1983), a sample size of at least 200 datapoints is sufficient for analysis based on structural equation modelling.

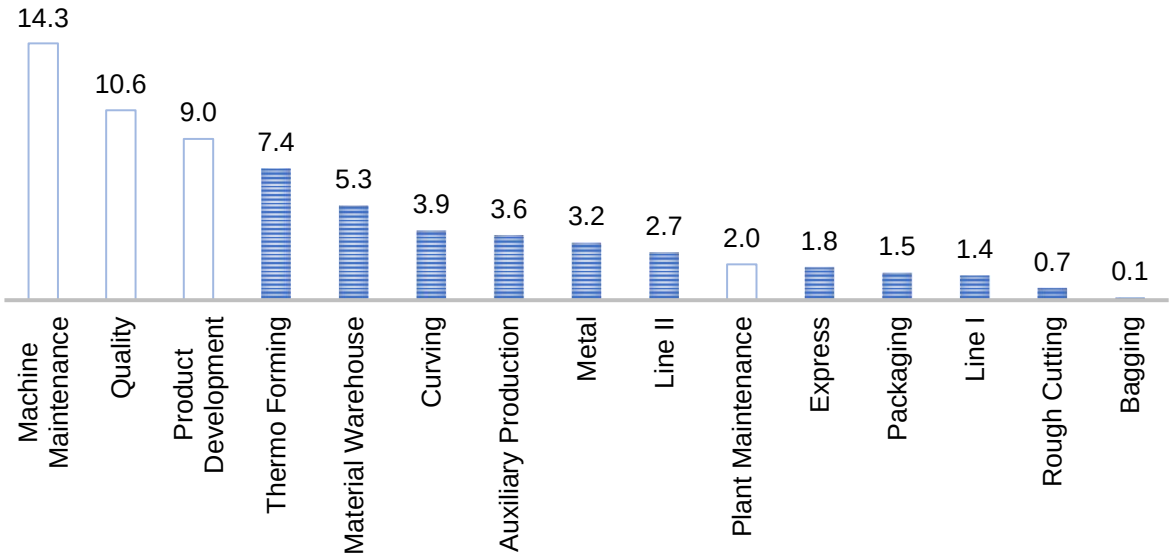


Figure 4. Average number of individual kaizens per employee across all lines

5. FINDINGS

5.1. Analysis

For the analysis, we used the *lavaan* package in R (Rosseel, 2012). We started by performing a confirmatory factor analysis (CFA). Since multivariate normality tests using the *MVN* package in R (Korkmaz et al., 2014) indicated multivariate *non*-normality in our data, which would violate the CFA's maximum likelihood assumptions, we applied the Satorra–Bentler (1994) correction. We then examined reliability and construct validity, both convergent and discriminant. Because we have two different models – one each involving subjective and objective strategy understanding, with all other variables remaining the same – we conducted two separate analyses for reliability and validity. One of the manifest variables of the engagement construct (namely, the last question in Schaufeli's UWES-9) had a factor loading below the 0.50 threshold, so we removed it from the construct. Our data meet all the requirements for reliability and construct validity for both models (see Tables 2-7).

Table 2. Questionnaire items

Item	*Std. factor loading (std.all)*
Supervisor Support (SS)	
My team leader discusses with me my work-related ideas in order to improve them	0.779
My team leader gives me useful feedback about my ideas concerning the workplace	0.848
My team leader encourages me to give suggestions	0.852
Giving suggestions is appreciated by my team leader	0.848
Employee Suggestion System (ESS)	
Management takes all product and process improvement suggestions seriously	0.787
We are encouraged to make suggestions for improving performance here at [company name]	0.765
The lean office tells us why our suggestions are implemented or not used	0.724
Many useful suggestions are implemented here at [company name]	0.772
Autonomy (AUTON)	
I have significant autonomy in determining how I do my job	0.837
I can decide on my own how to go about doing my work	0.815
I have considerable opportunity for independence and freedom in how I do my job	0.855
Employee Engagement (ENG)	
At my work, I feel bursting with energy	0.912
At my job, I feel strong and vigorous	0.929
I am enthusiastic about my job	0.857
My job inspires me	0.784
When I get up in the morning, I feel like going to work	0.732
I feel happy when I am working intensely	0.752
I am proud of the work that I do	0.642
I am immersed in my work	0.544
I get carried away when I am working	†
Subjective Strategy Understanding (SSU)	
I have a clear understanding of my line's goals	0.751
I am aware of how my day-to-day work aligns with my line's goals	0.820
I have a clear understanding of how my workgroup helps my line achieve its goals	0.707
It is important to me to help my line achieve its goals	0.767
Individual Kaizen Number (INDKZNUM) – numerical data from archival records	*1.000*

Note: Item marked by a dagger (†) was dropped after the initial CFA and reliability tests.

Table 3. Convergent and discriminant validity after (before) trimming: Subjective strategy understanding

	Alpha [0.7]	*CR [0.7]*	*AVE [0.5]*	*SS*	*ESS*	*AUTON*	*ENG*	*SSU*	*INDKZNUM*
SS	0.90 (0.90)	0.90 (0.90)	0.69 (0.69)	1.00					
ESS	0.84 (0.84)	0.84 (0.84)	0.58 (0.58)	0.28 (0.28)	1.00				
AUTON	0.87 (0.87)	0.87 (0.87)	0.70 (0.70)	0.20 (0.20)	0.18 (0.18)	1.00			
ENG	0.92 (0.91)	0.92 (0.91)	0.62 (0.54)	0.21 (0.21)	0.29 (0.29)	0.18 (0.18)	1.00		
SSU	0.83 (0.83)	0.84 (0.84)	0.57 (0.57)	0.36 (0.36)	0.26 (0.26)	0.10 (0.10)	0.37 (0.38)	1.00	
INDKZNUM				0.02 (0.02)	0.00 (0.00)	0.00 (0.00)	0.03 (0.03)	0.01 (0.01)	1.00

Notes: Minimum thresholds suggested by Hair et al. (2014: 619) in brackets. Off-diagonal values represent square correlations between constructs. Values in parentheses are those *before* trimming.

Table 4. HTMT ratios for model with subjective strategy understanding after (before) trimming

	SS	*ESS*	*AUTON*	*ENG*	*SSU*	*INDKZNUM*
SS	1.00					
ESS	0.53 (0.53)	1.00				
AUTON	0.45 (0.45)	0.42 (0.41)	1.00			
ENG	0.47 (0.46)	0.54 (0.53)	0.44 (0.44)	1.00		
SSU	0.60 (0.60)	0.52 (0.52)	0.33 (0.33)	0.67 (0.67)	1.00	
INDKZNUM	—	—	—	—	—	—

Note: Values in parentheses are those before trimming

Table 5. Questionnaire items (Subjective strategy understanding replaced with objective strategy understanding)

Item	*Std. factor loading (std.all)*
Supervisor Support (SS)	
My team leader discusses with me my work-related ideas in order to improve them.	0.788
My team leader gives me useful feedback about my ideas concerning the workplace.	0.853
My team leader encourages me to give suggestions.	0.847
Giving suggestions is appreciated by my team leader.	0.842
Employee Suggestion System (ESS)	
Management takes all product and process improvement suggestions seriously.	0.789
We are encouraged to make suggestions for improving performance here at [company name].	0.765
The lean office tells us why our suggestions are implemented or not used.	0.724
Many useful suggestions are implemented here at [company name].	0.770
Autonomy (AUTON)	
I have significant autonomy in determining how I do my job.	0.837
I can decide on my own how to go about doing my work.	0.817
I have considerable opportunity for independence and freedom in how I do my job.	0.854
Employee Engagement (ENG)	
At my work, I feel bursting with energy.	0.920
At my job, I feel strong and vigorous.	0.936
I am enthusiastic about my job.	0.850
My job inspires me.	0.778
When I get up in the morning, I feel like going to work.	0.726
I feel happy when I am working intensely.	0.749
I am proud of the work that I do.	0.632
I am immersed in my work.	0.534
I get carried away when I am working.	†
Objective Strategy Understanding – assessed by team leaders as a single-item scale	
Please write down three goals of your line/department for 2019.	1.000
Individual Kaizen Number (INDKZNUM) – numerical data from archival records	*1.000*

Note: Item marked by a dagger (†) was dropped after the initial CFA and reliability tests.

Table 6. Convergent and discriminant validity after (before) trimming: Objective strategy understanding

	Alpha [0.7]	*CR [0.7]*	*AVE [0.5]*	*SS*	*ESS*	*AUTON*	*ENG*	*OSU*	*INDKZ NUM*
SS	0.90	0.90	0.69	1.00					
	(0.90)	(0.90)	(0.69)						
ESS	0.84	0.84	0.58	0.28	1.00				
	(0.84)	(0.84)	(0.58)	(0.28)					
AUTON	0.87	0.87	0.70	0.20	0.18	1.00			
	(0.87)	(0.87)	(0.70)	(0.20)	(0.18)				
ENG	0.92	0.92	0.61	0.21	0.29	0.18	1.00		
	(0.91)	(0.91)	(0.54)	(0.21)	(0.29)	(0.18)			
OSU				0.01	0.00	0.00	0.03	1.00	
				(0.01)	(0.00)	(0.00)	(0.03)		
INDKZNUM				0.02	0.00	0.00	0.03	0.03	1.00
				(0.02)	(0.00)	(0.00)	(0.03)	(0.03)	

Notes: Minimum thresholds suggested by Hair et al. (2014: 619) in brackets. Off-diagonal values represent square correlations between constructs. Values in parentheses are those before trimming.

Table 7. HTMT ratios for model with objective strategy understanding after (before) trimming

	SS	*ESS*	*AUTON*	*ENG*	*OSU*	*INDKZNUM*
SS	1.00					
ESS	0.53	1.00				
	(0.53)					
AUTON	0.45	0.42	1.00			
	(0.45)	(0.42)				
ENG	0.47	0.54	0.44	1.00		
	(0.46)	(0.53)	(0.44)			
OSU	—	—	—	—	—	—
INDKZNUM	—	—	—	—	—	—

Notes: Values in parentheses are those before trimming.

How well the specified model reproduces the observed covariance matrix is assessed by model fit. The model need not exhibit an acceptable fit in terms of all reported criteria; yet it should, of course, satisfy many criteria. We calculated the initial CFA indices for both models, which were acceptably good at the global level (Table 8).

Table 8. Goodness-of-fit statistics for both models

	χ^2/df	*Robust RMSEA*	*Robust CFI*	*Robust TLI*	*SRMR*
Model with *objective* strategy understanding	1.87	0.071 [0.059–0.083]	0.928	0.914	0.051
Model with *subjective* strategy understanding	1.90	0.076 [0.065–0.087]	0.908	0.893	0.058

Notes: χ^2/df is the ratio of the chi-square statistic to degrees of freedom (i.e., the normed chi-square). A normed chi-square value of no more than 2 indicates a good fit; a value greater than 2 but of no more than 3 indicates an acceptable fit (Schermelleh-Engel et al., 2003).

An RMSEA value of between 0.05 and 0.08 (inclusive) indicates a reasonable fit. "One would not want to employ a model with a RMSEA greater than 0.10" (Browne and Cudeck, 1993). The associated 90% confidence intervals are given in brackets. CFI values above 0.90 are usually associated with a model that fits well (Hair et al., 2014: 580). A TLI value greater than 0.90 is acceptable (Morhart et al., 2009). A SRMR value of 0.08 or less indicates an acceptable fit (Hu and Bentler, 1999).

5.2. Common Method Bias (CMB)

Next we analyzed common method bias. In a pro-active effort to prevent CMB ex ante, we took several measures.

(i) Pre-testing the survey to improve its items, as explained previously.
(ii) Informing workers about the study's purpose (viz., to improve the plant's competitiveness through their support), which encourages self-disclosure.
(iii) Asking workers to take their time and to answer honestly.

(iv) Informing respondents that there are neither "right" nor "wrong" answers; also, asking them to leave no question unanswered and to give only one response to each question.
(v) Conducting the survey anonymously, which should mitigate bias due to social desirability; giving assurance that individual responses will be used only for research purposes and will be seen only by us as independent researchers.
(vi) Using different sources for independent and dependent variables, which should mitigate self-reporting bias.
(vii) Avoiding both reverse-coded items (which have been shown to induce method bias) and "double-barreled" items.
(viii) Providing a survey window that allows for a different context (here, the respondent's home environment) and breaks, which should mitigate location-related effects.
(ix) Not measuring the dependent and independent variables simultaneously: the dependent variable comprises the cumulative sum of continuous improvement activities from the beginning of 2019 to the survey date, whereas the independent variables reflect workers' current states of mind and perceptions as of the survey date. This approach should mitigate the measuring context's time-related effects.

Note also that we refrained from conducting the survey online because the lean office director advised us that workers were accustomed to the offline format and so most of them would have difficulty completing a survey online. All the measures that we adopted should have served to reduce the possibility of common method bias. In particular, collecting measures of different constructs from different sources is recommended as the best strategy to avoid or mitigate CMB (Chang et al., 2010) – a strategy that our design followed. We evaluated common method bias using Harman's single-factor test. The largest components accounted for only 39.3% and 38.5% of the variance in the models with (respectively) subjective and objective strategy understanding. Since these values are acceptably low, we conclude that our pro-active measures were largely effective and therefore view our analyses as *not* being compromised by common method bias.

5.3. Structural Equation Model (SEM)

For the SEM analysis described here, we used the *lavaan* package in R (Rosseel, 2012). First we performed a square-root transformation of the outcome variable in order to reduce non-equal variance of residuals (i.e., heteroscedasticity). This transformed outcome variable was then used as the base outcome for our main analysis.

5.3.1. SEM Results with Objective Strategy Understanding

Initial CFA fit indices were reasonably good at the global level with chi-square/df = 1.87, robust CFI = 0.928, robust TLI = 0.914, robust RMSEA = 0.071, and SRMR = 0.051 (where CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean square error of approximation, and SRMR = standardized root mean residual). Both robust CFI and robust TLI are above 0.90. All manifest items have a factor loading of at least 0.5 (cf. Hair et al., 2014: 632), and all constructs possess construct validity. Overall, 7 of the 11 hypotheses are significantly and positively supported (as indicated by the bold arrows in Figure 5). Our analysis confirms the existence of three principal drivers of continuous improvement performance: objective strategy understanding, employee engagement, and supervisor support.

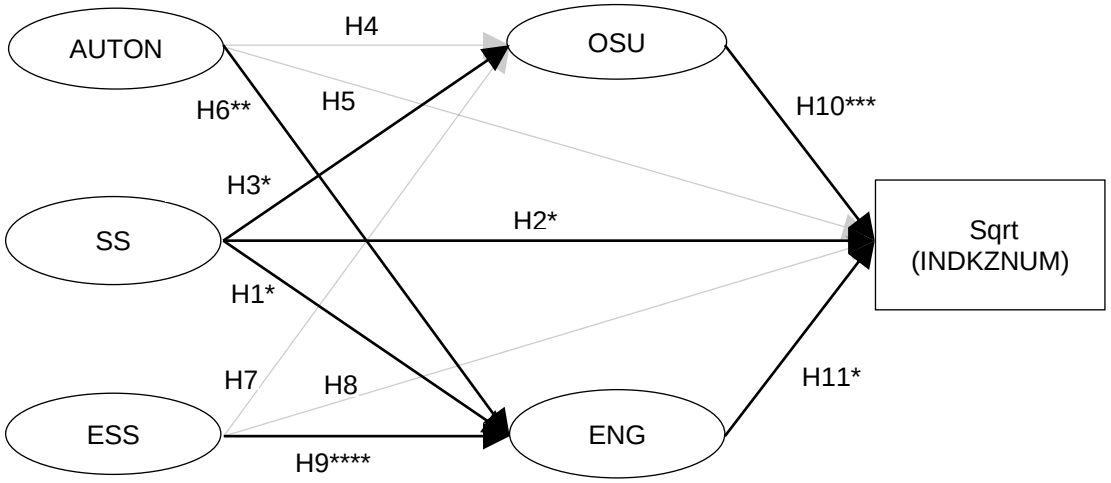


Figure 5. SEM framework for Objective Strategy Understanding with Square-Root-Transformed outcome variable (*p < 0.1, **p < 0.05, ***p < 0.01, ****p < 0.001)

5.3.2. SEM Results with Subjective Strategy Understanding

To discover what role, if any, is played by perceived rather than actual strategy understanding, we replaced objective strategy understanding with its subjective counterpart. The initial CFA fit indices were reasonably good at the global level: chi-square/df = 1.90, robust CFI = 0.908, robust TLI = 0.893, robust RMSEA = 0.076, and SRMR = 0.058. All manifest items have a factor loading of at least 0.5, and all constructs possess construct validity. In total, 7 of the 11 hypotheses are significantly and positively supported (the bold arrows in Figure 6). This confirms that subjective strategy understanding is *not* a contributor to continuous improvement performance.

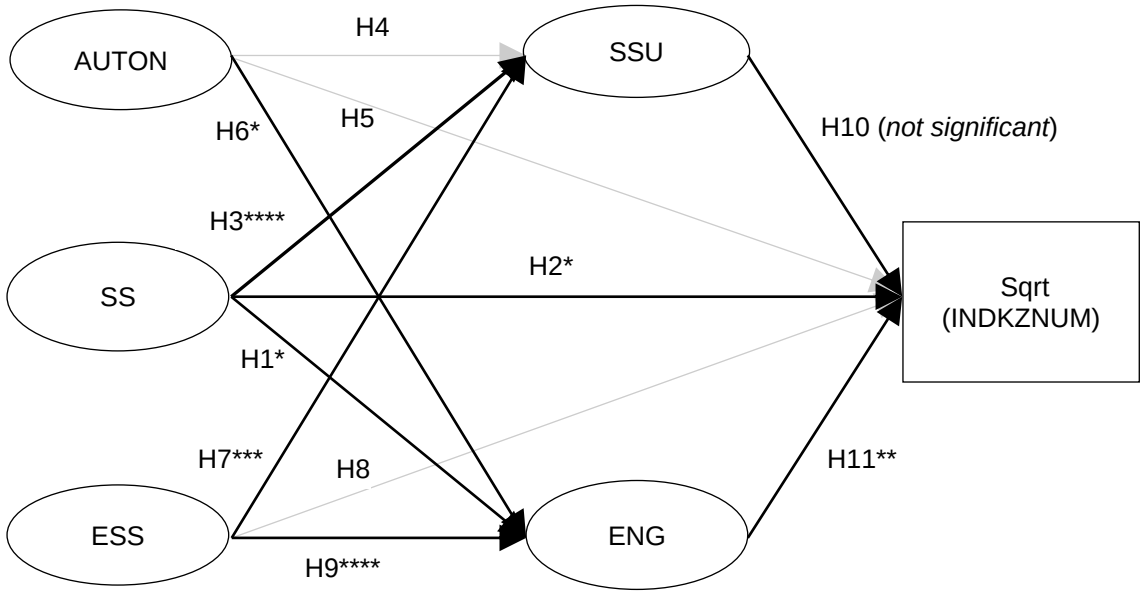


Figure 6. SEM framework for Subjective Strategy Understanding with Square-Root–Transformed outcome variable

5.4. Robustness Check

We analyze the robustness of our SEM results by way of multiple regression. In this context, we regressed the outcome variable (individual Kaizen performance of frontline employees) on the main constructs of interest including strategy understanding. For the analysis, we used the *lm()* function in R.

To maximize the exclusion of confounding effects in our analysis, we used fixed effects and control variables. Face-to-face interviews that we conducted with workers on the shop floor revealed that some lines systematically offer many opportunities for Kaizen while others offer few or none at all; we therefore decided to treat lines (i.e., work stations) as fixed effects. For this purpose, we asked the lean manager to group the shop floor's 15 lines according to their systemic advantageousness for promoting individual Kaizens. The result was four distinct clusters: unfavorable, neutral, favorable, and very favorable (see Figure 7).

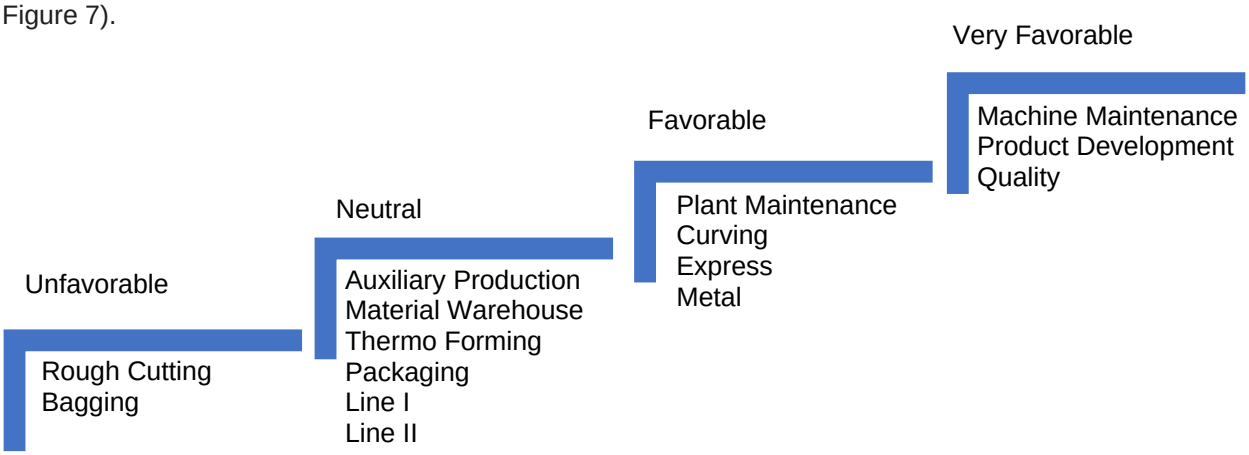


Figure 7. Systemic favorability of production lines for continuous improvement

The interpretation of this clustering is that a line classified as favorable (e.g., the metal line) is systemically more advantageous and thus offers employees more opportunities for process innovation than does a neutral or unfavorable line (e.g., resp., thermo forming or rough cutting). As explained in Section 4.2, the three "expert lines" (all classified as very favorable) as well as the plant maintenance line (which is classified as favorable) are not included in this study. This leaves three categories – unfavorable, neutral, and favorable – that enter the regression equation as fixed effects. In short, our data set includes 217 workers working on 11 lines in three different advantageousness categories.

Our regression analysis augments the SEM analysis in the sense that we could include line fixed effects and control variables. The chief motivation is to understand what role our constructs – in particular, operations strategy understanding – play in incremental innovation (i.e., continuous improvement activities). To deepen our knowledge, we expanded the study by including both objective and subjective types of strategy understanding. The independent variables in our model are SSAVER, ESSAVER, AUTONAVER, ENGAVER, SSUAVER, and OSU, which are (respectively): the arithmetic mean of workers' responses in the survey for supervisor support, employee suggestion system, autonomy, engagement, subjective strategy understanding, and a worker's operations strategy understanding as objectively assessed by the team leader. Our regressions also include line fixed effects and control variables. We take "unfavorable" as the reference category for fixed effects, and for control variables we use age, seniority, duration, and competence. Age refers to the age of workers, seniority indicates how long a worker has been at the plant, and duration is the period of time that workers have been supervised by their current team leaders. The plant's competence matrix informs our competence variable, which captures how capable a worker is of performing line-related tasks. Our statistical results follow.

5.4.1. The Results of Multiple Regression

The regression analysis identified four factors that were most predictive of an employee's number of individual Kaizens: the three independent variables supervisor support (coefficient: 0.12, $p < 0.1$), employee engagement (coefficient: 0.20, $p < 0.05$), and objective strategy understanding (coefficient: 0.08, $p < 0.1$) along with line fixed effects (coefficient for neutral: 0.75, coefficient for favorable: 0.86; both $p < 0.01$). None of the control variables was statistically significant. The R-square of the model was 0.127, and the p-value was 0.005. Next, for the sake of comparability with our SEM analysis, both the line fixed effects and the control variables were excluded from the regression equation. In this case, Kaizen performance was shown to be driven by the same three independent variables: supervisor support (coefficient: 0.12, $p < 0.1$), employee engagement (coefficient: 0.16, $p < 0.1$), and objective strategy understanding (coefficient: 0.11, $p < 0.05$). Here the model's R-square was 0.075 and the p-value was 0.01 (see Table 9).

Table 9. Multiple regression results

	Supervisor Support		*Employee Engagement*		*Objective SU*		*Line Neutral*		*Line Favorable*	
	Est.	*p-value*	*Est.*	*p-value*	*Est.*	*p-value*	*Est.*	*p-value*	*Est.*	*p-value*
Included	0.12	0.09*	0.20	0.03**	0.08	0.07*	0.75	0.007***	0.86	0.005***
Excluded	0.12	0.07*	0.16	0.08*	0.11	0.05**	excluded from analysis			

Notes: The dependent variable is the square root of the number of individual Kaizens. Only significant variables are shown. SU = Strategy Understanding. "Included" (resp., "Excluded") means that line fixed effects and control variables are both included in (resp., excluded from) the regression equations. *p < 0.1, **p < 0.05, ***p < 0.01,****p < 0.001

Both findings – with and without line fixed effects and control variables – are consistent with our original SEM analysis, whereby Kaizen performance was found to be driven mostly by supervisor support, employee engagement, and objective strategy understanding.

6. WORKER UNDERSTANDING of OPERATIONS STRATEGY

The focus of our research is worker operations strategy understanding, and we were able to assess both subjective and objective understanding at the individual level. As showed by the SEM and subsequent regression analyses, objective (resp., subjective) understanding does (resp., does not) appear to have a significant effect on continuous improvement.

Recall that, at the individual level, a gap in understanding is likely at any company; Figure 8 shows the gap at the plant. We use the collected data to conclude that two losses (Loss 1 and Loss 2) could reduce the effectiveness of strategy deployment in the plant (Figure 9).

If we treat our Likert scale as an interval type and compare the summated subjective understanding score to the objective understanding score, then one could argue that the output is only about 35% of the input. In other words: frontline employees appear to have internalized, on average, barely more than a third of the knowledge that management expects of them. It follows that these workers lack nearly *two thirds* of the "raw material" needed to generate Kaizens. Considering that the plant has already won awards for

productivity, these results underscore just how great is the potential of hidden productivity in the country's industries.

So far we have shown (i) that it is the objective understanding of operations strategy that matters for productivity in operations and (ii) that workers have an inflated view of their understanding. The latter finding supports Dunning et al.'s (2004) assertion that faulty self-assessments are widespread and that people tend to overestimate their abilities; it also echoes the previously cited work of Zukswert et al. (2019), who finds that students generally overestimate their understanding of specialized terminology. A similar study is that of Bloom et al. (2012), who report that 79% of more than 8,000 firms in 20 countries self-assessed their management practices as above average – which, of course, is mathematically impossible. Bloom and colleagues found no correlation between these self-assessments and their own objective evaluations.

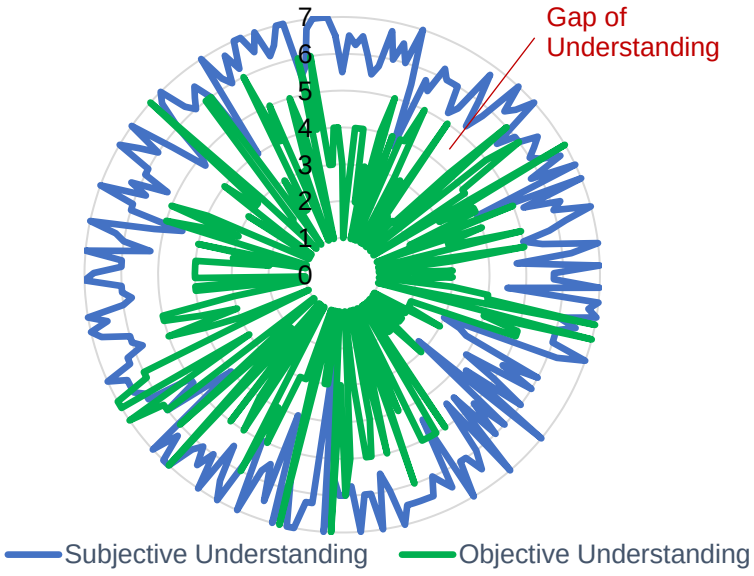


Figure 8. Workers' Operations Strategy Understanding (n =217, assessed on a Likert scale of 7)

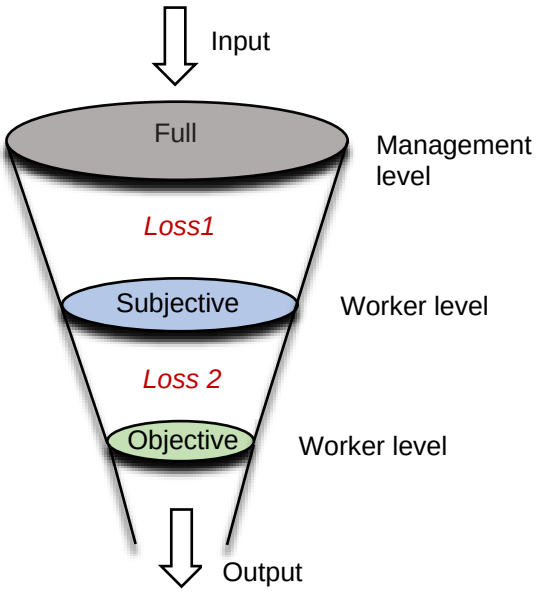


Figure 9. Erosion of operations strategy understanding

The output of a cascading process largely relates to what portion of employees' strategy knowledge is relevant for continuous improvement. It is probably fair to say that all available knowledge beyond the core strategy knowledge is of little use to Kaizens. Although output can indicate the plantwide effectiveness of strategy cascading, its shortcoming is that output says nothing about the *distribution* of understanding in the workforce. So even when the output from two different teams or business units is the same, the respective workforce's distribution across different clusters of operations strategy understanding may be quite different. Hence we cannot rely on output alone when waging the "battle for strategy understanding". Output can measure the intensity of understanding and can suggest how deeply strategy knowledge is embedded in the average employee's mind, but it offers no clue as to how widespread such knowledge is in the minds of the workforce. Figure 10 plots the range of strategy understanding at the plant of this study and also the distribution of understanding among its workers. For subjective understanding (SU), we took the arithmetic average of all four questions that informed our construct of subjective strategy understanding. If s ≤ SU < s+1, then subjective understanding was considered to be s ($1 \leq s \leq 7$).

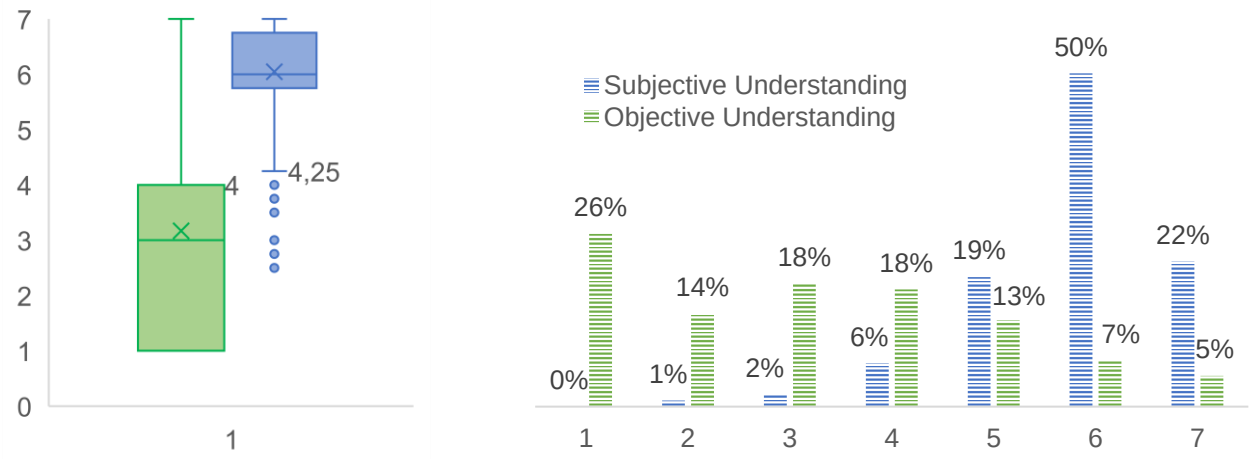


Figure 10. Range and distribution of understanding

As can be seen from both graphs in this figure, there is a discrepancy between the distribution of employees' self-assessments (blue) and that of the team leaders (green): the former is strongly left-skewed while the latter is moderately right-skewed. More precisely, even the upper quartile value of objective assessments (4) is *less* than the minimum subjective assessments (4.25, excluding outliers). This discrepancy corresponds to Loss 2, or the gap between what one thinks one knows and what one actually knows. The *knowledge gap* consists of this loss together with Loss 1, or the gap between complete knowledge and the knowledge one thinks one has acquired. The presence of these gaps suggests that the plant suffers from a human-related productivity loss, possibly due to poor communication. Therefore, objective understanding – and thus manufacturing productivity – can still be improved. So that operations managers will have additional weapons in this battle, we developed two metrics for them to consider (Table 10).

Table 10. Mathematics of operations strategy understanding

Metric	Formula	Value	Definition
Prevalence of Objective Strategy Understanding (POSU)	Equation 1	24%	The ratio of the workforce that has an adequate level of objective strategy understanding (the "core group") to the total workforce
Accuracy of Strategy Cascading (ASC)	Equation 2	27%	The ratio of employees in the clusters that "know themselves" to the total workforce

Notes: Cluster A, Best in Class (n=53 datapoints); Cluster B, Misinformed (n=0); Cluster C, Self-Aware (n=6); Cluster D, Misguided (n=115). The difference between Σ = 217 and the clusters' total corresponds to the sum of OSU = 4 (n=38) and SSU = 4 (n=5). The ASC would include datapoints for which OSU = SSU = 4, except that our data set contains no such datapoint.

$$\frac{(A+B)}{\Sigma} \quad (1)$$

$$\frac{(A+C)}{\Sigma} \quad (2)$$

The first metric, the *prevalence of objective strategy understanding* (POSU), is defined as the percentage of employees who can (irrespective of their self-assessment) adequately explain the operations strategy. At the plant, this core group amounts to 24% of the workforce. Kaplan and Norton (2005) claim that, on average, 95% of a company's employees are unaware of (or do not understand) its strategy; by that standard, the plant of this study is a model case. The second metric we propose concerns the accuracy of strategy cascading, where by "accuracy" we mean consistency between perceived and actual knowledge at the individual level. These cases are captured in Figure 2's "self-aware" and "best in class" clusters (i.e., those populated by knowledgeably self-aware individuals). The value for the plant on this metric is 27%, which means that almost three of every four employees in this study – with the "misguided" cluster being by far the most represented – exhibit knowledge asymmetry with regard to strategy: they think they know either more than or less than they actually do.

7. CONCLUSION and DISCUSSION

The aim of this study was to improve our understanding of the antecedents of bottom-up operations strategy formation – namely, of continuous improvement activities in manufacturing and with particular consideration given to operations strategy understanding. Drawing on the well-known MOA framework, we used both structural equation modeling and multiple regression to gain insights.

7.1. Implications for Research

This study contributes to the literature in a number of ways. First, we adopt Blumberg and Pringle's (1982) MOA framework to treat autonomy, supervisor support, and an employee suggestion system as opportunities that are provided top-down (i.e., by management). Both the SEM and multiple regression results indicated that all three factors contributed to the formation of a bottom-up operations strategy. To be precise, supervisor support makes both a direct and an indirect contribution to employee performance, and the other two have an indirect influence on it. This result contrasts with the findings of some other studies. For example, Scholz et al. (2021: 21) found a direct positive relationship between an "opportunity", namely structured idea management processes in their case, which respectively correspond to employee suggestion system in our setting, and behavior supporting strategy formation which is their measure of performance as a counterpart to our measure of continuous improvement ideas, i.e., kaizens. We also found that "ability", i.e., objective strategy understanding, is positively correlated with performance, i.e., kaizens. However, as contrary to us, Knies and Leisink (2014) found a negative effect of employees' "ability" on performance, i.e., extra-role behavior. In this regard, our results should be interpreted with caution. On the other hand, it is also noteworthy to mention that, in terms of the interrelationships between MOA variables, Knies and Leisink (2014) came to the same conclusion as we did, in the sense that individual employee characteristics (i.e., ability and motivation) have a direct effect on performance, while job characteristics (i.e., autonomy) have an indirect effect on it through motivation.

Second, we documented a discrepancy between objective and subjective strategy understanding at the employee level. In particular, employees overestimate their knowledge of strategy; this finding is in accordance with claims from previous work (Bjork, 1999) that people frequently mis-assess their own competencies. Third, we showed that objective strategy understanding is positively associated with continuous improvement activities, although the same cannot be said for subjective strategy understanding. Thus objective but not subjective strategy understanding seems to be decisive for efficiency gains. Here we refer back to Scholz et al. (2021: 21), who have not had objective strategy understanding in their model but, in contrast to us, reported a significant positive link between perceived strategy alignment, i.e., subjective strategy understanding, and behavior supporting strategy formation, i.e., kaizen performance. Fourth, as regards to the main antecedent of strategy understanding, supervisor support turned out to be the major driver of both objective and subjective strategy understanding. A suggestion scheme does not help employees understand strategy, but it does make them believe that they do. There are grounds for arguing that autonomy does nothing to help employees understand strategy, either objectively or subjectively. Overall, the most reliable – indeed, the only – mechanism for ensuring strategy understanding is support from the supervisor.

This paper's fifth contribution is to show that employee engagement is affected by all three of our model's exogenous constructs: supervisor support, employee suggestion system, and autonomy. The standard coefficients indicate that, regardless of whether subjective or objective strategy understanding is being considered, employee engagement is clearly most affected by employee suggestion system; supervisor support is not as influential, and autonomy is even less so. However, as a relatively contrasting example, in their research based on MOA model Beltrán-Martin and Bou-Llusar (2018) found that motivation is not only driven by opportunities but also abilities. Referring to social exchange perspective (Blau, 1964: 91), the authors note that employees may view the opportunities they are given as a signal from management that it cares about them, and therefore may feel compelled to reciprocate by making greater efforts, i.e.,

higher engagement. This argument could also apply to this study. Incidentally, engagement is the only construct in this study with which autonomy is significantly associated.

Sixth, we established that – regardless of the estimators used and the method of analysis – no statistically significant relationship exists between autonomy and strategy understanding (either subjective or objective) or between autonomy and incremental innovation (i.e., H4 and H5 were not supported). Surprisingly, autonomy proved beneficial only for employee engagement and contributed neither to strategy understanding nor to Kaizen performance. This contrasts with Scholz et al. (2021: 21) who found a significantly positive relationship between autonomy and perceived strategic alignment which corresponds to the subjective strategy understanding in our setting. In our opinion, this unexpected result might be related to Turkish culture. Aycan et al. (2014: 49) point out that it is questionable whether the job characteristics of the Job Characteristic Model (Hackman and Oldham, 1975) are effective in increasing motivation and satisfaction to the same extent in *all* cultural contexts. So, contrary to the original theory, "enhanced" jobs did not yield the same positive effects on motivation and business outcomes across cultures (Aycan et al., 2014: 49). Our results exemplify the business outcome aspect of that claim. The authors argue that managers in fatalistic cultures refrain from providing enriched jobs, e.g., with autonomy, as they assume that the nature of employees is constant and cannot be changed. Managers in collectivistic cultures, on the other hand, use job enrichment because they view it as their obligation to employees (Aycan et al., 2014: 49). According to INSEAD (2021: 263), the survey question "In your country, to what extent does senior management delegate authority to subordinates?" was answered with an average response of 4.37 [1 = not at all; 7 = to a great extent] in Türkiye, ranking 65th out of 134 countries (Denmark ranked 1st with 6.02, Chad ranked 134th with 2.81). In addition, Robert et al. (2000) found that culture moderates the relationship between autonomy and job satisfaction – something very similar to engagement. In a study of the relationship between societal culture dimensions and HRM practices, the strongest association was found in the function of "internal communication" (Papalexandris and Panayotopoulou, 2004) – which is necessarily a prerequisite for objective strategy understanding, which in turn is at the core of incremental innovation – as we have shown in this study.

Finally, our regression model results reveal that the lines themselves also matter. All else equal, an employee working on a favorable line (i.e., one conducive to innovation) can be expected to generate more Kaizens than an employee working on a neutral or unfavorable line. Hence we conclude that stations at which processes are relatively sophisticated and fluid (as in the case, e.g., of new furniture design) offer more opportunities for improvement than those with straightforward processes – such as simply putting nuts and bolts into a plastic bag, which is the primary task on the bagging line.

7.2. Implications for Managers

The research presented here suggests that leaders who seek a workforce that generates Kaizens should focus on seven core areas. First, employees cannot deliver Kaizens without an objective strategy understanding; subjective understandings are insufficient. We have shown that employees overestimate their level of understanding, which inevitably leads to an understanding gap. This gap is a hidden enemy of the firm's bottom line, and we believe that it should be considered a distinct form of "*waste*" in Lean Management. At best, it leaves some potential for improvement untapped; at worst, it hinders overall execution because employees may be rowing the boat in different (perhaps even opposite) directions. Hence management should address the causes of any understanding gap and strive to minimize it, which means that objective understanding must be as high as possible. Our findings suggest that neither job autonomy nor employee suggestion scheme leads to objective understanding – instead, it is supervisor support that brings this understanding to life. It follows that persistent communication and explanation by team leaders, especially during periods in which strategy may need to change frequently, is extremely important. To ensure that these communication efforts bear fruit, strategy understanding should be regularly monitored at the employee level with the goal that all employees become of the "best in class" type (Figure 2). The two metrics discussed in Section 6 can factor into the performance appraisal criteria of team leaders. Management might even consider making all leader ratings public throughout the facility, thereby encouraging leaders to support their teams even more (i.e., inducing constructive competition among leaders). In addition, the distribution of workforce across the clusters of understanding (Figure 2) should be a regular agenda item at board meetings. All in all, our method serves as a tool for managers to measure and manage communication losses, which silently eat up profits.

Second, employee engagement is another contributor to productivity. It is therefore crucial for managers to have engaged employees. Our research confirms that the three hypothesized factors – supervisor support, autonomy, and an employee suggestion system – all play a role in employee engagement. According to the structural model's standardized coefficients and p-values, a suggestion system emerges as the strongest driver of engagement. Although it does not directly lead to Kaizens, it increases productivity indirectly through employee engagement. Managers should therefore view a suggestion system not as a

cost but rather as an investment in the company's future. The third area worth highlighting is supervisor support, which played the leading role among the three opportunities provided top-down by management. Such support contributes to bottom-up strategy formation not only directly but also indirectly (through objective strategy understanding and employee engagement). Hence managers should ensure that the support provided by team leaders is always maximized. Toward that end, subordinates' ratings of perceived supervisor support could be included as a criterion in the team leaders' performance appraisal system; the ratings could also be disclosed, which might spur team leaders to give their subordinates even more support. Fourth, the regression analysis revealed that the line in which an employee works will affect the number of individual Kaizens that worker generates. Thus managers should be aware that a worker with a high number of Kaizens need not be a better employee than some other worker with fewer Kaizens, since the difference could be due to the line's favorability for innovation. For this reason, expecting all employees to deliver the same number of Kaizens (the plant's current practice) is probably not the best approach. Adjusting the target number of individual Kaizens by line would be more appropriate and so might contribute to perceived fairness at the plant.

The fifth area that merits close attention concerns the distribution of individual Kaizens. In this case, the machine maintenance department has the highest number of individual Kaizens per employee. For a plant where Total Productive Maintenance (TPM) is implemented, as it is at the plant of this study, we argue that the higher the number of suggestions from the maintenance department, the less developed the TPM activities – that is, the higher the *potential for improvement* in the name of autonomous maintenance. Therefore, plant managers should keep an eye on the share of suggestions from maintenance in the total suggestion pool. To prevent the dominance of maintenance, or (more generally) to achieve a more balanced distribution of Kaizens in the plant, managers could introduce an internal limit such that the number of suggestions from maintenance cannot exceed a stipulated percentage of all suggestions. The advantages of this approach are improving the management of Kaizen concentration risk, promoting a more effective use of TPM, and developing more leaders distributed across the facility. Sixth, the regression result shows that none of our four control variables (age, seniority, duration, competence) plays a meaningful role in the productivity game. We therefore caution managers against falling prey to status-related misconceptions, such as that older employees are less Kaizen-savvy than younger ones, or that employees with more "competency points" will produce more process innovations than their colleagues with fewer points. In sum, the four characteristics for which we controlled are not predictive of incremental innovation, in contrast to objective strategy understanding, employee engagement, and supervisor support.

Seventh, management must bear in mind that strategy deployment tools are not necessarily efficient communicators. Given the plant management's reported use of strategy cascading tools (e.g., Hoshin Kanri), our findings suggest that employing such tools cannot reasonably be supposed to guarantee an adequate strategy understanding. We recommend, at the least, that managers involve team leaders in the strategy development process. With respect to Loss 1 (cf. Figure 9), that approach could reduce the erosion of understanding and thus improve the quality of strategy understanding at the employee level (the "output" in that figure). Finally, it is almost certain that adaptations to strategy will become more frequent over time, given, for example, ever-increasing competition and the current ramifications of the Green Revolution, i.e., the carbon border adjustment mechanism. Each round of adaptation requires a comprehensive understanding at the individual level, usually from the ground up. As organizations navigate a post-pandemic world where much of the work is done in a distributed or "gig" way, workers' objective understanding of strategy will become more critical – and a greater differentiator – than ever.

7.3. Limitations and Avenues for Future Research

Like most studies, ours has some limitations that nonetheless point to avenues for future research. Our setting is a good case for multilevel SEM, with team leaders representing one level and workers another. Yet because the number of workers per team leader was statistically insufficient, we could not undertake multilevel modeling (i.e., account for fixed effects) with SEM – although we were able to do so with multiple regression. In future studies with a large number of workers, the multilevel approach could also be integrated with SEM. In our model, the dependent variable is the individual Kaizen performance of frontline employees. There are three types of Kaizens in the plant: Kobetsu, individual, and group. Kobetsu Kaizens are initiated solely by management and so do not involve voluntary actions on the part of employees; thus voluntary performance is the sum of individual and group Kaizens. However, we could not reliably determine how much an individual employee contributes to a group Kaizen activity; hence we did not include group Kaizens and considered only individual Kaizen performance. Voluntary performance also includes individual Kaizens that are ultimately not submitted to the suggestion system, but this behavior could not be incorporated into the analysis because no such data are kept at the plant. Future research should consider both aspects, if possible. Line fixed effects are an essential input for our regression analysis. When we interviewed the workers, some stated that there were no (or very few) opportunities for Kaizen on their lines. This state of affairs was usually attributed to the task being simple and routine, such as putting screws

and bolts into a small plastic bag. We therefore augmented the analysis by accounting for the lines' favorability, or systemic appropriateness. In classifying the lines according to their favorability, we relied on the information provided by the lean office director.

Given that industrial excellence requires organizational alignment, future research could examine strategy understanding beyond the shop floor level. For that purpose, it would be worth exploring the role that operations strategy understanding plays in the effectiveness of support and other primary activities of the value chain. Looking at the supplier side could yield some interesting results. As operations and finance are closely linked, the impact of strategy understanding on some key financial metrics (e.g., return on investment) should also be investigated. The same is true for companies that operate many business units around the world, as is the case with some Turkish conglomerates. For example, even if autonomy seems to be a minor factor for the employees of a business unit in Türkiye, it can be an indispensable factor for the employees of a subsidiary of the same business unit abroad. Examining the productivity factors of a particular company in different cultures should provide useful insights into the motivation of local employees and the development of managers worldwide. Finally, since many managers rely on technology to increase productivity, it follows that we need to do more research to examine how human capital compares to technology – and the relative importance of both in increasing productivity.

Author Contributions
Cem Mercikoğlu: Literature Review, Conceptualization, Methodology, Data Curation, Analysis, Writing-original draft *Arnd Huchzermeier*: Modelling, Writing-review and editing *Serden Özcan*: Modelling, Writing-review and editing.

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Ethical Statement
It was declared by the author(s) that scientific and ethical principles have been followed in this study and all the sources used have been properly cited.

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