



Exploring the quality performance implications of temporary workers: the importance of process capabilities

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***Title:** Exploring the quality performance implications of temporary workers: the importance of process capabilities*

Abstract:

The current pandemic with its associated economic downturn has intensified the pressures on companies to produce quality offerings with an increased pressure on cost controls. Across industries companies have reduced their costs by enhancing their ability to operate flexibly, through increasing the use of temporary workers. However, such a reliance on temporary workers is generally associated with deteriorating quality. In order to untangle the relationship between quality and temporary workers we address the following research questions: 1. What are the quality performance implications of employing temporary workers? and 2. Can process capabilities eliminate the potential quality performance deterioration that are due to temporary workers? Process capabilities are conceptualized through the plant's level of of-the-art manufacturing processes technology. To address our research questions, we utilize survey data collected through the Global Manufacturing Research Group. The results suggest that an increased usage of temporary workers significantly increases reject rates and customer returns. Furthermore, we identified that managers cannot rely on their processes to safeguard them from quality performance deterioration, when employing temporary workers.

Paper type: Research paper

Keywords: Quality performance, temporary workers, process capability, volume flexibility.

1. Introduction

The current economic downturn and uncertainties have put an increased pressure on companies across industries and countries to increase their production effectiveness and stay competitive in the marketplace. A differentiation dimension that customers have frequently used to make purchasing decisions is quality. However, companies are equally under pressure, to reduce overheads and induce capacity flexibilities (Ivanov et al., 2018; de Giovanni and Massabo, 2018). Increasingly companies are using temporary workers to reduce costs and at the same time induce flexibilities to manage demand and supply uncertainties (Schwab et al., 2019).

Whilst from a company perspective the advantages of temporary contracts seem compelling (i.e., cost reduction and flexibility gains), the downside of this practice seems to be almost overlooked (Fisher and Connolly, 2017). A reoccurring counterargument against precarious work is that an increase in the number of temporary production workers could lead to quality deterioration (Jeunet and Bou Orm, 2020). This argument has been formed from a *knowledge and skill perspective* but can equally be formed from an *effort perspective* (Flynn, 2005; Tsui et al., 1997). Starting with the effort or commitment argument, temporary workers, especially in the manufacturing domain, do generally not choose to be in such contractual positions. Their economic standing and hierarchical position are usually lower in comparison to full-time employees. Building on reciprocal exchange theory their commitment and effort for the long-term success of the company might be comparably lower to permanent staff, leading to potential quality issues (Chadwick and Flinchbaugh, 2016). However, this statement can also be reversed, arguing from a power perspective, that temporary workers are in a much weaker position and need to put more effort into their work, to potentially achieve job security. This discussion highlights the controversy surrounding the use of temporary workers in production management, which has been recently introduced under the umbrella term precarious work

(Wiengarten et al., 2021). Furthermore, from the skill and knowledge perspective it has long been argued in the quality management literature that to achieve lasting improvement and standards in quality, it is important to have workers with relatively high levels of skills (Rungtusanatham et al., 2005; Mellat-Parast, 2013). However, temporary workers do generally possess lower levels of skills in comparison to permanent workers.

The management of quality has always been at the heart of operations and production decision making and improvement efforts and thus taking a major part in the investment strategies of organizations. The operations management discipline has accumulated a large body of research and knowledge with regards to improving or ensuring quality through focusing on process design, process controls, material management, quality management programs, etc. (Vecchi and Brennan, 2009). However, hiring temporary workers seems to be the antithesis of these quality improvement programs, given that they require dedicated and skilled workers (Wishon et al., 2015). On the other hand, it has been argued that build-in quality is realized through process management and that automation, standardization and control may lead to fool proof quality realization (Sabella et al., 2014). Recent studies, such as Chaudhuri and Jayaram (2019) and Grosse et al. (2015) highlight the need to investigate the impact of the structure of the workforce (the ratio of temporary workers to permanent workers) on general operational performance dimensions such as quality.

The objective of this paper is to bring these contradicting views together to explore the performance implications of temporary workers on quality performance. Subsequently, we seek to answer the research question: *(1) What are the quality performance implications of employing temporary workers?* Furthermore, we assess whether the potential operational issue with temporary workers is due to a lack of knowledge and skills or whether it is rather due to a lack of effort or motivation, through testing the potential moderating effect of process capabilities. The skill argument is based on the assumption that temporary worker generally

lack firm- and task-specific skills and are largely assumed to be a group of relatively low skilled workers (Wiengarten et al., 2021). The effort or motivational argument is based on the assumption, that at least in a manufacturing setting, temporary workers are of lower standing in terms of remuneration, benefits, rights, and developmental opportunities in comparison to full-time permanent workers (Maertz et al., 2010). Subsequently, we also seek to answer (2) *Can process capabilities eliminate the potential quality performance deterioration that are due to the usage of temporary workers?* Specifically, we conceptualize process capabilities through the company's level of technology, technological know-how, skills, and unique process abilities (Sardana et al., 2020).

To provide answers to these research questions, we analyze survey data collected through the *Global Manufacturing Research Group* (GMRG). The GMRG collects data throughout the world and for this paper we use data from plants situated in 13 different countries. Data is collected from multiple respondents at the plant level of analysis. To analyze the data, we conducted hierarchical regression analysis.

The article is structured as follows. We firstly present a literature review on research conducted in the areas of temporary workers, quality performance and process capabilities, which present the underpinnings of our hypotheses. Afterwards we present our methodological approach and results, and discussion of our findings. We conclude this paper with discussing our limitations and provide avenues for potential future research.

2. Literature review

2.1. Temporary work and operational performance

Non-standard work in general, and temporary work in particular, has been employed as a practice to overcome the initial operational trade-off and simultaneously achieve cost and flexibility gains. According to Chadwick and Flinchbaugh (2013), the non-standard work literature includes a wide range of work arrangements, including temporary work, part-time work, independent contracting, seasonal work, and leased (agency) work (Broschak et al., 2008; Kalleberg, 2000). Thus, multiple terms are being used across disciplines that focus on different aspects and contractual forms of non-standard work.

Over the last two decades there has been a rise in the employment of temporary workers across the globe. According to Eurofound (2018) there has been an increase in workers employed on short-term contracts and paid on a weekly basis, particularly in Austria and Germany. A study by the OECD of twenty-six European countries found that over half of the jobs created between 2007 and 2013 involved temporary employment (OECD, 2018). Specific types of temporary workers have been categorized as having precarious employment and a recent report has shown that the probability of having a temporary contract is high for young, foreign-born workers, with low levels of education (Eurofound, 2018). It is important to differentiate between voluntary and non-voluntary temporary working arrangements, which is largely dependent on skill levels. Generally temporary workers have lower skill levels (especially in manufacturing industries), are employed for a defined duration, and have less firm specific experience. Thus, we postulate that these characteristics are affecting quality performance.

Labor practices, or more generally, capacity management practices to increase output flexibility have been studied from a modelling as well as an empirical perspective in our discipline (de Giovanni and Massabo, 2018). However, the assumption has always been that it

predominantly leads to positive outcomes for companies (i.e., reducing costs and increasing flexibility). The potential downsides of using temporary workers have largely been ignored in our domain (Fisher and Connelly, 2017; Wiengarten et al., 2021). Kesavan et al. (2014), representing an exception, investigated the costs and benefits of flexible labor resources in services. They argued that too much flexibility in workforces (retail sales) could lead to an increase in coordination requirements, resulting in a decrease in sales. They concluded that flexible labor resources could induce inefficiencies and hence they postulated that too much labor flexibility can have negative performance implications. Sancha et al. (2020) explored the role of temporary work on the impact of lean practices on operational performance. Lean was conceptualized through just-in-time practices, TQM practices, and TPM practices and performance was conceptualized through cost, quality, delivery, and flexibility performance. Through survey data they identified that temporary work only influences the impact of lean on flexibility performance and not on the other three production performance dimensions. This study identified only limited benefits of temporary work in the lean manufacturing environment.

Furthermore, in order to investigate the potential downsides of non-standard and temporary work, the organizational and human resource literature has attempted to combine the organizational perspective with the workers' perspective. Fisher and Connelly (2017) used a simulation approach to assess the organizational cost and benefits of using contingent work. Overall, they identified that the assumed relationship "temporary workers reduce labor costs" does not hold holistically and that the indirect costs also have to be taken into consideration. Using a production management lens, Wiengarten et al. (2021) took a holistic approach to explore the performance implications of precarious work on organizational performance. They conceptualize precarious work as a multi-dimensional construct measuring employment insecurity, inadequate income, and a lack of rights and protections (Campbell and Price, 2016;

Kreshpaj et al., 2020). Organizational performance was conceptualized in terms of production cost and flexibility performance, occupational health and safety, and financial performance. Applying a human capital perspective, they argued that the employment of precarious workers does not result in the development or accumulation of human capital and thus does not lead to a sustainable competitive advantage (Methot et al., 2018). Furthermore, they identified an inverted u-shaped relationship between the adoption of precarious work, flexibility, and financial performance. relatively lower levels of precarious work improve flexibility and financial performance whereas relatively higher levels of precarious work harm both, thus indicating the existence of diminishing returns from increasing the levels of precarious work.

These results can be theoretically interpreted and underpinned through reciprocal exchange theory. The rationale for applying this viewpoint to our research model is that temporary work conflicts with the principal concept of reciprocal exchange (i.e., mutual resource investment) between the temporary worker and the employer (Chadwick and Finchbaugh, 2013). The central idea of reciprocal exchange theory is based on the notion that employees decide on how much they invest of themselves in their workplace. They judge their level of investment on the experience they have with the organization as an entity or system (Tsui et al., 1997). Based on the notion of give and take, a contingent work arrangement, as present in this research in the form of temporary contracts, indicates a lack of investment in this type of workforce and a transitory employment relationship (Chadwick and Flinchbaugh, 2013). This is indicative economically through generally lower levels of pay and benefits and psychologically through being put in the position of a “*second-class citizen*” (i.e., worker) in comparison to standard workers (Chadwick and Flinchbaugh, 2013). Based on reciprocal exchange theory, their response by the temporary workers would be to reduce their investment in the workplace (i.e., effort). Practically, this can have consequences for the quality of the work and the subsequent organizational quality performance.

2.2. Temporary work and quality performance

Our review of the literature has revealed that only a very few studies have explored the specific implications of non-standard forms of work on quality performance. Kesavan et al. (2014) explored the costs and benefits of flexibility labor resources in a service setting. They concluded in their discussion they concluded that their results might have been different if they would have introduced additional dependent variables such as service quality. Another study by Hashemi-Petroodi et al. (2020) highlighted that temporary workers can be used as complementary to permanent workers; however, they refer to workforce assignment problems due to the differences in skill levels. In seasonal or uncertain demand, the use of temporary workers may improve the responsiveness of a manufacturing system, but there are possible trade-offs in the form of product quality. Stratman et al. (2004) conducted a multi-method study on the deployment of temporary workers in assembly productions. They identified that the initial benefits achieved through deploying temporary production workers deteriorates over time. With regards to quality performance, Stratman et al. (2004) concluded that temporary workers have higher average defect rates associated with their assembly activity, and lower rates of learning. Additionally, this leads to higher levels of variance of their production time. Studies by Gabszewicz and Turrini (2000) and Mital et al. (1999) investigated the relationship between worker's skills and product quality. Their findings indicate that lower skilled workers produce lower quality products, and vice versa. Results show that the skill of a worker represents a key decision factor to determine the effectiveness and efficiency of a production line, as well as the quality of the outputs. A recent study by Jeunet and Bou Orm (2020) developed a mixed integer linear programming model to assess the relationship between temporary work and quality. They identified that when companies increase the number of temporary workers, the total and overall quality losses increase as well. Chen et al. (2017)

explored the role of motivation impacting on the performance of temporary agency workers. They point towards a potential lack of intrinsic and extrinsic motivation of temporary agency workers. They imply that in order to not suffer from performance deteriorations (i.e., quality performance) extensive monitoring and monitoring costs occur with temporary agency workers.

Subsequently, quality performance is a result of workers not only being willing (from an effort standpoint), but also not being able (from a skill perspective) to do their jobs effectively (from a quality standpoint) and to engage in continuous improvement activities. However, temporary work emanating from working at a specific plant, on a specific process for only a very limited timespan impedes task related work experience and the development of specialized skills (Allwood and Lee, 2004). This reduces learning effects, the development of routines, limits the creation of process knowledge and can result in negative quality performance outcomes (Kesavan et al., 2014). Furthermore, temporary workers are generally characterized by lower levels of skills and training, relative to the permanent workforce (Fisher and Connelly, 2017). Subsequently, we conclude from the review of the literature, that some evidence suggests that temporary workers may lead to quality performance issues. However, this has been mainly explored from a modelling or theoretical perspective (e.g. Fisher and Connelly, 2017, Jeunet and Bou Orm, 2020). Empirical evidence on the quality performance implications of temporary work is still sparse. Furthermore, from a theoretical perspective the reasons for it are contradicting and still underexplored. Thus, in order to explore the mechanisms and reasons as to why quality performance may deteriorate, we propose:

H1: An increase in the usage of temporary workers will result in deteriorating quality performance.

2.3. Process capabilities, temporary workers, and quality performance

The argument that the use of temporary workers may cause quality issues seems to be theoretically convincing. For a temporary worker, being less engaged to an employer and putting in less effort (in comparison to the permanent workforce) should thus result in quality deterioration. This is the argumentation we developed in the build-up of hypothesis one.

However, if we observe practice and industries, it still seems that companies employ temporary workers successfully with all the cost and flexibility benefits, but largely without declining quality performance. For example, the car manufacturer BMW has used up to 500 temporary workers in its manufacturing plant in Greer South Carolina (Mitchell, 2019). They produce part of their “X” model range (models X3, X4, X5, X6, and recently X7) in that specific South Carolina plant. However, whilst using temporary workers to induce volume flexibility, BMW does not seem to have specific quality issues with these models as they are consistently ranked high in terms of reliability, customer satisfaction etc. (e.g., JD Power¹).

The argumentation we are developing for hypothesis two (a) is based on the skill argument and implicitly tests for the effort argumentation as well. Being relatively less qualified and trained, working only for a defined duration on a specific process or workstation can lead by itself to quality issues. However, enhancing process capabilities could enable companies to hire temporary workers without the potential downside of quality performance deterioration. Thus, referring back to the quality management literature we propose that companies that are successfully employing temporary workers, might have distinguishing capabilities developed at the process level.

¹ <https://www.jdpower.com/cars/ratings/quality/2019/top-ranked-luxury-suvs-2019-jd-power-us-initial-quality-study>

Taking a process management perspective to quality, has been a key pillar of quality management (Dean and Bowen, 1994; Sila and Ebrahimpour, 2005; Evans and Lindsay, 1995). According to Kaynak (2003), “[quality] *process management entails taking a preventive approach to quality improvement such as designing processes that are fool-proof and that provide stable production schedules and work distribution to reduce process variation by building quality into the product during the production stage*” (p. 417-418). Focusing on reducing process variability is then a key capability at the process level achieved through process design, transforming-, and transformed-resources. Employing temporary workers, by characterization, induces variability into the process. Thus, referring back to the previous quote, the process design needs to focus on all other sources of variability (Forza and Flippini, 1998) and the workplace needs to be designed to be fool-proof, stable and predictable (Flynn et al., 1995; Saraph et al., 1989).

Process variabilities and output variation can be reduced through process capabilities that are developed through practices such as preventive maintenance (Ho et al., 1999), investing in state-of-the-art processes and technologies. In our first moderating hypothesis we thus propose a complementary argument. Process capabilities could support and enable temporary workers to execute their tasks to a comparable degree of similarity and accuracy as the permanent workforce. If that is the case, the arguments made in the development of our first hypothesis could be disregarded or reduced and temporary workers would not negatively affect quality performance in the presence of process capabilities. Thus, if process capabilities can dampen or eliminate the negative performance implications of temporary work then the skill and knowledge perspective would be supported. Process capabilities could then be viewed as a substitute for the lack of skills and knowledge of the temporary workforce.

Subsequently, we hypothesize:

H2_(a=skill hypothesis): Process capabilities positively moderate the relationship between temporary workers and quality performance.

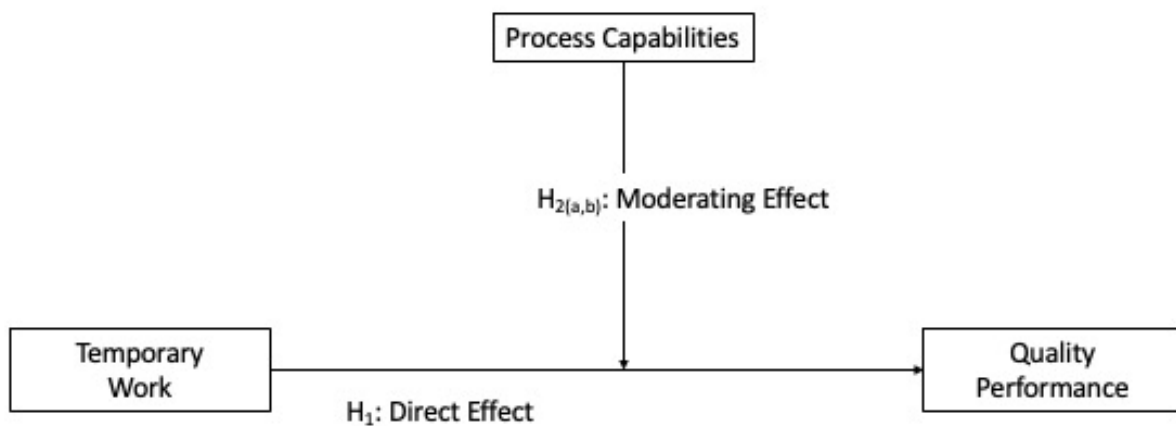
However, a rejection of H2_(a) would imply a rejection of the skill substitution argument that has been proposed. Recently, there has been a debate on the application of the social exchange perspective to analyze the relationship between employers and workers in production management (Wiengarten et al., 2021). The argument being that if workers feel that they are not treated fairly they respond with lower levels of efforts. Thus, in terms of quality management, if the argumentation would solely be based on the social exchange perspective in terms of reciprocal exchanges, the operational arguments might not suffice. A rejection of the previous hypothesis would indicate that companies could not develop and apply process capabilities to substitute for the lack of knowledge and skills. If temporary workers are feeling disadvantaged in comparison to the permanent workforce and evaluate the employer-employee relationship as unfair, they may intentionally put in less effort. Thus, even with high levels of automation a negative intervention by the worker could lead to negative quality performance outcomes. Therefore, even the existence of high levels of process capabilities would not prevent temporary workers adversely affecting quality performance.

Furthermore, Chadwick and Flinchbaugh (2013) has argued that when the percentage of temporary workers increases, the likelihood of interactions between temporary and standard workers also increases. This rise in interactions may lead to the discovery of differences (e.g., pay, social security etc.) between temporary and standard workers. According to Boswell et al. (2012), *“this perception of lower status could interfere with contract workers forming relationships with standard employees and developing an emotional attachment to the client organization”* (p. 456). Subsequently, following the reciprocal exchange argument we propose a counter hypothesis as:

H2_(b=effort hypothesis): Process capabilities do not act as a moderator between temporary workers and quality performance and thus quality performance is negatively affected.

In Figure 1, we graphically illustrate our research model including our direct hypothesis (H1) and the potential moderating hypothesis (H2_(a,b)) that have been stated as competing hypotheses based on the literature and theoretical underpinnings.

Figure 1. Research Model



3. Method

3.1. Sample and data collection

To study the performance implications of temporary work on quality we utilize data collected through the Global Manufacturing Research Group (GMRG). The GMRG is a multinational association of researchers in the area of production and operations management, that has conducted joint surveys since 1985. Over the years, it has developed and refined a common survey instrument and data collection protocol. Frequently, the GMRG has collected over the past years through multiple survey rounds across the globe. The fifth round of GMRG survey data was collected in 14 countries and across 21 manufacturing industry sectors. The original English survey instrument was translated into the native language of each country

using the back-translation approach suggested in Sperber et al. (1994). The manufacturing plant was surveyed as the study's unit of analysis and the operations/plant/production managers were the key informants. They were advised to liaise with other functional managers/departments if they were unable to answer the questions. Returned questionnaires were controlled for missing data by the local survey administrators and were handled on a case-by-case approach, usually by contacting the plant again (Durach and Wiengarten, 2020). The local survey administrators also checked for non-response bias in their subsamples by comparing key demographic information of early responses (i.e., early third) with that of late responses (i.e., late third) (Armstrong and Overton, 1977). No statistically significant differences between these groups were identified. We could not contact individuals that did not respond to the surveys due to the unavailability of such information. Therefore, in order to further corroborate the non-response bias, we carried out independent sample t-tests to compare surveys from questionnaires that were fully completed to those that were only partially completed (Wagener and Kemmerling, 2010). This approach is considered more rigorous (Wright and Amstrong, 2008), as it uses the incomplete surveys as a proxy for non-respondents and are not included in our sample. The results showed that the differences between complete and incomplete questionnaires were non-significant ($p > 0.05$), further reinforcing the absence of non-response bias.

A detailed overview of the scale development and the administration of the survey instrument can be found in Whybark et al. (2009). In this fifth round of the GMRG survey, data was collected from plants situated across the globe. Due to missing data we could only utilize a portion of the dataset ($n=863$). To defer from any potential biases between the utilized sample and the sample group with missing data, we analyzed for potential differences across a selected number of variables (i.e., production performance variables). No significant differences were detected.

Specifically, data was collected across 13 nations (in our sample: Australia (n=71), China (n=97), Croatia (n=112), Germany (n=44), Hungary (n=36), India (n=57), Ireland (n=30), Nigeria (n=38), Poland (n=80), Taiwan (n=40), Ukraine (n=48), USA (n=168), and Vietnam (n=42)). We tested and confirmed measurement equivalence across all nations in section 3.3.

The data is quite wide ranging across the variables, increasing the potential for generalizability, with data collected from manufacturing firms across 21 industries. However, it has to be acknowledged that one major limitation of GMRG data collection process is that each survey administrator individually decided on the most appropriate collection process (i.e., timing and online vs. mail-survey) and the suitable population.

In addition to the core module of the survey, the local survey administrators were free to collect data on a number of specific modules (i.e., innovation, sustainability, supply chain management and facility culture). In Table 1 we display the descriptives and correlations of the variables we use to test our research model.

3.2. Construct Measurements

Our study explores the quality performance implications of temporary workers and how process capabilities influence this relationship. To measure temporary workers, respondents were asked to indicate what percentage of the direct production workers are temporary. This measure is aligned with the OECD (2018) broad description of temporary workers, as those workers have an employment contract with a pre-defined termination date (Sancha et al., 2020).

Quality performance was measured through the aggregation of three variables that encompassed the percentage of rejects during processing, rejections at final inspection and rejections from the customer (Power, 2014; Schmenner and Vastag, 2006). An increase in the value of quality indicates an increase in rejects and thus declining quality performance. In the regression analysis we use the aggregated measure of quality, consisting of processing rejects,

inspection rejects and returns to develop composite measure for quality. Thus, for each company we calculated the percentage sum of processing rejects, inspection rejects and returns. A higher percentage indicates worsening percentages and thus deterioration in quality performance.

Furthermore, we utilized existing measures from previous studies to assess a plant’s process capabilities (Wu et al., 2010; Jonker et al., 2006). Using a Likert scale from 1 (not at all) to 7 (great extent) respondents were asked to indicate their level of agreement with regards to having state-of-the-art manufacturing processes.

Finally, company size and industry type were used as control variables. Company size was measured through the number of employees (Durand and Coeurderoy, 2001). Larger companies are likely to invest more in plant capabilities, compared to smaller plants. Additionally, we controlled for industry type since certain industries are more proactive towards investments in their firms’ capabilities (Hines et al., 2004). The inclusion of these two control variables will increase the generalizability of this study across the industries and company sizes within this sample. All survey items are listed in Appendix A.

With regards to ensuring content validity, it is important to note that the GMRG survey instrument has been developed over a number of years and administered over five rounds. Input from well-recognized scholars and industry practitioners were used to design the questionnaire (Whybark et al., 2009).

Table 1. Descriptives and correlations

Variables	Descriptives		Correlations			
	Mean	Std. Deviation	(1)	(2)	(3)	(4)
Company size (number of employees) (1)	1033.98	7309.32	1	-.008	.068*	-.040
Temporary workers (percentage) (2)	12.32	19.43	-.008	1	.027	.080*
Process capabilities (7-point likert scale) (3)	4.68	1.498	.068*	.027	1	-.064

Quality performance (percentage) (4)	12.26	20.02	-.040	.080*	-.064	1
*Correlation is significant at the 0.05 level (2-tailed)						

3.3. Data equivalence

The GMRG collects data throughout the world and in this case, we utilize data from plants situated in 13 different countries. Thus, data inequivalence across countries may be a potential source of measurement error. The operationalization of the constructs may be interpreted differently across the countries in the subsample (Hult et al., 2008). We therefore employed several measures to ensure high levels of data collection equivalence in terms of measuring constructs and the measurement for the plant-level variables.

Firstly, the rigorous data collection approach ensured equivalence through: GMRG survey administrators employed a response bias test within each country specific subsample. Furthermore, the individual data collection process was coordinated to be executed over the same period of time across all countries. Finally, the data collection procedures were aligned across countries.

Additionally, measurement equivalence within the plant-level variables was established by ensuring translation equivalence using the back-translation approach for the survey items. It has to be noted that the wordings of some constructs were slightly modified to better reflect country differences. In addition, we conducted an equality of means test (ANOVA) and reject the null hypothesis of mean invariance (i.e., between-country mean differences observed for all three constructs: temporary work, process capabilities, quality performance).

4. Analysis and results

To test the proposed hypotheses, we carried out a moderated hierarchical regression analysis. In the first step, the control variables company size and industry type were added. In

the second step, the independent variable (IV) temporary workers measure was introduced to test the direct effect on the dependent variable (DV) quality performance. In the third step, the process capability construct was inserted; lastly, in the fourth step the interaction term (temporary workers and process capabilities) was introduced. To test the moderating effect of process capabilities on the relationship between usage of temporary workers and quality performance we followed Baron and Kenny (1986) approach and reported the results in line with Goldsby et al. (2013). Firstly, we standardized the independent variable (usage of temporary workers), as well as the moderator (process capability). Secondly, we created the product between the IV and moderator, to determine the interaction term (TWxPCap). Thirdly, we added the IV, moderator and interaction term in the regression. The variance inflation factors (VIFs) were determined and the resulting values indicate that multicollinearity is not apparent (see table 2).

Table 2. Regression results

DV: Quality Performance	Step 1	Step 2	Step 3	Step 4
Control Variables:				
Company Size	-0.083*	-0.095*	-0.095*	-0.095*
Industry Type	0.043	0.050	0.050	0.050
Independent Variables:				
Temporary Workers (TW)		0.071*	0.071*	0.071*
Process Capabilities (PCap)			0.005	0.005
Moderator:				
TW*PCap				0.006
R square Change/Sig.	0.008/ (0.063)	0.005/ (0.074)	0.000/ (0.904)	0.000/ (0.885)
Max VIF	1.001	1.032	1.085	1.097
R	0.092	0.115	0.125	0.116
Adjusted R2	0.005	0.009	0.007	0.006

Note: *p<0.1; Standardized Coefficients

Hypothesis 1 stated that an increase in the usage of temporary workers will result in deteriorating quality performance. Our results show a significant negative effect between the usage of temporary workers and quality performance ($\beta=0.071$, t-static=1.787). This supports our argument that companies that display an increase usage of temporary workers will achieve

lower quality performance. Companies that are overly reliant on temporary workers will tend to experience a lack of job-related effectiveness. This is due to the limited opportunities for temporary workers to develop task related work knowledge and/or the enhancement of specific skills (Allwood and Lee, 2004). Our findings corroborate with Kesavan et al. (2014) and Fisher and Connelly (2017), in that the usage of temporary workers diminishes the development and existence of process specific knowledge and skills that subsequently lead to lower quality performance outcomes.

Our second hypothesis H2(a) argued that process capabilities positively moderate the relationship between temporary workers and quality performance. This hypothesis was not supported ($\beta=0.006$, $t\text{-static}=0.145$) and the finding is in contrast with previous literature, that posits that process capabilities can act as a dampener for process variability and output variation (Ho et al., 1999). Subsequently, our result supports our counter hypothesis H2(b) and highlights that companies cannot rely on process capabilities to reduce the negative effects that temporary workers have on quality performance.

The results are somewhat aligned with the social exchange view, in that workers efforts in their daily work are proportional to the support they receive from their employers (Eisenberger et al., 1986). Given that temporary workers are likely to be subjected to job uncertainty and a perceived lower status in the company structure, they will have lower levels of commitment (Sancha et al., 2020). Through these findings we imply that we disprove the *knowledge and skill* argumentation and find support for the *effort* proposition. In other words, it is not the lack of skills and knowledge of the temporary workers that leads to quality performance issues but the lack of effort by temporary workers.

5. Discussion

The need for flexibility with a simultaneous emphasis on cost is not a recent, but rather a very pressing and acute demand that production management is facing in this current recession (de Giovanni and Massabo, 2018). Policies and rules across many countries have made it very attractive for companies to “find flexibility” through their work force. Traditionally temporary workers have been used to manage surges of seasonal demand. Production management research has typically concluded that flexible forms of work reduce costs and increase flexibility and ultimately financial performance (e.g., Kesavan et al., 2014).

However, unsurprisingly in the current business climate, more often businesses are relying on temporary workers to take on an increasing share of the “regular” capacity requirements in companies (e.g., last mile delivery companies) (Blustein et al., 2020). Much of the burden and risk that helps to overcome this initial trade-off between cost and flexibility has, in many respects, been forced upon employees by employers and has been recently discussed in the production/operations management literature under the umbrella term “precarious work” (Wiengarten et al., 2021). Temporary work and workers represent one facet of precarious work. In this paper we took a quality viewpoint on temporary work through assessing the performance implications of temporary workers. Thus, instead of solely focusing on the benefits of temporary work, this paper proposes and investigates its potential downsides in terms of quality performance. Recent literature has argued that a holistic performance appraisal is needed when judging the benefits of such precarious employment practices (Fisher and Connolly, 2017). Consequently, this paper was set out to explore: *What are the quality performance implications of temporary workers?* We identified that with the increased employment of temporary workers firms will experience worsening quality performance. This finding should not come as a surprise to managers, as to some extent this finding represents our managerial intuition. Relying

on temporary workers makes it difficult to develop and rely on firm specific process skills that are required to produce materials and products of high quality.

Furthermore, in our second research question we proposed the development and existence of *process capabilities to manage the negative quality performance influence of temporary workers*. We argued that if process capabilities could ultimately reduce the negative implications of temporary workers the skill hypothesis would prevail. Or in other words, the lack of effort and motivation is not the decisive factors. Our results could not find support for this. Process capabilities cannot dampen the negative quality performance implications of temporary work. Thus, our findings indicate that the negative performance implications of temporary work are likely to be due to a lack of effort/motivation and not a lack of knowledge and skills of the temporary workers. We will discuss the managerial and theoretical implications of these findings in the following sections.

5.1. Managerial implications

The ability of a firm to induce volume flexibility in their production system is becoming more and more crucial to its survival and can be a source of competitive advantage. Predicting the future in terms of demand patterns is unsurprisingly more difficult in times of high uncertainty. Companies have been reacting to unpredictability through developing and employing capacity flexibility (e.g., Dong et al., 2014). On the surface, a relatively easy and cost-efficient approach and fix to induce flexibility in an operation is to use temporary workers in production as well as in service processes. Furthermore, the current labor market and its conditions make the employment of temporary workers a practical working solution across countries (The Guardian, 2018). Employing temporary workers, induces volume or quantity flexibility in the production process making it possible to, at least from a human resource perspective, to alter capacity levels (Schwab et al., 2019, Ostermeier, 2020). Whilst this has

not been hailed as a “sophisticated” approach to create flexibility, it has the advantage of being a relatively quick fix (Wiengarten et al., 2021). Production managers have for some time relied on this practice to successfully manage their plants through uncertain times and more often during stable economic cycles, as well.

Our study had the intention to help managers to make a more informed decision when considering the employment of temporary workers. As mentioned previously, from a management perspective, it is easy to focus on the flexibility gains and overhead reduction of using temporary workers. However, this study has identified that there are clear downsides to employing such an approach. Our results indicate that increasing the percentage of temporary workers leads to an increase in reject rates during processing, reject rates during inspection and the percentage of product return from customers. Traditionally, the treatment of the workforce and the negative performance implications of temporary work have not been the focus of the production management domain (Wiengarten et al., 2021). Our finding seems to be intuitive or somewhat unsurprising, but one that is rarely considered when making a cost/benefit analysis for employing temporary workers (Fisher and Connolly, 2017). Subsequently, managers need to take the cost of temporary workers, i.e., the deterioration of quality, into consideration when making this important operational decision, leading to negative strategic consequences for the organization. The costs of quality are well-known stemming from internal costs such as excess material usage, machine breakdowns, re-works, and waste to external costs such as reputational losses, customer complaints, service or repair costs, and warranty claims (Feigenbaum, 1956). An increased usage of temporary workers can have initial and lasting performance repercussions. Thus, the initial gains need to be weighed up against the cost, which manifests itself in terms of poor-quality performance. With this finding, managers can make a more realistic and informed decision in terms of managing the composition of their workforce with regard to how many temporary workers are employed. Ultimately, managers

need to be aware that when increasing the reliance on temporary workers, there are performance implications to consider when making decisions with regard to the trade-off between cost and flexibility.

Furthermore, we recognize that the practice of relying on temporary work arrangements is here to stay, and over time, given the regulatory environment it is only likely to increase. Thus, the question from a company's perspective is how to make it work for both stakeholders, the workforce, and the employer. Additionally, we also observe that companies are indeed using temporary workers without any observable quality performance drawbacks (see BMW example in Section 2.2). Consequently, this prompts the question as to how to integrate precarious workers into the existing manufacturing processes. Hypothesis one revealed that temporary workers do negatively affect quality performance. Thus, we proposed that process capabilities could be the factor that may support temporary workers in their activities at the shop floor. Our results indicated that even with relatively high levels of process capabilities, quality performance is negatively affected. This is an important finding in combination with hypothesis one. Managers need to be aware of the potential negative performance consequences of temporary workers and the apparent difficulties of managing the drawbacks of these types of workers. It seems that process design decisions, in terms of capability development, on their own do not suffice. A combination with contemporary human resource practices, such as developing employee value programs, which provide formal training and encourage empowerment, as proposed by Wiengarten et al. (2021), might dampen or eliminate the negative performance consequences of temporary workers. However, as outlined in this paper the initial cost and flexibility gains that companies are striving for when employing temporary workers might quickly diminish. Subsequently, managers have to take the costs of employing temporary workers into consideration when making a cost/benefit decision. Ultimately, the relationship between temporary workers and employers should simply be

viewed from a reciprocal social exchange perspective. For example, if workers feel mistreated, exploited or simply not getting the reward that they expect, the relationship can be terminated; or if continued, the level of engagement with the company reduces and less effort goes into delivering tasks, thus impacting upon performance (Sancha et al., 2020). Our results support this finding, which is an important managerial contribution that we make with this paper. Managers cannot rely on process capabilities to deal with an uneven or unbalanced relationship between the employer and worker (as exemplified through temporary workers). Investing in process capability, in order to gain competitive advantage, should not be done at the expense of hiring temporary workers.

Alternatively, finding more positive and constructive (from an employee perspective) ways to create flexibility could be a more sustainable approach for employers to adopt. For example, a recent survey by the EEF (2011) highlights a range of flexible working practices, such as individualizing shift patterns and compressing work hours, so that employees can work a four day, rather than five day working week. One of the most popular approaches is banking hours, where employees can debit and credit working hours. Thus, during slack periods, employees can take time off whereas, when there is a surge in demand (credited as extra hours), they may need to work overtime. In complex manufacturing processes such practices might be a more beneficial approach in the long run than using temporary workers.

5.2. Theoretical implications

The production management discipline has traditionally viewed workers as part of the operating system, part of the process and have treated the employee as an exogenous factor (e.g., Whitt, 1999; Bhandari et al., 2008). It is only recently, that the worker has become a focus within the production domain, given their impact on the performance of the organization

(Wiengarten et al., 2017). Employing workers on a temporary contractual basis is a common practice and advantageous from a flexibility and cost perspective. However, the potential downsides of doing so for companies and workers have been largely overlooked across disciplines and specifically within the production discipline (Wiengarten et al., 2021). According to Fisher and Connolly (2017), “*contingent workers may represent a false economy when all costs and benefits are considered*” (p. 179). This paper contributed to this largely theoretical discourse through exploring the costs of adopting temporary workers through identifying the negative implications on quality performance.

In contrast to the above, the quality management literature has for a long time emphasized the importance of employees in the achievement of lasting quality performance improvements. The workers play a central role in the sustainable achievement of quality performance levels and improvement in programs such as TQM (Martinez-Costa et al., 2009). We resonate on their importance with our results from two perspectives. Firstly, temporary workers are generally of lower skills, especially in the manufacturing environment, and thus in comparison to the permanent workforce less able to positively influence quality performance. Secondly, due to the lower status and generally less favorable contractual arrangements, in comparison to the permanent workforce, temporary workers may have less motivation to put in the effort to sustain a focus on quality.

Related to this, we implicitly based the relationship between temporary workers and quality performance on reciprocal social exchange theory (Tsui et al., 1997). We postulated that temporary workers may not judge their relationship with their employer as fair in comparison to the permanent workforce. Our results provide support for this proposition in the sense that higher levels of employment of temporary workers lead to quality performance issues. In addition, these quality issues may be a result of temporary workers putting in less effort.

Another explanation for the diminishing effects of quality performance is related to the lower levels of skills and knowledge of the temporary workforce. We implicitly established this proposition through testing whether enhanced process capabilities can counteract the adoption of a temporary workforce and thus avoid a deterioration in quality performance. Our results indicate that even with relatively high levels of process capabilities, quality performance issues arise as the level of temporary workers increases. Our results provided support for the effort hypothesis (H2b) but not for the skill hypothesis (H2a). Theoretically this implies that process capabilities cannot compensate for the lack of skills. Thus, we concluded that the reciprocal exchange theory argumentation provides an explanation of the negative relationship. In other words, it is not the lack of skill that leads to quality performance deterioration but rather the lack of effort of the temporary workers.

6. Conclusion and limitations

The aim of this paper was to explore the quality performance consequences of an increased reliance on temporary workers. We identified that with an increased usage of temporary workers, plants can expect that their quality performance will deteriorate. Furthermore, we identified that even the development of process capabilities cannot prevent companies from these negative performance consequences. The power of the simplicity of the paper and the intriguing findings make this paper important for production management and the wider community. Furthermore, the current labor market environment will only encourage the use of temporary production workers, given the need for volume flexibility to react to uncertainty in demand and supply. We also found that process capabilities cannot prevent companies from experiencing negative performance implications of temporary work.

There are a number of limitations with the current study, which may also provide opportunities for future research. First, the sampling method employed by GMRG is not

random. However, the sample consists of a broad set of plants surveyed that are large and diverse. This allows for some degree of generalizability. In addition, we tested and confirmed that our sub-sample that we used, did not differ significantly from the total sample of key demographic metrics. We therefore conclude that the inferences we drew from our data, provide important managerial and theoretical implications. Second, the number of respondents per survey varied. In the GMRG survey, between one and six respondents were deployed from each plant to fill in the survey questionnaires. While these respondents are considered key informants within their firms, with potentially the best vantage point for viewing the required aspects of their organization, they ultimately represent a source of subjective information. Furthermore, we only considered process capabilities as a possible moderator between temporary workers and quality management. However, other factors such as high-performance human resource practices might also affect the relationship. From a production management and multi-disciplinary perspective there may be many factors that could be explored in future research. Finally, the measure process capabilities might be overly simplistic in its conceptualization. Process capabilities are developed through an interplay of technology, human operator and managerial skills. A more nuanced, or multidimensional measurement might provide more refined results. Nevertheless, taking these limitations into consideration this research contributes to the production management discipline in providing an alternative performance assessment of temporary work and investigating its potential downsides.

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Appendix A Survey Instrument

Temporary Workers

What percentage of the direct production workers is temporary? % of direct workers

Quality Performance

Please give the following reject rates:

Percent rejects during processing %

Percent rejects at final inspection %

Percent returns from the customer %

Process Capabilities

Please indicate your level of agreement with these statements on the plant's capabilities: (range

1=not at all; 4= to some extent; 7= to a great extent)

1. Your plant has state-of-the-art manufacturing processes 1 2 3 4 5 6 7

Control variables

Company size: Approximately how many employees work at the plant in total?

Industry type: Please identify the industry sector that describes your business activity