



Temporal perceptions and tensions in production management

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ABSTRACT

This study, through conducting a micro-level analysis of temporal dimensions, identified divergent temporalities between managers who establish temporal practices, and operators who work within the established norms. Data collected from three organizations experiencing production-related temporal operating tensions were triangulated across a survey, semi-structured interviews and observations and supported by secondary data. Four temporal operating tensions, that reflect gaps between managerial and operator temporal understandings, were identified: *Efficiency versus Effectiveness*; *Process Standardization versus Process Improvement*; *Synchronization versus Autonomy*; and *Control versus Flexibility*. This research identifies resulting temporal operating tensions and potential mitigation approaches at the junction of managerial practices and operator activities, illustrating the importance of understanding tensions at the micro-level.

1. Introduction

Research about time is key to understanding the complex role of temporal tensions in developing, organizing, and managing processes (Hernes, 2022; Feuls, Plotnikof, & Stjerne, 2023). Temporal tension is defined as the dilemmas, dichotomies, and dualities that emerge at the boundaries between competing temporal perceptions (Putnam, Fairhurst, & Banghart, 2016; Stjerne, Söderlund, & Minbaeva, 2019). Temporal tensions arise when people hold divergent temporal understandings and perceptions that conflict with organizational schemata intended to manage divergence of contradictory interpretations (Reinecke & Ansari, 2016; Stjerne et al., 2019; Kohtamäki, Einola and Rabetino, 2020). Tensions can create benefits if associated with the highest levels of employee performance and reward (Janssen, 2001) or negativity if the time available impacts quality and completeness (Mcdaniel, 1990). This body of research has generated interesting and informative insights into temporal tensions highlighting the importance of comprehending time related tensions in the management of organizations at macro and micro-levels.

Within the production management literature, researchers have recently explored divergent organizational temporal perceptions at a business level (Whyte & Nussbaum, 2020; Kohtamäki et al., 2020; Zhang, Yalcin, & Hales, 2020). Other authors have examined temporal

tensions in supply chains through studying organizing contradictions caused by entrainment with different customer and supplier temporal demands (Mohammed & Nadkarni, 2011; Dille & Söderlund, 2013; Slawinski and Bansal, 2015; Putnam et al., 2016). However, research in the field has provided limited insights into temporal tensions at the individual level. Instead, focus has been at the macro-organizational and supply chain levels (Klassen & Hajmohammad, 2017). Examining tensions at an organizational, macro-level provides greater simplicity. However, oversimplifying complex realities can reduce insights and limit the practical implications for managers (Klassen & Hajmohammad, 2017; Schad, Lewis, Raisch, & Smith, 2016). Through conducting research at the micro-level, this paper develops insights into temporal tensions that impact on individuals within a production context – tensions which we identify as temporal operating tensions.

Comprehending temporal operating tensions at the individual level highlights the interface of production procedures and the managerial practices to manage them. Temporal operational conflicts can arise as organizations adjust in response to both internal and external challenges, that occur as the business landscape alters (Reinecke & Ansari, 2015). Examining and understanding how individuals respond to organizing contradictions that surface is critical to the success or failure of organizations in competitive and dynamic markets (Schriber & Gutek, 1987; Gerdali, Stjerne, & Oehmen, 2020). This research explores

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operator and managerial temporal operating perceptions, through applying Schriber and Gutek's (1987) temporal dimensions, and provides insights into the approaches used to mitigate or accommodate temporal operating tensions (Kamalahmadi & Parast, 2017; Smith & Lewis, 2011; Whyte & Nussbaum, 2020).

Our study aims to examine temporal operating tensions in the context of manufacturing to provide insights to operating tensions that arise and the managerial approaches that are developed to address temporal challenges that surface. Through discussions with management teams of manufacturing companies, the authors identified organizations that were experiencing divergence in temporal perceptions of individuals within their operations. Our research explores temporal operating tensions through the following research questions:

- What temporal operating tensions exist at the micro-level in manufacturing organizations?
- What approaches do manufacturing organizations deploy to manage temporal operating tensions that arise at the micro-level?

The investigation deploys Schriber and Gutek's (1987:644) research instrument to examine the "perceptions of temporal rules and customs governing behavior in work organizations". The findings elaborate different temporal operating tensions through analysing individual perceptions on 8 temporal dimensions, as per their tool. The quantitative analysis focused the remit of the semi-structured interviews which were also informed by observations, feedback sessions and secondary document analysis. Examining the role of divergent temporal perceptions and operating tensions in delivering customer value supports practitioners to alter their schemata, during periods of change. Our contribution is twofold. First, we contribute to the operations management literature by providing rich insights into temporal diversity and tensions at a micro-level. This begins to address the lack of literature on tensions below the organizational level (Schad et al., 2016). Second, we examine temporal operating tensions at the interface of production processes and managerial practices to understand how organizations respond during periods of change.

A review of relevant literature is presented in the next section, followed by descriptions of the methodology and research instrument. The case study findings are then presented and discussed, including the implications for academics and practitioners. Limitations and research opportunities conclude the paper.

2. Literature review

2.1. Time in production management

The Scottish economist and philosopher Adam Smith (1776) provides one of the earliest references to time in production environments. Smith argued that division of labor reduces the time wasted when individuals pass from one type of work to another, increases dexterity in the individual, and creates machines that save time and cost. As reported by Locke (1982), by the turn of the twentieth century, Taylor's time-and-motion studies focused on individual tasks and how to compress the time needed to complete them and, in 1926, Henry Ford noted that "time waste differs from material waste in that there can be no salvage. The easiest of all the wastes and the hardest to correct is time because wasted time does not litter the floor like wasted material" (Ford, 1926, p. 110).

In the 1980s, Just In Time (JIT) philosophy, tools and techniques were developed from the Toyota Product System. JIT focuses on the reduction of seven wastes (mudas) and in particular on the reduction of time waste. Coined 'lean' in the West, from JIT emerged the idea of value stream mapping (Rother & Shook, 1999) in which the identified non-value adding activities/wastes are minimized; thus reducing throughput time and improving efficiencies. In contrast with the lean approaches, which are judged best suited to stable demand, agility is

about responding to a highly variable demand that is being stimulated by broad product ranges and short product life cycles. Thus, over the course of the last century, the perspective on time in production management changed as customers demanded more variety and shorter response times. Rather than being viewed as a potential waste, time became viewed as a source of competitive advantage through considerations of agility (Lee, 2004). The time taken, or more accurately the speed of response, as a competitive advantage, is less about waste minimization (or efficiency maximization) and more about the need to respond to market needs quickly to achieve higher sales (by accurately matching supply with demand). Indeed, in reducing the lead-time as part of the agile strategy, a company should be prepared to invest aggressively (Fisher, 1997) via a variety of approaches, including automation, or ensuring excess manufacturing or distribution capacity is available by outsourcing to many suppliers.

Industrialized work regimes subsequently led to objective measures of work activity based on the time used, which became an important management tool in the coordination and orchestration of manufacturing. Time from a Fordism managerial or time-and-motion engineering perspective is not without challenges. Individuals and groups gathered for an activity, such as a production line, challenge temporal control instruments through operating in ways contrary to the expected durations for each activity. Operators have demonstrated the ability to work faster or slower to support colleagues without impacting on the planned outputs (Bluedorn, 2002; Powell & Schultz, 2004). These different temporal perspectives challenges reflect the development of a broader understanding of time in management. That is, time that has altered from a metric to control resources, to a temporal lens that supports a flexible understanding of how humans and organizations experience time and the tensions that arise through temporal diversity (Ancona, Goodman, Lawrence, & Tushman, 2001; Klassen & Hajmohammad, 2017; Slawinski & Bansal, 2015).

Temporal studies in production management have generally opted for investigations at an organizational level, often neglecting the micro-analysis of individuals and their temporal perspectives, despite these comprising the overall organizational result. From an organizational perspective, "contradictory yet interrelated elements (dualities) exist simultaneously and persist over time" (Smith & Lewis, 2011, p. 387), while temporal conflicts "arise in managing different processes such as exploitation and exploration or change and continuity" (Reinecke & Ansari, 2015, p. 622). Therefore, during periods of change, it can be expected that operating temporal conflicts will arise as the organization and its actors adjust processes and practices. Within the project management literature, which has focused on temporality, such accommodations may require the ability of "temporal switching" between formal and informal organizing structures to expedite change and deliver on time (Petro, Ojiako, Williams, & Marshall, 2020). Temporal operating tensions in production processes and controls reflects the presence of temporal diversity in operations (Mohammed & Harrison, 2013). These forms of temporal operating tensions within operations environs are frequently highlighted by ambitemporality through short-term orientation vs long-term goals (Petro et al., 2020; Stjerne et al., 2019).

Assessing temporal divergency and tensions at an organizational level has developed several interesting insights, however it simplifies the complex realities that exist at the individual level (Schad et al., 2016). Comprehending how organizations accommodate seemingly contradictory temporal orientations to leverage different aspects of temporality at an individual level is rare in operations research (Klassen & Hajmohammad, 2017; Whyte & Nussbaum, 2020). Our study aims to examine divergent temporal perceptions in manufacturing, at the individual-level, to provide insights to temporal operating tensions that arise and the organizational approaches to managing the challenges that surface. The next section examines temporal operating tensions in production management.

2.2. Temporal operating tensions in production management

Even though time is inexhaustible, production managers treat it as a scarce resource, which provides the operational focus for managing the time used to deliver business goals related to productivity and delivery accuracy. Emphasizing time management and control has led to various techniques and concepts, including time compression, product development speed, project management time, and swift-even flow. This focus on controlling blocks of time provides an ethic quality to pursue specific business objectives and managerial interventions (Bluedorn & Denhardt, 1998). However, other authors argue that utilizing a singular temporal view in management frameworks needs revisiting to “cultivate heterogeneity in organizational temporal views” (Reinecke & Ansari, 2015, p. 643).

Although the dominant view of time as an objective and linear time in operations has proven extremely useful, Klassen and Hajmohammad (2017) highlight the challenge of holding onto a rigid stance because it undermines emergent, complex, and indeterminate processes needing a more flexible perspective to perceive and manage time. Unexpected or unplanned changes within or upon manufacturing can generate emergent process changes containing contradictory temporal demands on employees. Temporal operating tensions are epitomised in issues such as speed versus quality when production is faced with capacity constraints. Perlow, Okhuysen, and Repenning (2002) reported that pressure to make decisions quickly, leads to poorer decisions. This issue is particularly acute when operations are non-standardized, requiring operators to analyze problems before continuing work (Chen & Huang, 2006). Activities related to managing operational changes may temporarily conflict with business objectives and lead to tensions if members of the organization hold alternative temporal perspectives (Back, Rosing, Dickler, Kraft, & Bausch, 2020; Bendoly, Croson, Goncalves, & Schultz, 2010; Chen & Miller, 2011).

The management of divergent temporal perceptions of actors requires an assessment of the nature of the tension and its potential resolution (Stjerne et al., 2019). Traditional manufacturing techniques assume that employees share a unified temporal perspective congruent with stated business objectives and plans (Klassen & Hajmohammad, 2017). Managers view the time to complete tasks as standardized and fixed, while operators view it as malleable (Mohammed & Harrison, 2013). Understanding the dimensions that generate temporal variances, at the micro-level of managers and operators, is not discussed in temporal operations research literature. This research investigates the gap, as its importance increases due to manufacturing environs becoming more volatile.

The need for this knowledge development in a production context is becoming more acute as the magnitude and prevalence of endogenous and exogenous influences impact organizations and management's ability to respond. Manufacturing organizations cannot easily adapt their physical operations and processes, as in the service sector, to overcome sudden market changes. The process rigidity that has historically delivered value can create manager-operator temporal tensions. These tensions may be present in many contexts however, the tangible delivery of goods production causes quality and backlog issues different to intangible or service companies. Examining temporal operating tensions at the interface of physical production processes and managerial practices, to understand how organizations respond to organizing contradictions, is becoming increasingly important. Tensions generated by unplanned changes in operations, such as machine breakdowns, component quality issues and surges in customer demand, have the capacity to produce short-term contradictory interpretations of schemata impacting on performance (Mohammed & Harrison, 2013).

Temporal operating tensions in manufacturing mirror the inter-temporal tensions within organizations as they grapple with managing long and short-term challenges (Slawinski & Bansal, 2017). Temporal operating tensions manifest when contradictory elements cannot be strictly controlled or organized (Cunha et al., 2017). Within production,

temporal operating tensions can also foster anxiety for managers and operators as they cope with process changes triggered by endogenous and exogenous crises (Reinecke & Ansari, 2015). By taking a practice-based approach which, views time as constituted by, as well as constituting ongoing, human action (Feldman & Orlikowski, 2011; Nicolini, 2012), we address the micro-dynamics of everyday activities and interactions that produce operational outcomes (Feldman & Orlikowski, 2011). More specifically, we are interested in what really occurs in production environments, especially concerning how actors mitigate and resolve temporal operating tensions in their everyday work lives. We centre on shared practical understanding informed by temporal dimensions (Schriber & Gutek, 1987) and structures that orient practitioners' ongoing activities (Dille & Söderlund, 2013; Braun & Lampel, 2020), to provide insights into the micro-level foundations of temporal operating tensions. Differing perceptions of time leads to organizations having inherent contradictory views of how resources including time should be organized (Slawinski & Bansal, 2015). As noted by Reinecke and Ansari (2015), resolving the temporal operating tensions that arise may require various mechanisms to negotiate, balance, and demarcate boundaries around and within the focal activity to managing competing temporal needs. The study examines, at a micro-level, how organizations manage, mitigate, or accommodate temporal operating tensions.

3. Methodology

The multiple case study approach utilizes three in-depth cases containing multiple examples of temporal divergences at the micro-level (Yin, 2018). Comparison of the temporal perceptions of production managers and operators in manufacturing companies experiencing temporal operating tensions used data triangulation across a survey, semi-structured interviews, observations and feedback sessions supported by secondary data (Eisenhardt, 1989). The case study data collection design is presented in Fig. 1.

3.1. Case selection

Because large multinationals are likely to have less latitude regarding their temporal orientation, our study is situationally grounded in small to medium enterprise (SME) production companies based in the United Kingdom (UK). Appropriate case selection is crucial in studies that reflect on multiple, competing temporalities as the research design must incorporate temporalities in which it is possible to get insights on the micro-level processes as well as the broader context (Feuls et al., 2023). The cases studied for this research were selected on two criteria. First, the case companies could provide evidence of micro-level temporal operating tensions. Second, the companies had to be from different product-process categories to support theoretical replication logic. Thus, the case selection aligned with the scholarship on temporal operating tensions between tasks which are organized based on calculated time and tasks which are organized based on their order of completion. The initial task was identifying case organizations experiencing temporal operating tensions and temporal perspective separations. Thus, informal semi-structured interviews with a convenience sample of production managers revealed several potential companies experiencing challenges of temporal divergence.

By selecting companies from different product-process categories outlined by Hayes and Wheelwright (1979), theoretical replication logic ensures that each case yields results for explicable and theoretical reasons (Yin, 2018). The below product-process categories reflect the options open to a company when it generates and delivers customer value:

- *Job shop operations* involve complex tasks requiring a pace of work conducive to meeting agreed deadlines of bespoke projects (Mohammed & Harrison, 2013). Multidirectional workflow through the shop involves concurrent activities, encouraging a polychronic approach (Bluedorn, Kaufman, & Lane, 1992). Polychronic

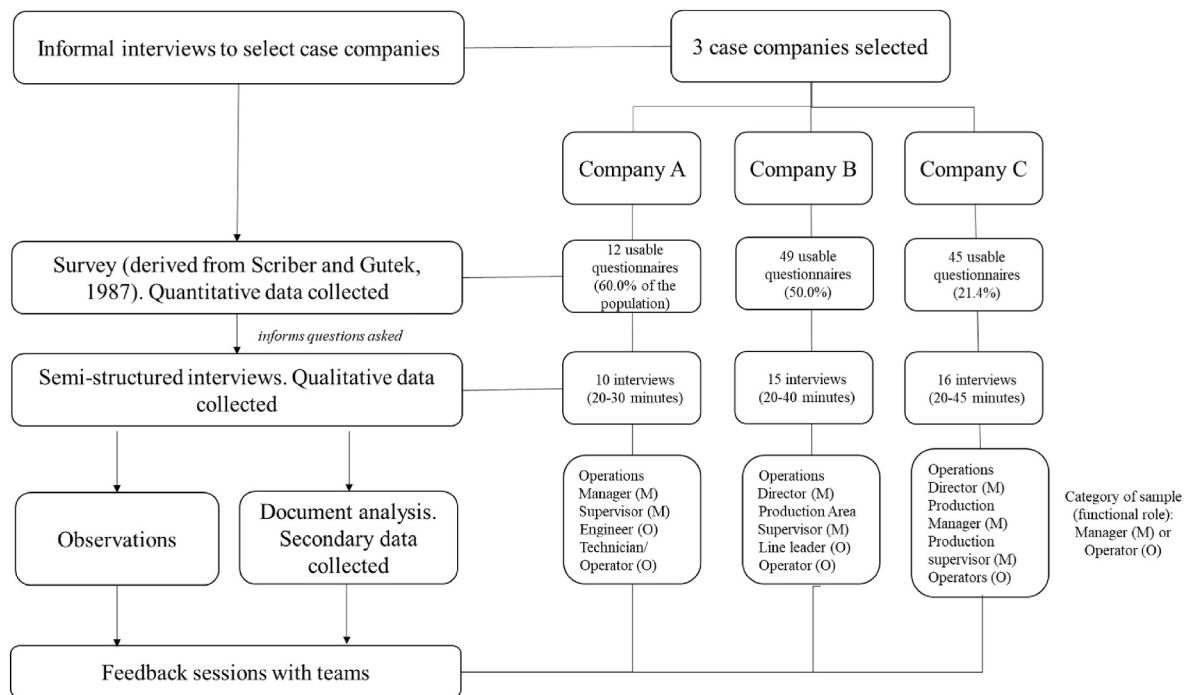


Fig. 1. 1.2 case data collection.

organizations reflect an ethos that schedules are malleable guides, so priorities change as the day progresses. During the project flow through the job shop, human interactions guide organizational members on the priority and sequence of activities (Tukiainen & Granqvist, 2016). Managers find it challenging to appreciate the nuances and time variations across broad products and dynamic processes, leading to differing temporal perspectives. The variety and variability of tasks also challenge the capacity of the organization to standardize the processes and time requirements, leading to fluid scheduling.

- **Batch production** involves separate flow lines with inventory between successive build stages, providing temporal buffers and increasing flexibility (van der Meer & Gudim, 1996). Drawings that codify the sequence of each build phase and the required tasks support the operators in their decision-making. Although the overall batch completion time is known, the team decides the duration of each process stage, aiming to vary the mix, volume, and product variety without significant losses in productivity as production progresses. Batch mode also offers a degree of autonomy for production operators and manages work pace through the teams (Choudhari, Adil, & Ananthakumar, 2012). However, scheduling and process are less dynamic and variable than in a job shop environment due to the significant codification involved. Also, the temporal perspectives of managers and operators are likely to differ less when managers can appreciate the time variations across different products and processes.
- **Conventional flow line production** is often machine-paced and highly scheduled due to the limited product variety and standardized activities and times. Founded on Taylorism principles, low work autonomy within the job design limits discretion on how and when activities occur. Task standardization and a synchronized sequence “guide routine enactment” (Turner & Rindova, 2018, p. 1254). Operators in this environment do not usually schedule their work because their roles and job content are coordinated and controlled via direct supervision. Organizational artifacts such as routinized tasks and standard operating procedures and times further reduce the decision-making flexibility of production operators in their role performance (Turner & Rindova, 2018). Consequently, the temporal

perspectives of managers and operators are likely to differ only to a minor extent.

Although the extent to which the temporal perceptions of managers and operators differ is debatable, job shop production should display the most difference and flow line production the least, again reflecting the theoretical replication logic of the study. Consequently, three case companies were selected which were experiencing micro-level temporal operating tensions and represented the three product-process categories, as shown in Table 1 – identified through semi-structured interviews with senior company managers about the operating context, organizational structure, and temporal operating tensions. Questions posed to managers were orientated towards a focus on the present situation rather than speculation on the future or discussion on the past. This approach underpinned and mirrored the planned data collection on current experiences and practices for operators and managers.

Company A. With annual revenues of £2.6 million and 20 employees, Company A is a specialist restorer and repairer of vintage cars via a job-shop approach. Its processes are only partly codified because the assessment of individual customer vehicles determines the actual work content and restoration activities. Client specification changes during the build stage of the process create significant problems to workflows and synchronization. Temporal operating tensions arise due to delivering customer value on deadlines that generally remain fixed due to car rallies and touring event calendars while accommodating significant changes to product specifications.

Company B. With annual revenues of £20 million and 98 employees, Company B is a batch assembler of electrical products sold business-to-business within the UK and overseas. Company B has a very structured planning process supported by an enterprise resource planning system. Agreed lead times determine the customer delivery schedule and, while the product range utilizes modular designs, customization before installation is usual. Frequent and unplanned changes occur as last-minute product customization changes alter routinization of tasks and production build times. The tensions that arise as the highly efficient and standardized processes clash with urgent bespoke product demands.

Company C. With annual revenues of £110 million, Company C has 210 employees and processes organic/healthy food products, which it

Table 1

Case company characteristics.

Company Identifier	No. Of Employees	Product-process categorization	Functional Makeup	Potential Temporal Operating Tensions
A	20	Job shop	Purchasing (incl. logistics); Engineering (incl. product development); Manufacturing; Sales and Marketing; Finance	Poorly defined customer specifications versus strict customer deadlines; Delivering quality versus speed of activities
B	98	Batch	Purchasing; Engineering; Manufacturing; Logistics; Product development; Sales and Marketing; HR; Finance (incl. IT.)	Customization versus standardized processes; Efficiency versus effectiveness due to cost down-pressure
C	210	Flow line	Purchasing; Engineering; Manufacturing; Logistics; Product development; Sales and Marketing; HR; Finance (incl. IT.)	Efficiency versus effectiveness due to recurring equipment breakdowns; Schedule adherence versus planning flexibility

supplies to UK supermarkets, restaurants, and food-service firms with different lead-time, logistical, and product requirements. Flow line manufacturing of its base product has limited changeovers to equipment cleaning between batches. Manually blending the base with spices and herbs creates flavoured varieties before an automated packing and packaging process. Frequent machine breakdowns and production cycles that exceed lead times, place the operation under extreme time pressure. Company C's tensions are generated through delivering customer value from highly efficient operations while accommodating frequent demand changes.

3.2. Research tool

After informal interviews to identify the three case companies which were experiencing micro-level temporal operating tension, the research design (shown in Fig. 1) sought to achieve insights into manager-operator temporal operating tensions via a survey using a pre-established research instrument. Schriber and Gutek (1987) developed thirteen measures of temporal dimensions of which 8 align with the temporal mechanisms deployed by manufacturing firms to manage and control outputs. Identifying differing perceptions of each temporal dimension provides the opportunity to assess what differences exist within and across the organization. Although initially developed within a psychology context, this instrument largely applies to the manufacturing context due to its temporal dimensions. Six of the constructs examine the organizing and pacing of activities and contain measures associated with delivering planned work to set deadlines (*Schedules and Deadlines*; *Work Pace*; *Allocation of Time*; *Awareness of Time Use*; *Quality versus Speed*; *Synchronization and Coordination of Work*). Moreover, two constructs examine the organization's future orientation and the extent that respondents believe they have autonomy over the use of their time (*Future Orientation*; *Autonomy of Time Use*).

Table 2

Temporal dimensions (Schriber & Gutek, 1987).

Theoretical Construct	Measured Variable
Synchronization and Coordination of Work	To get the job done, it is important for each person to coordinate his/her work with others People have to work together to get the job done Teamwork is not very important here People here feel that deadlines 'don't really matter' Staying on schedule is important here It is important to meet our deadline We don't pay much attention to schedules (R) No one gets upset when you miss a deadline (R) All of our work is tightly scheduled It is very important" to "be on time" for everything People do most of their work under deadlines People do things when they are ready, not on schedule (R)
Schedules and Deadlines	Working fast is not important here Most people can work at their own pace Most people can take breaks when they want to It is easy to find time to plan something new People are expected to work fast (R)
Work Pace	Schedules usually seem too tight for most big jobs/projects We never seem to have enough time to get everything done Tasks usually take longer than planned
Allocation of Time	Around here, people like "talk about "the "good old days" People here do not have the freedom to use their time the way they choose Most people here cannot set their own schedules Most people "here" just expect" "to kill time" on the job
Autonomy of Time Use	People expect their work to be routine Doing things right is better than doing things fast It is better to make a bad decision quickly than a good decision slowly (R) Most people don't think about how they use their time People here worry about using their time well (R) People here plan their time carefully (R) People expect you to know how long it will take you to do something (R)
Quality versus Speed	This organization invests in the future Planning for the future is important here
Awareness of Time Use	
Future Orientation	

Notes: Measured variable: 1 = strongly disagree, 5 = strongly agree; R denotes reversed meaning.

Table 2 shows the measures associated with the temporal dimensions in the survey, which capture how participants manage their time during production-related activities.

The temporal dimension *Synchronization and Coordination of Work* indicates that employee use and management of time cannot be pre-defined reliably due to the various manufacturing processes (Nembhard, Schoenherr, & Schultz, 2003; Powell & Schultz, 2004; Schultz, Juran, Boudreau, McClain, & Thomas, 1998). *Schedules and Deadlines* refers to how an organization plans temporal stops and starts as mechanisms for individuals to meet deadlines, thereby stipulating the *Allocation of Time* and *Work Pace* (Levine & Wolff, 1985; Scott-Young & Samson, 2009). *Autonomy of Time Use* assesses the extent that employees have the freedom to complete tasks over a prescribed period independently (Schriber & Gutek, 1987). When work activities are not routine or well-defined, a rigid focus on quality can provoke enhanced *Awareness of Time Use*, leading to conflicts and trade-offs and increased production rates to meet deadlines as employees seek to manage the *Quality versus Speed* process trade-offs (Chen & Huang, 2006). Finally, the dimension *Future Orientation* concerns the extent that planning for the organization's future is considered essential relative to meeting today's needs (Reinecke and Ansari, 2016, 2015; Stjerne et al., 2019).

3.3. Data collection

Claims of temporal perspective separation between the production managers and operators highlighted the need to investigate a broad representative sample of participants and analyze data across populations to ascertain whether any differences are significant. Formal data collection within each case company comprised the survey, followed by semi-structured interviews on site with managers and operators, using the findings from the quantitative data collection. During these visits to site, observations were recorded and backed up by secondary data analysis. Using a variety of methods to investigate the research questions, allowed for tailored data inquiry from the broader quantitative survey to more specific detail in the qualitative data collection. This mixed methods approach enhances rigor where the research team has the ability to balance time, effort, and resources. The triangulated approach is particularly appropriate where the goal is to generate greater understanding of the mechanisms underlying quantitative results in at least partially new territory (Edmondson & McManus, 2007; Gibson, 2017). The managers and operators completed Schriber and Gutek's (1987) validated instrument (Cronbach alpha: 0.80–0.52), capturing the quantitative temporal dimensions data. Then the qualitative data from semi-structured interviews, followed by feedback sessions to seek clarification and further understanding, were conducted. This resulted in capturing multiple voices explaining operating tensions in and across the organizations (DeFillippi & Uriarte, 2020).

Of the 20 employees in Company A, three managers and nine operators (60.0% of the company population) returned a useable survey response. In Company B, ten managers and 39 operators (50.0%) from the 98 employees returned a useable response. Finally, 13 managers and 32 operators (21.4%) from the 210 UK employees in Company C returned a useable response. Semi-structured interviews with both managers and operators evaluated the instrument's ability to reflect participant meaning and probed for insights into the responses. A record of each interview, transcribed verbatim, was returned to the firm for validation. Observations of managers and operators during periods of operational challenges were also noted along with company document analysis outlining business-as-usual production norms to strengthen the evidence presented. Fig. 1 indicates the data collection procedures used in each case company and the order of the process.

3.4. Data analysis

The unit of analysis is the individual employee, and the temporal dimensions instrument captures individual employee data to gauge the results for each case company. The analysis also identifies each firm's temporal operating tensions and mitigation practices, if any. The sample response mean of each measure was used to calculate the sample mean and variance of the temporal dimensions. Due to different sample sizes, ANOVA was used to detect whether the differences between the overall dimension profiles were statistically significant (see Tables A1, A2 and A3).

In addition to within-case analysis of each case company, cross-case pattern searching identified research contributions to theory and practice (Eisenhardt, 1989). Comparison of the temporal perspective and individual dimension profiles of managers and operators identified misalignments and commonalities and sought possible explanations within the contextual data. Despite the drive for efficiency while delivering a customised solution, Company B showed no significant divergence of temporal perspectives between production managers and operators, which allowed us to investigate potential good practices. Finally, discussions with production managers and operators sought

feedback that helped develop the findings into a set of mitigation strategies (see Table 6).

3.5. Researcher reflexivity

Temporality reflects how an organization experiences and socially organizes time which can differ across individuals (Reinecke & Ansari, 2015). This paper's researchers have several years of manufacturing experience which embedded them with an understanding of temporality within production environs. Recognizing this position of the researchers is vital in temporality studies (Feuls et al., 2023). The researchers' temporal embeddedness was beneficial to the suitability of the case selection of the organizations as there were very specific requirements for the firms to be SMEs facing operational uncertainty. By reflecting on our participation in the field, thus in the temporalities – we ensured we only used our previous experience in the manufacturing context to set up the sample of suitable case companies for collection and did not allow temporal assumptions to affect the study once data collection was in progress. Through pre-study discussions we anticipated that managers and operators would share a common understanding and orientation of temporal dimensions related to day-to-day activities – however, temporal dimensions involving future orientated aspects would be different. The views of the researchers were informed by a processual view of temporality (e.g. see Hernes, 2007; Söderlund, 2013, pp. 117–135). This perspective highlights that individuals with a focus on today take more risks and work on shorter time windows. That is, future orientated individuals are considerate of future plans and consequences of their actions (Mohammed & Harrison, 2013). Using a mixture of an initial survey followed by interviews based on the findings of the survey facilitated conversations about the data to inform the next stage of data collection and analysis (Cole, 2023).

3.6. Quality assurance

Four quality criteria used to judge case study research are construct validity, internal validity, external validity, and reliability (Eisenhardt, 1989; Yin, 2018). Table 3 summarises the actions taken within this study to assure quality.

Table 3
Assurance of research quality.

Criterion	Quality Assurance Methods
Construct validity (Eisenhardt, 1989; Yin, 2018)	Construct operationalization supported by literature review. Multiple sources of evidence are collected and analyzed (survey, interview, secondary data, observation, feedback discussion). The participants either hold key management positions or are operators who understand time use related to their firm.
Internal validity (Yin, 2018)	Pattern matching developed from within-case and cross-case analysis, with cases selected from a single context (SME manufacturers with fewer than 250 employees).
External validity (Yin, 2018)	Analytic generalization and theoretical replication logic employed. The case companies exhibit varying degrees of temporal perspective divergence, which extends the generalisability of the findings.
Reliability	Transparency of the process. The case study protocols define how data is collected and analyzed. Each case company validates case study findings in a feedback session.

4. Findings

4.1. Temporal perception differences

Within-company comparisons of the temporal perceptions held by production managers and operators reveal several differences between the populations. In Company A, four temporal perspective dimensions exhibit significant differences, *Schedules*, and *Deadlines*, *Quality versus Speed*, *Awareness of Time Use* (all significant at the $p < 0.05$ level), and *Work Pace* (significant at the $p < 0.10$ level). The only temporal dimension in Company B to indicate a significant difference is *Allocation of Time* (significant at the $p < 0.10$ level). In Company C, three temporal dimensions indicate significant differences, *Schedules*, and *Deadlines*, *Allocation of Time* (significant at the $p < 0.05$ level), and *Quality versus Speed* (significant at the $p < 0.10$ level). Absent are the temporal dimensions *Synchronization and Coordination of Work* and *Autonomy of Time Use* there being no statistically significant differences detected between the temporal perceptions of managers and operators in any case company. Tables A1, A2 and A3 in the Appendix show where there were significant differences for each company and the temporal dimensions. Below, Table 4 presents supporting evidence from interviews and field observations of Schriber and Gutek's temporal dimensions. Where evidence is in italic font, statistically significant differences were found.

4.2. Temporal operating tensions

Discussions with case company production managers and operators uncovered four temporal production-related tensions at the micro-level: *efficiency versus effectiveness*, *process standardization versus process improvement*, *synchronization versus autonomy*, and *temporal control versus flexibility*.

Table 4

Within Case Comparison of Micro-level Temporal Dimensions – Production Manager and Operator Perspectives
Evidence in italics represents temporal dimensions of statistically significant difference.

Temporal Dimension	Company A (Vintage car restorer)	Company B (Electrical products assembler)	Company C (Organic and health food products)
Schedules and Deadlines	<i>Management believes that scheduling is only an indicator of the actual work sequence due to the uncertainty in the work content. Operators believe that working to schedule is essential to meet deadlines.</i>	Everyone views the meeting of schedules and deadlines as essential for the business.	<i>Due to breakdowns and unplanned changes, management does not see schedules as reliable. Plans and organizing activities require flexibility. Operators view schedules as their work instructions; hence, essential when executing their job.</i>
Quality versus Speed	<i>Operators view product quality to be more important than production speed. Operators are responsible for the quality, so extend the time to ensure it is correct. Management also believes that quality is essential, but not at the expense of unreasonably low speed.</i>	Management and operators view the quality of the product as more important than working quickly.	<i>The need for quality surpasses speed for operators since a rejected product directly reflects their ability to perform the job. Management has a similar view. However, managers believe the process controls in place assure good quality, so operators should produce as quickly as possible.</i>
Allocation of Time	Due to unknowns in the work content, management and operators find 'never enough time' allocated to jobs.	<i>Operators believe that the time allocated is not quite enough. Management knows that this is by design as there is a need to reduce costs by improving productivity.</i>	<i>Due to frequent engineering issues, management believes there is not enough time built into the plan to cope with downtime. Hence, they under-plan. Operators also believe that there is not enough time. However, they are not aware of the under-planning that buffers the plan.</i>
Awareness of Time Use	<i>Management believes that people should be aware of their use of time, mainly due to the unknowns of the work. There is an expectation that operators use their experience, adjust their activities, and plan to make the best use of time. Operators are ambivalent as they are focused on the job at hand rather than speed.</i>	Most production tasks have prescribed set times and standard operating procedures, so awareness of time use is not significant.	Most production tasks have prescribed set times and standard operating procedures, so awareness of time use is not significant.
Work Pace	<i>Management believes the operators are not working fast enough. Operators believe they are working at a good pace appropriate to upholding quality and meeting deadlines.</i>	Production rate is set at a responsible pace for assembly operations and established through time and motion studies.	The speed of the conveyors sets the pace, so most people feel this is a non-issue.
Future Orientation	Management and operators plan training through skills matrices. Apprenticeship scheme exists.	Management and operators plan training via skills matrices.	Management and operators plan training through skills matrices. Apprenticeship scheme exists.

Notes.

Company A, 20 employees, 3 observations (Managers), 9 observations (Operators). Significant difference: Work Pace ($p < 0.10$). All others ($p < 0.05$) (ANOVA single factor test).

Company B, 98 employees, 10 observations (Managers), 39 observations (Operators). Significant difference: Allocation of Time ($p < 0.10$).

Company C, 210 employees, 13 observations (Managers), 32 observations (Operators). Significant differences Quality versus Speed ($p < 0.10$ level). All others ($p < 0.05$).

Efficiency versus effectiveness. These competing constructs represent a divergent perspective at the micro-level on objectives that fosters competing goals in operations and develops performance tensions (Smith & Lewis, 2011; Kohtamäki et al., 2020). The tension reflects patience versus urgency when enacting the pace of production (Gerald et al., 2020) as managers provide measures and targets that operate as temporal controls to drive operator productivity and outputs. Managerial focus on time urgency, as manifested in efficiency measures, reflects constraints that are internally imposed (Mohammed & Harrison, 2013). Within the cases operators discussed working effectively rather than quickly to ensure product, process, and decision-making quality (Perlow et al., 2002). The temporal operating tension between effectiveness and efficiency reflects the trade-off between quality and speed (Schriber & Gutek, 1987). Due to machine downtime and specification changes, operators experienced the duality of processing more quickly yet having to spend time considering potential issues with specification accuracy or machine quality problems. The tension experienced by individuals reflects Takeuchi, Osono, and Shimizu's (2008) observation of Toyota. Toyota values the need for individuals to consider quality improvement and process management and provides time. The operators in the case companies had not attained this temporal norm. Each organization management attempted to counter this tension through shift briefings to share issues and challenges ahead that day.

Process Standardization versus Process Improvement. Standardization of manufacturing activities and task durations fosters tensions between delivering today's objectives and tomorrow's improvements (Smith & Lewis, 2011). Delivering objectives by managing and operating via standard operating procedures and processes in a time-bound and highly structured approach is common but limits improvement opportunities. The managers of Companies B and C utilized skill matrices to balance the demands of today with future requirements,

partially mitigating the tensions. Creating temporal space for training and development is challenging, and case study managers planned to use temporal means, including inventory buffers, to decouple supply from demand. While the managers of Companies B and C aspire for the development of an ambidextrous approach, they currently have diverging temporalities with a temporal norm focused upon today that creates a “time collision” with tomorrow’s organizational need (Reinecke & Ansari, 2015). This tension reflects the time horizon of management’s ambition versus realism of today’s demands when enacting the time horizon (Geraldi et al., 2020)

Synchronization versus Autonomy. Although synchronization and coordination activities support collective activities, they can foster tensions between individual opportunity and the team role (Smith & Lewis, 2011). The self-organizing teams in Company A and Company B offer freedom of autonomy for operators to act within an overall temporal boundary. Flexible working hours, ability to adjust work pace and task-time flexibility in Company A helps reduce tensions for operators and allowed the group to recognize individual and collective accomplishments. Temporal operating tensions arise when organizational desire for operator autonomy clashes with schema that expects specific performances against overall planned timelines creating contradictory interpretations (Klassen & Hajmohammad, 2017). During periods of abrupt specifications changes, managerial demands for controlled synchronization of tasks undermines autonomy of operators – and drives a managerial approach and temporal operating tensions.

Temporal Control versus Flexibility. Smith and Lewis (2011) point out that although schedules provide structure to plan and organize activities, they can foster tensions between flexibility, control, empowerment, and directing. In addition to shift briefings, Company A and Company C managers both attempt to mitigate potential tensions with priority lists and shared delivery deadlines, thereby creating a ‘burning bridge’ to focus effort and resources. Such temporal techniques also develop sensemaking to create orderly and coherent understandings that enable change. Through socially organizing time and experiences the managers actively develop temporal norms (Reinecke & Ansari, 2015) that address potential tensions of scheduling based temporal controls and the necessity for rapid unplanned changes. Temporal perspectives that focus on the controlling the present for operators while aspiring for an alternative future state of flexibility creates tensions (Mohammed & Harrison, 2013).

Table 5 summarises the feedback comments and insights, indicating the temporal operating tensions and temporal perspective dissimilarities between managers and operators. Fig. 2 presents the temporal operating tensions between production managers and operators and their mitigation strategies.

4.3. Mitigation of temporal operating tensions

Table 6 indicates how each case company attempts to successfully mitigate the temporal operating tensions between production managers and operators. For each temporal operating tension, the mitigation technique used by the company is listed in Table 6 (and explained above against each tension).

5. Discussion

5.1. Temporal operating tensions

Temporality differences can impact the performance of individuals and teams if the divergence disrupts the synchronization of planned activities (Mohammed & Harrison, 2013). The selected case studies had different temporal dimension values between management and operators due to process challenges and temporal control issues. These technical and organizing problems, from a management perspective, were transient and potentially resolvable however, they did create tensions in operations. The four temporal operating tensions highlight the daily

Table 5
Temporal operating tensions.

Temporal Operating Tensions	Source	Quote
Company A Efficiency vs. Effectiveness	Operations Manager	“Our operators don’t seem to understand that our labor costs are significant, and we need them to work quicker and produce more.”
Synchronization vs. Autonomy	Technician	“Managers don’t seem to realize how much work is needed to be done sometimes. What looks straightforward can be tricky if a bolt snaps off or something won’t fit the first time. We often have to stop the job to work out how to repair the item as it is new to us.”
	Supervisor	“When we are up against a deadline, one of the challenges is getting the technicians to work as a unified and coordinated team instead of as individuals.”
Temporal Control vs. Flexibility	Operations Manager	“We supply work schedules to the shop floor, but we know that they are only a guide. The operators sometimes think we don’t know what we are doing, but the company has to respond to customer changes quickly, as the operators should.”
Company B Efficiency vs. Effectiveness	Operator	“We are always up against the clock. (There is) never enough time to do our jobs.”
Process Standardization vs. Process Improvement	Operations Director	“What is interesting from your results is the fact that we don’t have many differences in our company. The lack of tension worries me. I mean, where is our creativity? Have we over standardized our operation?”
Company C Efficiency vs. Effectiveness	Production Supervisor Operations Director	“The issue we have is the constant breakdowns which create unplanned changes to our schedule. We try to buffer the schedule by building in more slack. We haven’t told the operators that as we don’t want them to take their foot off the gas.”
		“We need to create headroom for maintenance training to upskill our people. We need to get ahead in production to create the time.”
Process Standardization vs. Process Improvement	Operations Director	“On the surface, we have a highly automated production flow line environment that should require limited operator input; however, we have common issues with breakdowns and sensors”.
Synchronization vs. Autonomy	Operator	“They always plan for more output but at what cost? If we don’t keep adjusting the machine settings, we will get quality issues, and that doesn’t help anybody.”

schemata challenges and trade-offs confronting managers’ decision-making ability when organizing people and value-adding processes at an operational level. If the temporal norms, values, and assumptions that created the schema are deeply rooted in managing short-term tensions, the organization’s ability to develop new approaches, if required, that embrace contradictory although interrelated issues will be restricted (Choi, Dooley, & Rungtusanatham, 2001; Smith, Gonin, & Besharov, 2013). The case studies illustrate management models focused on economic efficiency driven by calculated times based structures which shape the temporal practices of the organization (Reinecke & Ansari, 2015; Orlikowski and Yates, 2002). Problems created by external or internal challenges highlight that temporality differences exist within the companies which can disrupt the efficiency, synchronization, scheduling, and routine operations (Mohammed &

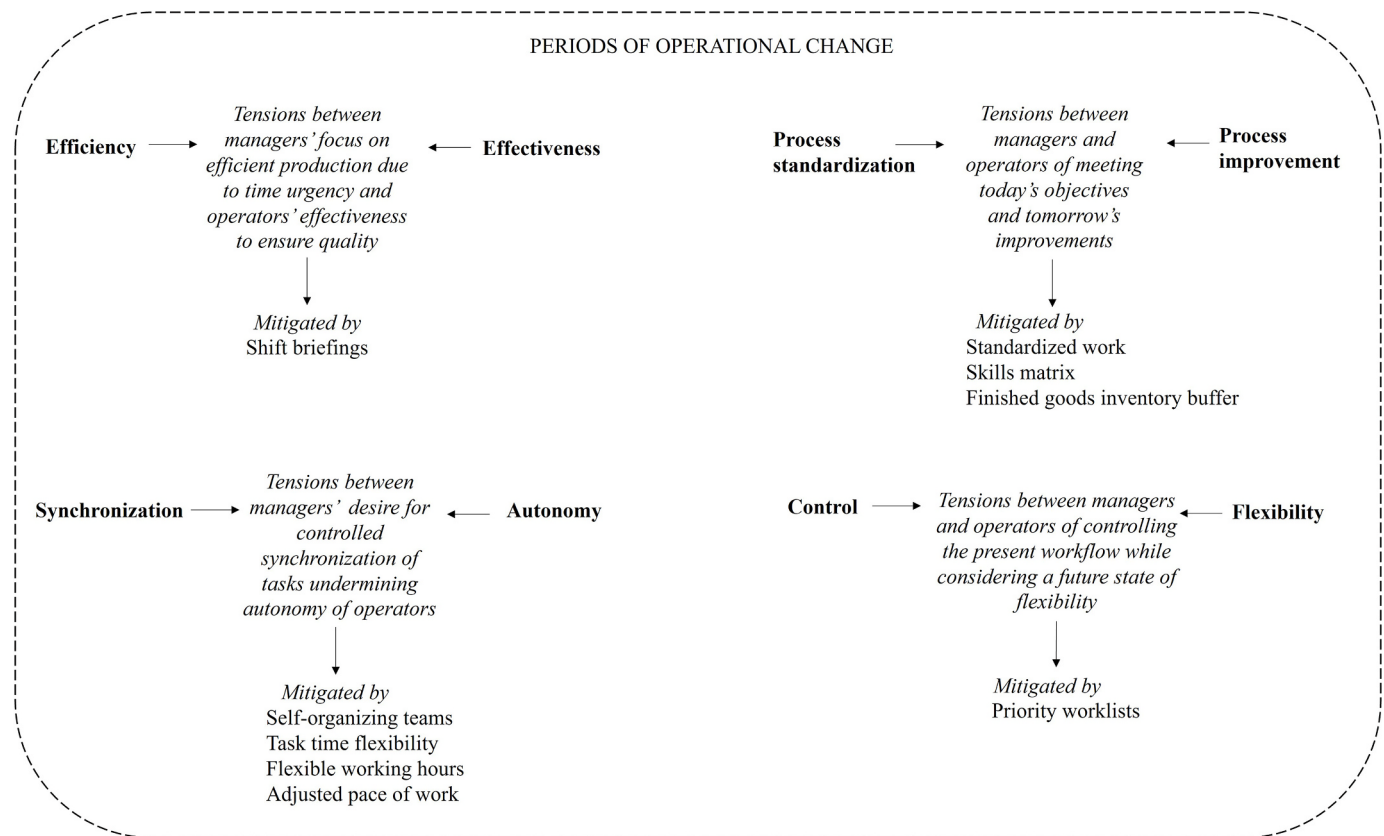


Fig. 2. Temporal operating tensions between production managers and operators during period of change and their mitigation strategies.

Table 6

Mitigation of temporal operating tensions.

Temporal Operating Tension	Mitigation Technique	Company A	Company B	Company C
Efficiency versus Effectiveness (every case company)	Shift briefings	⊙	⊙	⊙
Process Standardization versus Process Improvement (Company B and Company C)	Standardized work	Not detected	⊙	⊙
	Skills matrix	⊙	⊙	⊙
	Finished goods inventory buffer	Not detected	⊙	⊙
Synchronization versus Autonomy (Company A and Company B)	Self-organizing teams	⊙	⊙	Not detected
	Task time flexibility	⊙	Not detected	Not detected
	Flexible working hours	⊙	⊙	Not detected
	Adjust the pace of work	⊙	⊙	Not detected
Temporal Control versus Flexibility (Company A and Company C)	Priority worklists	⊙	Not detected	⊙

⊙ = detected.

Harrison, 2013). Through examining the temporal dimensions of managers, who design and implement the temporal controls, and operators, who are bound by the resultant structures, temporal divergence was identified. We found that managers mostly wanted operators to work to established temporal norms, but that operators preferred to work to event-time. Although the dominant perspective in production

management of time based on engineering calculations, has proven to be invaluable, Klassen and Hajmohammad (2017) highlight the inflexibility of holding such a rigid view because it undermines emergent, complex, and indeterminate processes. Therefore, many processes in production management, from managerial to operator roles, require an event-time perspective – such as involving supplier development and stakeholder engagement (Klassen & Hajmohammad, 2017).

Our research examined temporal dimensions of managers and operators to examine if divergent temporal perceptions create temporal operating tensions, during periods of change. In Company A, job-shop manufacturing, agility, and customization are critical, and the tensions observed reflect the types of transformational challenges noted by Martinez, Bastl, Kingston, and Evans (2010) to achieve responsiveness and efficiency while having flexibility. The differences observed in manager and operator temporal perceptions ultimately reduced management's control as it struggled to manipulate work pace to meet customer deadlines while addressing changes to specifications. Deadlines, which represent temporal start and end points of processes, are assessed on task sequencing and temporal constraints within the organization. Differences in the temporal construct synchronization and autonomy reflect the challenge in realizing deadlines. Similarly challenges with *Quality versus Speed* align with the findings of Hopp, Irvani, and Yuen (2007) by confirming that management may induce suboptimal solutions when insisting on increased production speeds. These micro-level differences are undermining the organization's ability to deliver orders on-time.

Company B strives to reduce throughput time through a batch production approach but allows no time to explore improvement possibilities, thereby challenging the homogeneity of temporal perceptions (Turner, Aitken, & Bozarth, 2018). Today's demands displace the time available to learn and invest for the future. On the other hand, only slight differences exist between the temporal perceptions of managers and operators due to reliable production schedules and regular lineside

updates on delivery deadlines, and the operators are empowered to self-organize and have the flexibility to set the work pace.

In Company C, the managers and operators have different temporal perceptions when overcoming output losses due to the frequent flow line manufacturing breakdowns. While management urges greater output to compensate for downtimes, the operators advocate for slower running machines to resolve quality issues and view the output objective as dysfunctional within the context of unstable processes (Hopp et al., 2007). Breakdowns also affect schedule stability and reduce the ability to achieve effectiveness and efficiency (Coenen, Von Felten, & Schmid, 2011), thereby creating challenges to productivity in a very competitive consumer goods marketplace.

Our findings indicate that different temporal perceptions coexisting in a manufacturing organization challenge the singular temporal perspective commonly assumed in production management and reflect how temporality is malleable (Bluedorn & Waller, 2006; Klassen & Hajmohammad, 2017). Comprehending the different temporalities that exist within the case studies highlights the challenges for managers and operators in delivering success when faced with organizing contradictions (Putnam et al., 2016; Gherardi et al., 2020). The four temporal operating tensions revealed in the findings, through replication logic, illustrates the types of tensions that arise as temporal divergencies emerge.

The theoretical replication logic deployed at the outset ensured that each case gave different results for explicable and theoretical reasons (Yin, 2018), with companies selected from different categories of the Hayes and Wheelwright (1979) product–process matrix. Within the job shop (Company A), temporal perceptions differed due to the variety and variability of the products and processes, which rendered a Taylorism approach to managing time unworkable. Exogenous changes driven by customers revising specifications and delivery dates challenged the organization's ability to schedule and plan with conviction, thereby encouraging further temporal operating tension. The challenges facing Company A include confronting institutional expectations and developing divergent temporal perceptions and tensions between management and operators (Miron-Spektor, Ingram, Keller, Smith, & Lewis, 2018).

The batch production operation, Company B, experienced narrower temporal divergence by successfully applying mitigation practices that helped managers and operators to remain aligned. Such actions enabled teams to flexibly work within imposed control and pace boundaries while meeting management's target output rate and time allowance (Santos, Passos, & Uitdewilligen, 2016). Buffers between customers and operations, created via lead-time adherence practices, limited the impact of external changes. The routinized set of activities that are present in Company B are governed by institutional expectations that support a common understanding of temporality lowering the opportunity for tensions to arise (Braun & Lampel, 2020). Surprisingly, the flow line case with greater standardization and low operator autonomy exhibited more temporal variation than the batch flow operation (Company C). The highly regulated flow-line process, based on Taylorism principles, would be expected to have institutional governance derived from a shared understanding of temporality (Turner & Rindova, 2018). However, reoccurring process problems are increasing divergencies and tensions. The on-going challenges linked to unplanned and unexpected equipment problems and process stability issues are diminishing a common understanding of temporality leading to temporal divergences between management and operators.

5.2. Mitigation strategies

Identifying and exploring the variances in perceptions of temporal dimensions and corresponding tensions provides useful insights for managers, however, just as important is to how organizations work to address them (Stjerne et al., 2019). The mitigation approaches deployed varied across the Hayes and Wheelwright product–process

categorization axis reflects the degree of standardization and temporal controls within processes and procedures. The flow line case, due to on-going breakdowns, attempted to introduce flexibility through priority lists against a background of highly structured temporal controls. Conversely, the job shop utilized priority lists to create temporal controls. The same mitigation technique, depending upon context, has demonstrated the ability to lower or raise control. Similarly, self-organizing teams are used by the job shop and batch operation, although they perform different roles. Within the batch operation teams work together to decide on the focus and pace of their efforts to complete standardized activities within pre-defined temporal boundaries. The job-shop operators work independently and at different paces before organizing into a team for final assembly based on agreed customer deadlines. The mitigation for the batch operation is to provide flexibility within standardized work practices and times whereas, the job-shop management utilize the approach to create peer pressure to limit temporal flexibility against a shared deadline.

In summary, the mitigation approaches deployed by the case study organizations were developed to address the four temporal operating tensions that emerged; *Efficiency versus effectiveness* that fosters competing goals in operations and develops performance tensions as urgency versus patience; *Process Standardization versus Process Improvement* that creates a “time collision” tension that reflects the time horizon of management's ambition versus realism of today's demands; *Synchronization versus Autonomy* develops tensions when managerial desire for operator autonomy clashes with schema that expects specific performances representing a managerial approach and tensions that are based on expected versus actual time; *Temporal Control versus Flexibility* generates temporal operating tensions when managerial focus on controlling the present for operators clashes with an aspiration of an alternative future state of flexibility. Ultimately, managers and operators are continually faced with multiple intersecting temporalities, obliging them to make choices about what to do in the present, how to understand the past they emerge from, and how to navigate the future (Hernes, 2022).

6. Implications for theory and practice

6.1. Theoretical contributions

The empirical results elaborate how production management schemata based on an understanding of time as a resource to synchronize tasks, increase efficiency, and standardize business processes, generates contradicting temporal interpretations when faced with operational challenges. Four temporal operating tensions were identified through a micro-level analysis of temporal dimensions perceptions of managers and operators; *Efficiency versus Effectiveness*; *Process Standardization versus Process Improvement*; *Synchronization versus Autonomy*; *Control versus Flexibility*. Each tension reflects a gap between managerial and operator temporal expectations. Examining tensions at an operational level provides insights into challenges that organizations face when processes and procedures that provide temporal boundaries are challenged, due to customers pressures and internal operational issues. This research, through identifying temporal operating tensions at a micro-level, illustrates the importance of understanding tensions at different organizational levels. Macro-organizational studies of tensions in production management have flourished (Petro et al., 2020) however, research on temporal tensions that are temporary and exist within the junction of managerial and operator interfaces are rare (Schad et al., 2016; Whyte & Nussbaum, 2020). This study contributes to this gap in production management temporality literature by extending the work on temporal operating tensions (Putnam et al., 2016; Stjerne & Svejnova, 2016; Stjerne et al., 2019) from a macro-level, organizational issue to theorizing on the role and importance of micro-level, individual temporal divergencies. We describe the temporal operating tensions and mitigation approaches that surface as temporal divergences emerge

which challenge temporal organizing norms that underpin production processes, procedures, and managerial practices. We argue that comprehending micro-level temporal divergences supports organizations to manage temporal operating tensions that arise because of macro contextual changes.

The temporal variances between managers and operators represent potential organizational performance challenges that can determine the success or failure of employees (Geraldi et al., 2020; Schriber & Gutek, 1987). Resolving divergent temporal perceptions requires a recognition of tension types to formulate an appropriate mitigation (Stjerne et al., 2019). The case study companies addressed temporal operating tensions through several techniques that enhanced operator flexibility and flow of information. The engaged mitigation approaches were designed to address temporal perception mismatches through short-term activities (e.g. priority worklists) and objective sharing (via shift briefings). Identifying mitigation strategies that align with temporal operating tensions is important for organizations in managing temporal conflicts and variations amongst individual employees (Reinecke & Ansari, 2015; Miron-Spektor et al., 2018). This research provides insights into an operations area that has limited focus within the academic community.

6.2. Managerial implications

Comprehending temporal divergencies can assist organizations in managing issues that challenge temporal norms which support the delivery of customer value (Braun & Lampel, 2020). Temporal differences can impact on the synchronization of planned activities and performance of the operation. Through the collection and analysis of data on temporal dimensions, organizations can assess variances at the juxtaposition of managerial practices and operator activities. Identifying temporal operating tensions proffers the opportunity to develop and implement mitigation approaches while still meeting overarching business objectives. This research provides examples of mitigation approaches, aligned to temporal operating tensions in Table 6, arming managers with a portfolio of options to deploy in addressing temporal variances they may be experiencing within their business. This study seeks to provide decision-makers with guidance on how to use temporal norms to align different temporal perspectives in support of production management performance objectives. Within the manufacturing context, the time perspectives held by employees should not be assumed homogeneous and uniform (Whyte & Nussbaum, 2020). Recognizing temporal duality co-exists enables managers to accommodate the different perspectives when developing normative regulations and processes for the effective delivery of customer value.

7. Conclusion

This study provides decision-makers with guidance on how to use temporal norms to align different temporal perspectives in support of production management performance objectives. Within the manufacturing context, the time perspectives held by employees should not be assumed homogeneous and uniform. Recognizing temporal duality enables managers to accommodate the different perspectives when developing normative regulations and processes for the effective delivery of customer value. Through conducting a micro-level analysis, the study identified that managers and operators have different perceptions of temporal dimensions. While managers prefer to impose specific temporal norms, different temporal perspectives can coexist within the same organization, challenging the delivery of operational performance objectives.

The research identified four types of temporal operating tensions experienced by manufacturing organizations across divergent industry sectors. Recognizing that temporality divergence is evident within organizations facing process and procedural challenges highlights the importance of examining tensions in a more holistic manner. We show significant differences to the temporal operating perceptions based on

divergent temporal perspectives that have implications for managers regarding the delivery of business objectives and priorities. Our research highlights the significance and importance of comprehending micro-level temporary temporal operating tensions in manufacturing. That is, tensions that have an immediate and impactful result on the performance of organizations and their ability to deliver value.

8. Limitations and future research directions

Research of this scope inevitably has limitations. The temporal operating tensions identified are based on data collected within the confines of three manufacturing sites limiting generalisability. While our findings confirm the applicability of the Schriber and Gutek (1987) survey instrument to UK manufacturing organizations, it remains untested in non-Western cultures and non-manufacturing settings where alternative temporal measures might prevail. The data collected for the study provided only a snapshot of participants views of the temporal dimensions. Future studies should consider the processual perspective of time and how it impacts on the interpretation and operation of actors as they subscribe to the temporal norms of the organization.

Researchers across other management areas have developed time as a research lens to provide a much richer understanding of strategy, leadership, and sustainability. Because time is viewed as a fundamental social construction supporting social structure and relationships, utilizing a temporal lens can enrich our further comprehension of production management by understanding why two similar sized businesses that operate in the same sector exhibit different delivery performances. Also, the mitigation approaches outlined in the study require further research, perhaps using simulations to assess the temporal implications for production and the supply base and the influence of externalities on potential mitigation strategies. The extension of our findings will also aid in understanding the benefits of preparing a priori temporal impact mitigation strategies to buffer against sudden and unexpected temporal divergences.

Data access statement

All data supporting this study is provided as supplementary information accompanying this paper.

CRediT authorship contribution statement

James Aitken: Investigation, Conceptualization, Writing – review & editing, Writing – original draft. **Eric Deakins:** Methodology, Writing – original draft. **Heather Skipworth:** Conceptualization, Writing – original draft. **Rosanna Cole:** Investigation, Writing – original draft, Writing – review & editing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.emj.2024.05.001>.

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