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Uncovering the link between worker well-being and factory performance: A longitudinal study with workers in China

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Title: **Uncovering the link between well-being and factory performance among workers in China: A longitudinal study**

Abstract

Purpose. Companies are concerned about the well-being of workers in their supply chains, but conventional audits fail to uncover critical problems. Yet, if the *happy worker – productive worker* thesis is correct, it would benefit factories in fast-developing countries, particularly China which is key to many global supply chains, to ensure the well-being of their workers. We set out to better understand the relationship between well-being and performance in four Chinese factories.

Approach. Over 12-months we collected digital diaries from 466 workers in four factories, and monthly data about the performance of their factories. We used this data to gain insights into the well-being of workers in these factories; to design experimental interventions to improve this; and to consider any effects these had on factory performance.

Findings. Our experiments showed that training interventions to improve workers' well-being through their work relationships and individual skills improved not just a factory's general worker well-being, but also some aspects of its performance and worker retention. Thus, it brought benefits not only for the workers but also for the factory owners and their client companies.

Originality. While there is a significant body of research investigating the *happy worker – productive worker* thesis, this was not conducted in Chinese factories. Our work demonstrates that in this and similar environments, workers' *eudaimonic* well-being is more important than might be assumed, and that in this context there is a relationship between well-being and performance which can be practically addressed.

Keywords: worker well-being, digital diaries, CSR audits, supply chain factories, factory operational performance, factory productivity.

1. Introduction

SDG8 of the UN's Sustainable Development Goals promotes "decent work and economic growth". While China has significant economic growth – particularly in manufacturing for Western clients – there are still reports of poor social conditions in this industry, and pressure on the buying companies to better safeguard the workers in their geographically remote suppliers' factories. Yet, while factory audits are now widely used, there is little evidence that they are actually improving people's well-being at work (Sinkovics *et al.,* 2016; Anner, 2017). Instead, they may be seen as an inconvenience rather than an opportunity for learning and improvement.

Yet the *happy worker – productive worker* thesis (Zelenski *et al.,* 2008) would suggest that improving well-being could lead to productivity improvements, creating an incentive for factory managers to pay attention to their workers' well-being. However, how can we know about workers' well-being, given that this is not explored by conventional audits? And what exactly is the relationship with factory performance? We built on our earlier study of well-being in a Chinese factory (Bellingan *et al*., 2020) to explore the relationship between well-being and factory performance.

We conducted a year-long study in four Chinese factories. Our three-stage approach was to: 1) use diary data gathered during our initial pilot study (Bellingan *et al*., 2020) to develop a theoretical model for improving the well-being of these workers, then 2) conduct action research testing some interventions suggested by those diaries and 3) use workers' diaries and factory-level performance metrics to test hypotheses about these. We designed two experimental interventions and implemented both in two of the factories, continuing to monitor the well-being in, and performance of, all four factories throughout. We found our intervention removed some of the factors we had seen undermining worker well-being, allowing them to be more productive. This appeared to improve their well-being, rather than vice versa.

This suggests that in settings where well-being is primarily *eudaimonic*, rather than hedonic, making individuals' work more productive can improve both factory performance and well-being. This has important implications for how companies work with their supplier factories: once an audit has established that a factory is safe, rather than trying to find ways to audit the more subtle aspects of well-being, it may be more effective to work with factories to improve their workers' ability to perform in their roles.

2. The well-being of Chinese factory workers

2.1 The changing role of well-being in Chinese factories

China has become known as *the world's factory* (Yang and He, 2016). Its role in global supply chains remains crucial. In the largest, most rapid urbanisation in history (Hamnett, 2020), millions of China's rural workers migrated for factory work. Meanwhile, Western consumers, increasingly conscious of global working conditions, urge companies to ensure factory workers' well-being, most often asking where, by whom, and under what conditions their products are produced (Benoît-Norris *et al.,* 2012). Risks to well-being may not be physical: they can also be social, as low wages and long hours lead to adversarial behaviour in a struggle for promotion (Jacka, 2014; Siu, 2017). Media continue to report unethical labour practices. In 2019, Amazon faced global reports of poor well-being among

schoolchildren pressured into working overnight at a Chinese factory owned by Alexa-supplier Foxconn (Chamberlain, 2019). This same manufacturer had seen multiple worker suicides in 2010 and 2011 (Dean and Ting-I, 2010; Mozur, 2012).

Despite the reputational risk such stories present to a factory's client companies (Glendon, 2013; Rogers, 2016), some companies know little about conditions in their supply chains. They usually seek reassurance about the well-being of workers in fast developing countries through third-party audits, which have not been successful in improving workers' well-being. Studies suggest they can fail to produce even adequate transparency (Sinkovics *et al.,* 2016; Anner, 2017). Factories in Rana Plaza, for example, had been audited weeks before its fatal collapse (Sinkovics *et al.,* 2016). Audits tend to produce a culture of compliance which fails to reduce a company's reputational risk, to improve workers' well-being, or to add value for the factory (Egels-Zandén, 2014; Sinkovics *et al.,* 2016; Anner, 2017).

Meanwhile, pressures on manufacturers are changing. The Chinese factory workforce is ageing and shrinking. While former migrants can afford to stay closer to family, young adults reject factory jobs for education (Cheng, 2021). Factories are struggling to keep production roles filled. Their workers' well-being is therefore vital, to both social sustainability and the continued prosperity of interested companies. The priorities of China's factory workers changed as physical conditions improved (Unger and Siu, 2019). They may now rightly view safe conditions and fair wages as rights, but also need career prospects, hope and self-worth. They value training and management that encourages productive behaviour (Luthans *et al.,* 2005; Luthans *et al.,* 2008). The literature also highlights relationships with both management and colleagues (Dutton, 2003). Well-being support may require more than simply providing for workers' basic needs.

If well-being improves performance, everyone benefits. The workers are able to achieve their aspirations, and client companies face less reputational risk. However, there is currently no standard well-being model for use in examining factory conditions (Vogel, 2010; O'Rourke, 2003; Locke, 2013). Because hedonic elements such as temperature and noise are simple to measure, these tend to form the basis of the labour standards monitored through audits (Cottini *et al.,* 2011; Schwarz *et al.,* 2016; Adler *et al.,* 2017). Other well-being aspects are at least as important to Chinese factory workers (Bellingan *et al.,* 2020).

2.2 Are happy workers really more productive?

The idea that happy workers are productive is intuitively appealing. Fisher (2003) found 92% of Australasian employees believed *a happy worker is likely to be a productive worker.* However, seven decades of studies have produced inconsistent results (Zelenski *et al.,* 2008) remaining inconclusive on one intriguing question in particular: if there is a relationship between happiness and productivity, what is the causality?

Happiness is an elusive concept, not straightforward to define or measure in workplace settings (Benuyenah and Pandya, 2020). Debates about whether it is a trait or a state have led research along two paths, one examining relationships with personality, the other exploring situational factors such as job or life satisfaction. Happiness and life satisfaction, both fundamental to subjective well-being, are different. Happiness is an immediate, usually transitory, emotion. This has led researchers to alternatives such as *job satisfaction,* which is easy to measure using surveys. A recent meta-analysis (Krekel *et al.,* 2019) found a strong

correlation with company performance. However, this may be contextual, and arise from multiple factors in a given situation. Fisher (2014) identifies three types of well-being: hedonic (pleasurable), eudaimonic (developmental) and social (relational). Each has its own sub-categories, constructs and indicators, any of which can act in combination (Gallagher *et al.,* 2009).

What, then, is well-being in a manufacturing context? Literature on well-being in manufacturing tends to focus on Western workplaces, and on testing correlations between performance factors and fixed positive traits such as conscientiousness or self-esteem (Luthans et al., 2005). Sustainable supply chain management (SSCM) studies have focused on physical conditions. Work environments are also social and organisational, and both can significantly impact satisfaction and well-being (Manaf *et al.,* 2019). Researchers identify social environmental threats to well-being including lack of promotion prospects (Jaesok, 2015) and being treated as a commodity, devalued, socially marginalised or subjected to violence or harassment (Perera-Desilva, 2015; Akhter *et al.,* 2019). Conversely, well-being can develop from the promise of upward mobility and positive supervisor feedback (Hewamanne, 2018; Levi, 2019).

Before we can assess any relationship between well-being and performance in a Chinese factory we need an effective model of well-being in this environment, which may include hedonic, eudaimonic and social factors. We also need to discover how to measure this. Studies in Western settings tend to focus on situations where individual productivity is easy to measure, like call centres. Although Western studies do suggest a correlation between well-being, or happiness, and productivity, causality remains unclear (Warr and Nielsen, 2018; Krekel *et al*., 2019). If there is a connection, it may not be straightforward (Warr and Nielsen, 2018). Well-being and productivity could have a common driver, like good management, or a common obstacle like an outdated production system.

There have been few attempts to address these questions outside the Western workplace. The only previous studies attempting to measure Chinese factory workers' well-being (i.e. Luthans *et al.,* 2005; Luthans and Youssef, 2007; and Luthans *et al.,* 2008) showed a promising connection with performance, but the methods used had significant limitations. First, the well-being data was collected at one point in time, while well-being is likely to change over time. Second, the authors used supervisor surveys, rather than factory performance data, to gauge individuals' performance, an approach susceptible to bias (Short *et al.,* 2014). Little is therefore known about the relationship between worker well-being and a factory's performance in China, or how relevant the existing literature might be there.

2.3 A model for well-being and performance in Chinese factories

The first academic to explore well-being and performance specifically in Chinese factories, Luthans used psychological capital (PsyCap) as a way of exploring the relationship. PsyCap, which indicates a worker's psychological resources, has been shown to improve both well-being and work performance (Luthans *et al.,* 2005). It can increase the ability to cope, adapt, form positive relationships and remain motivated. Luthans (2002) proposed PsyCap's components as hope, self-efficacy, resilience and optimism, suggesting the combination can engender "organisational citizenship behaviour" and a "mastery-oriented mindset toward training" (Luthans *et al.,* 2011; Qadeer and Jaffery, 2014; Pouramini and Fayyazi, 2015;

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Nolzen, 2018). It can predict an individual's ability to problem-solve (Hsu and Chen, 2015) and allows a worker to feel more resourceful and engaged, and less stressed, even in a challenging workplace (Siu *et al.,* 2014; Mazzetti *et al.,* 2016; Joo and Lee, 2017). Nel and Kotzé found it, combined with tools like meditation, able to mitigate even extreme stress, preventing burnout (Nel and Kotzé, 2017). The PsyCap literature also shows a positive relationship between job-specific training for workers and their self-efficacy (Earley, 1994; Luthans *et al.,* 2013; Guan and Frenkel, 2018).

Our work had first set out to address the more fundamental question of what constituted well-being for the workers. We had conducted a qualitative digital diary pilot with a group of 82 workers at a single Chinese factory (Bellingan *et al.,* 2020) and identified three dimensions of these workers' well-being, as shown in Figure I, below.

Figure I, Dimensions of worker well-being seen in the pilot factory

[Insert Figure I]

Bellingan et al., *2020.*

These dimensions were not independent: operational problems could impede a worker's efforts to achieve their life goals, in turn undermining their working relationships. We saw production delays outside the worker's control, which we ascribed to poor factory management, block workers from achieving their performance targets, negatively impacting their remuneration. By impeding their ability to work toward long-term life goals, this damaged workers' eudaimonic well-being. Their supervisors, rather than addressing the problems, would often simply scold them, which could reduce their self-worth. Social aspects emerged as particularly important to these workers, most of whom live with colleagues, away from their own communities. Those who had migrated to work toward goals for their families were already enduring the pain of separation. Frustration undermined their eudaimonic well-being, and added friction to their working relationships, impacting social well-being. Poor well-being could lead to resignations.

Staff retention was raised to us as an important issue for overall factory performance. One manager told us their worker attrition had increased by about 15% year-on-year, significantly affecting that factory's financials. Without no training or experience, new workers generate delays and quality issues, creating a negative feedback loop, as illustrated in Figure II, below.

Our pilot suggested a focus by audits on hedonic well-being was misplaced; our diarists' well-being depended more on eudaimonic factors such as achievement or purpose. We thought targeted training interventions addressing their work frustrations might improve these workers' well-being. In a study of Turkish bank workers Leblebici (2012) shows the behavioural environment affecting work performance more than the physical workplace, and that training supervisors could improve that environment, leading to better performance. We developed a model to identify some potential points of intervention, as shown in Figure II, below.

Figure II: The cycle of poor worker well-being, and points for intervention

[Insert Figure II]

While this shows the problem as systemic, were identified two points, A and B, where our own intervention might help, as shown. These were:

Intervention 1 (at A): Work-skills training, a daily 10-minute demonstration of the day's production task.

Intervention 2 (at point B): Managers' supervision training.

Table I, below shows the identified issues these interventions aimed to address.

[Insert Table I: Interventions addressing some of the identified work-related issues]

We developed four hypotheses about the outcomes:

Hypothesis 1. Sentiment in a factory can be improved by providing training for workers and supervisors.

Hypothesis 2. Training for workers will lead to a change in the content of their diaries. At the level of second-order theme:

2a. They will report fewer production delays and less rework

2b. They will report more feelings of appreciation and fewer of being devalued by supervisors or colleagues.

Hypothesis 3. Training for workers leads to improvements in (a) rework rates, (b) product attrition, and (c) order delays.

Hypothesis 4. Improvements brought about by our training interventions are associated with worker retention.

3. Methodology

3.1 Research approach

Researching in Chinese factories poses particular challenges which, while not unique, are problematic in combination. It can be difficult to conduct interviews or surveys in any busy factory. In a typical Chinese factory, workers speak many dialects and languages and have variable literacy. They also find it unusually difficult to be honest with auditors or researchers (whom they regard as similar) given the extreme power imbalance they may face at work (Anner, 2012; Chan, 2013; Egels-Zandén, 2014). Chinese factory workers are commonly coached prior to audits and repercussions for sharing concerns may be severe. In 2022, the 43-year-old whistle-blower in the Alexa case mentioned above demanded an apology from Amazon after his subsequent torture and imprisonment by Chinese authorities (Chamberlain, 2022).

Where individuals were likely to be unwilling or unable to provide reliable survey data, we needed a less conventional approach to data collection. For our pilot study we had created a longitudinal method which appeared to bridge some of the problems listed above, enabling subjects to share easily and openly without anxiety or fear of repercussions (Bellingan *et al.,* 2020). We therefore adopted this method for this experimental study.

We designed a 12-month research programme, working with four Chinese factories from January 2019 to January 2020. These included the host of our pilot, (Factory A in Table III). Although it is bigger than the other factories, we felt the volume of data would be useful. Futhermore, many pilot diarists were enthusiastic and wished to contribute further. New data was collected at that factory for this study, from a new cohort which included some of the original 82. The overall approach is shown in Table II:

[insert Table II: The two-phase research approach]

During phase one we established baseline metrics for worker sentiment and factory performance. In phase two we tested interventions, which both took the form of training. We continued to collect data until January 2020, then made longitudinal (before-and-after) comparisons.

Enabling workers to perform their tasks and feel the goals set for them are achievable is necessary to their well-being. We provided task-specific skills training in the hope that this would support both their expertise and their self-efficacy, boosting their optimism as they started to succeed in their tasks. We perceived that to provide encouragement and positive performance feedback in a Chinese factory would require training for most line leaders. Most have been promoted from the production line, and have no previous management experience or training. We decided to also train the leaders to provide positive and supportive feedback and achievable goals, potentially improving workers' resilience and hope.

3.2 Research setting

Our four host factories were recruited on a convenience sampling basis by the first author, who already had established relationships with their management. They are similar in that they are all final-assembly factories, in clean industries (i.e. no painting, injection molding or hazardous chemicals). All produce consumer products for global companies. Their markets and demographics are similar, making it unlikely that they would experience different external events that could skew our results. All are routinely audited and show no safety violations, allowing us to focus on their workers' well-being rather than physical safety. One was the site of our pilot (Bellingan *et al.,* 2020), but no data from that study was used in this analysis.

[insert Table III: Summary of four participating factories]

3.3 The interventions

We provided daily work-skills training (including all workers) at two of the factories for two weeks in June 2019. A supervision training day for managers, focused on communication skills, was held at the same factories in July 2019. As we had to work with the co-operation of factory managers, the two intervention factories were selected on a convenience sampling basis. They were larger and had more consistent production volumes and schedules, providing stability for our data capture. The two smaller factories did not receive our training, and served as a control.

The workers' training took the form of a daily 10-minute demonstration of that day's production task for each group. This was filmed and shown on TV screens at the production line. Participants received feedback to show how their group was improving.

For the supervisors, an external Lean production trainer delivered a session focused on communication skills and using positive reinforcement and recognition to motivate workers. They learned goal-setting and how to inform their teams about their goals, the product, and how their work would contribute to factory objectives. Leaders were also taught how to talk to team members in an encouraging way, without shouting.

[Insert Table IV]

A potential third well-being intervention would have been to give workers more opportunities to return home to their families, but this was outside the scope of our agreements with the factories' management.

3.4 Data collection

We decided to explore well-being and performance at factory rather than individual level. Our novel method allowed us to gather honest well-being information direct from individual workers, without unhelpful mediation from supervisors or managers. We chose factory-level peformance data to avoid the potential bias in supervisor evaluations. To test our hypotheses, we needed three distinct types of data. For H1, we needed to see if our training improved overall factory sentiment. For H2, we needed to see if it changed workers' general concerns. For H3 and H4, we needed data from the factories.

466 workers across the four factories volunteered to keep a digital daily diary in the form of voice messages recorded using their smartphones. This data was analysed for H1 and H2. Although not all these workers are literate, all have smartphones. 178 of the 466 continued to actively participate over the 12 months, and we saw both quality and regularity of entries improve with time. On average, workers left us a total 2,000 entries per week. However, not all were included in the analyses. While our focus was work, diarists were free to share about any subject they chose. Entries about leisure activities, food, the weather or love interests were excluded as part of the coding process, and only those referring to the relevant second order themes were used to address H2.

The factory performance data was provided monthly by managers. We collected four operational metrics, selected to be comparable between factories:

1. rework rate (total number of units / reworked units)

2. product attrition rate (% of total units discarded [i.e. cannot be reworked])

3. order delay rate (% of orders failing to ship on confirmed date)

4. worker attrition rate (% of total workforce who left their jobs).

Managers populated an Excel file supplied and returned by e-mail. Participating factories did not have well-established routines for collecting some of this data. To help them manage the routine, it was collected monthy rather than more frequently. The lead author often visited factories during the first three months, to advise the managers on how to collect the data and populate the spreadsheet. They then did this independently, although it would sometimes prove necessary to ask for their data repeatedly.

[insert Table V: Data types]

3.5 Data analysis

While the factory data could be used as supplied, we needed to classify the qualitative diary data in order to test H1 and H2.

To test H1, we scored each diary entry for sentiment. To enable us to assess overall well-being we developed a simple, four-point semantic scale – *happy, neutral, a little down* and *unhappy* – to reflect common sentiments from the pilot diaries. Because of the volume of data, and to avoid human variation, we then developed automatic sentiment assignment, using the Python standard multinomial classification model, the Naïve-Bayes Natural Language Toolkit (NLTK) (Vadivukarassi *et al.,* 2017), which was easy to use and could provide an acceptable reference. In the event it did not provide acceptable levels of accuracy, mainly because of the complexity of language and nuances of workers' expressions. After manual checks revealed some questionable assignments, a full audit showed ambiguous entries without strong language tending to be assigned the *neutral* sentiment. We therefore used the tool to give an initial classification which we then manually checked daily. To test H2, we needed to measure diary entries' content. We therefore coded each entry manually by the second-order themes in the data structure presented in Figure I, above.

4. Research findings

4.1 Does training improve sentiment?

H1: *Sentiment in a factory can be improved by providing training for workers and supervisors*.
Sentiments attached to diary entries (i.e. *happy, neutral, a little down* or *unhappy)* were reviewed to see whether any had significantly trended up or down following an intervention. A two-proportion Z-test was used to compare the *Before* and *After* proportions of each sentiment.

Table VI, below, shows sentiment scores for the full year across all diary entries.

[Insert Table VI]

Table VII, below, shows sentiment before and after the training.

[Insert table VII: Impact of training interventions on sentiment scores]

Although the number of entries coded as happy increased a little, the most significant effect was a reduction in negative sentiment. Meanwhile, no significant changes were found in the control group. Thus, we accepted Hypothesis 1.

4.2 What changed as a result of the training?

H2. *Training for workers will lead to a change in the content of their diaries. At the level of second-order theme:*

2a. They will report fewer production delays and less rework

2b. They will report more feelings of appreciation, and fewer of being devalued by supervisors or colleagues.

We tested H2 by examining the thematic content of the diaries before and after the interventions. Only diaries related to the second-order themes (shown in Figure I above) were included in this analysis, leading to smaller but still significant sample sizes. A two-proportion Z-test was used to compare *Before* and *After* percentages of each theme.

[Insert Table VIII: Impact of training interventions on second-order well-being themes]

The frequency at which different qualitative second-order themes were mentioned in diaries indicated significant changes after the training. Specifically, there were fewer negative references to operational problems like production delays or rework, and evidence of significant improvements to relations in the factory, with workers more often reporting feeling appreciated, and less often feeling devalued, particularly by colleagues but also to a lesser extent by supervisors. No similar, significant changes were found in the control group (see Table VIII above). Thus, we accepted Hypothesis 2a, and partially accepted Hypothesis 2b.

Post-intervention diaries illustrating this positive shift include:

"Today we're working on a new style and we've encountered many difficulties. But after co-operating and all working hard together, we made 100 bags in an evening. This was the first day and it's normal for everyone to be slow, so it feels great to have finished so many products. I'm very happy."

4.3 Does training improve factory performance?

H3. *Training for workers leads to improvements in (a) rework rates, (b) product attrition, and (c) order delays.*

This was tested by checking each performance indicator for changes following the interventions. A two-sample t-test was then used to determine if the means of the two groups (*Before* and *After*) differed significantly from each other. Findings are shown in Table IX.

[Insert Table IX: Impact of training interventions on factory performance]

This shows reported rework rates improving significantly after the interventions. Similar changes were not seen in product-attrition rates or order-delay rates. We therefore accepted only part (a) of Hypothesis 3.

One post-intervention diary entry described the impact on rework:

"We've just started working on a backpack. On previous orders, there were always a lot of problems. This time, several managers came to the production line to teach us how to make the bag well. Today, the team resolved all the issues together and all the backpacks we produced are perfect! It was everyone's concerted efforts that led to today's good results. It was worth it!"

The training interventions had not attempted to address, for example, machine breakdowns or raw materials issues. During our visits we observed substantial backlogs at both intervention factories.

4.4 What is the effect on worker retention?

H4. *Improvements brought about by our training interventions are associated with worker retention*

A two-sample t-test was used to determine if the means of the two groups (*Before* and *After*) differed significantly.

As shown in Table X, the data indicates that worker attrition was significantly lower in the intervention factories after training. We therefore accepted Hypothesis 4.

[Insert Table X - Impact of combined training interventions on worker attrition]

One worker's diary illustrates well the role of training in worker retention:

'I used to think of the training session in the morning meeting as a formality, but actually, it's working! I've heard fewer complaints in the workshop about difficult products recently, and more laughter. Even those who kept saying they were going to leave the factory have suddenly shut up and I still see them in their seats, working away. Well, that's interesting!'

4.5 Summary of findings

We have four main findings. We accept H1, that sentiment in a factory can be improved with training for workers and supervisors. As well as the quantitative analysis presented above, this idea was illustrated by several comments in post-intervention diaries. For example:

"Today our company gave us a lecture, which gave us a lot of information. I've learned some excellent skills to speed up my work. It was so useful and we all enjoyed it. I hope we can get more training like this in the future."

Our findings for H2 are mixed. The trainings had led diarists to write less often about production delays or rework. Post-intervention diaries in the intervention factories showed signs of gratitude from workers, indicating that they value training and being able to perform their tasks well:

"In today's morning meeting, the team leader taught us how to sew several materials together in one shot. Previously I'd had to stop several times to adjust the threads, but now I can combine a few processes. I'm excited: now I can make more bags and earn more money! I really appreciate this training, thank you team leader!"

We had also hypothesised more reports of appreciation and fewer of feeling devalued by supervisors or colleagues. We saw more reports of appreciation, and less of devaluation by colleagues, but the change to feeling devalued by supervisors was not significant. Despite this, there were some more positive reports of interactions with supervisors in the diaries.

"The team leader has been on leave for two days for training. Now she's back, something looks different. She usually seems very mean. But today she was nice, with a smile, and gave us some useful instructions on sewing. Well, maybe she did learn something from the training!"

"Today I was amazed when my supervisor praised me for being faster and more flexible at work. I've been in a great mood all day. He's never commended anyone in the team before! I hear the team leaders received some training lately, does this have something to do with his attitude change?

H3 was that training for workers would improve (a) rework rates, (b) product attrition, and (c) order delays. The factory data suggested improvement only to rework rates. The training had only improved matters within workers' direct control. However, it supports the reduction in reports of rework (in Hypothesis 2) with factory evidence, indicating that training improved both factory performance in reduced rework and workers' perceptions of their own performance.

Finally, we accepted H4, that our interventions were associated with improved worker retention. Although we did not have control data for this hypothesis, we accepted it on the basis of the data from the two intervention factories. We conclude that our training interventions significantly improved aspects of both worker well-being and factory performance.

5. Discussion

Training is a well-established approach to improving factory performance. However, it is relatively novel, and has not previously been explored as a means to improving well-being, in China. Our work suggests it does this in four ways. First, the workers – focused on eudaimonic concerns – appreciate feeling more competent. This improves their self-efficacy (Luthans, 2005) increasing PsyCap. Previous studies have not considered these workers' personal aspirations, yet when allowed to choose their own subject, many created diary entries about their longer-term goals (Bellingan *et al.,* 2020). This sense of making progress in life also explains the improved worker retention: why leave a factory when it is helping you achieve your life goals?

Second is a connection between well-being and performance. As people became more proficient in their tasks, their ability to meet the factory's targets improved. Significantly, they spent less time reworking items they had made earlier. The role of frustration in a lack of job satisfaction has been researched (Fisher, 2000) but not in Chinese factories. The content of the diaries suggested improvement to well-being due to the reduction in stress and frustration from frequent rework. Reduced frustration led to less venting and blame, and diarists made several comments about improved relationships. Although there was not statistically significant evidence in the diary codes of a reduction in supervisors disrespecting workers, the improved performance and reduction in rework meant there were fewer occasions for friction. The diaries reflect a need for positive relationships at work. Strains on these relationships can undermine a worker's self-worth and demotivate them, further reducing their ability to meet their targets. Our training interventions had an impact on both workers' well-being and the elements of performance that were within their control.

There are limits to this, of course. While workers felt more positive about aspects such as rework levels, failures with production flows and maintenance management remained as sources of frustration. While conventional audits consider physical aspects of a factory's environment (such as temperature) in terms of safety and hedonic well-being, they tend to ignore factors such as effective working practices and good supervision which could significantly improve workers' experiences.

This study provides new insights into the *happy worker – productive worker* thesis. We believe it is contextual rather than absolute: both *happiness* and *productivity* can mean different things to different people at different times. This would explain the very varied

results from the range of studies conducted to test it. For our eudaimonically-driven workers, productivity is related to well-being because it improves their ability to achieve their goals, rather than their short-term comfort. In this case, therefore, improved productivity at work boosted well-being. These workers are not more productive because they are happy – they are happy, or at least less unhappy, because they are able to perform better.

The background of these workers is an important consideration. Only 71% of our diarists had stayed at school until 15, and many were not fully literate. They were from a society that greatly values education, so we suspect some of the benefit we saw may have been from the novelty of being trained. This means there is probably an upper limit to the effect we saw: at some point, training will produce diminishing returns. That said, the factories involved in this study were far from reaching that point.

There are some substantial limitations to our research. First, this is a messy environment in which to collect data. The factories did not have established or consistent routines for producing performance data, and it was difficult to check the quality of the data they provided (although we did visit and check their data management). In a factory, many factors can impact a worker's performance. There remained, inevitably, factors beyond our control. A very large order placed with a very short lead-time can suddenly change the amount of overtime workers need to do, leading to exhaustion. Such factors cannot be identified specifically in the data, but could have distorted our results. Second, while the diaries provide rich data, it is essentially qualitative. We adopted the approach described by Gioia and Corley (2013) to interpret entries impassively as data, but our coding is still subjective. While the factories and workers involved were judged reasonably representative of Chinese final-assembly factories, there are also limits to the potential for generalising the results to other settings or cultures.

Nevertheless, we believe this work has some useful implications for future research and for practice. We see three potential future research streams. First, the influence of our interventions was limited by broader bottlenecks in the production systems (all four factories showing similar issues), and it would be valuable to test the impacts of improving production at the system level, not just the product level, on well-being and performance. Second, our findings suggest a complex mix of eudaimonic and social factors are implicated in well-being in this context, and our interventions addressed them all together. It would be illuminating to separately test the the impacts of supervisor and worker training. Third, our analysis focused specifically on our effects on workers, but supervisors play a critical role in both performance and well-being in Chinese factories, for which they usually receive no real preparation. There is potential to explore how they develop in this role and how they could be supported in being more effective.

The most important implication for practice is that well-targeted interventions can simultaneously improve both the worker well-being and the performance of a Chinese factory. This could be implemented by factory owners, and encouraged by their client companies. Three questions could immediately be added to audits based on our findings. First, given the effect that training has, it would make sense to check what training is provided to workers and supervisors. Second, worker retention emerges from this study as an indicator of well-being, and could be a suitable metric to consider in this context. Third, many Chinese factory workers are migrants who struggle with the separation from family.

The number of times they are able to go home in a year is a another potential indicator of their well-being.

6. Conclusions

We regard this research as transformational, particularly in terms of practice. We show that SDG8's "decent work" and "economic growth" can be addressed together, and comparatively inexpensively. Our results could change the way companies think about their interactions with their supplier factories and the data they collect from them.

While there is certainly a moral case for decent work, we set out to see whether there was also a business case for factories to change their approach to well-being. Our work suggests that there is. By reducing work frustration and improving eudaimonic well-being, factories can improve worker retention. The factory workforce in China is shrinking and a factory's workers should be a source of competitive advantage. More experienced workers are more productive, and make fewer mistakes. This creates a win/win situation: the factory does not incur the expense and trouble of replacing staff, and workers' well-being is improved, both in terms of their ability to reach their goals and the quality of their social interactions.

We propose that, in the interest of ensuring "decent work" in which workers will choose to stay and develop, Western clients could address supplier factories' systemic operational problems. This might be achieved by encouraging training in management and operational planning techniques through their supplier management and monitoring regimes. We contend that this important insight should change how factory conditions are viewed. As well as attempting to manage social risk, audits could be adding value by considering factors indicative of workers' well-being.

Our main theoritical contribution is that we start to connect SSCM and workplace well-being theories. While previous studies have suggested that "self-efficacy can be improved by training, relationships or encouragement and support from managers" (Du *et al.,* 2015; Rego *et al.,* 2019) our results uniquely suggest it might also be improved through more operational efficiency. Self-efficacy might also, therefore, be practically addressed by working to resolve operational problems. PsyCap literature shows improved self-efficacy and optimism leading to better work performance but we find the link to be more complex and nuanced.

We believe our use of digital diaries has given Chinese workers a genuine voice for the first time. Our work sheds some light on the complex link between a factory's performance and its workers' well-being in this context, revealing that many factors impacting their well-being can actually be addressed by taking steps to improve their ability to be productive. This could provide a new avenue of exploration for *happy worker – productive worker* studies. While this thesis has proved helpful in considering the relationship between work and well-being, people need both, and the interventions required will vary from case to case. Our findings suggest that it is time to move on the 70-year old debate from asking "are happy workers productive?" to asking "what can be done to improve the well-being and performance of this particular group?"
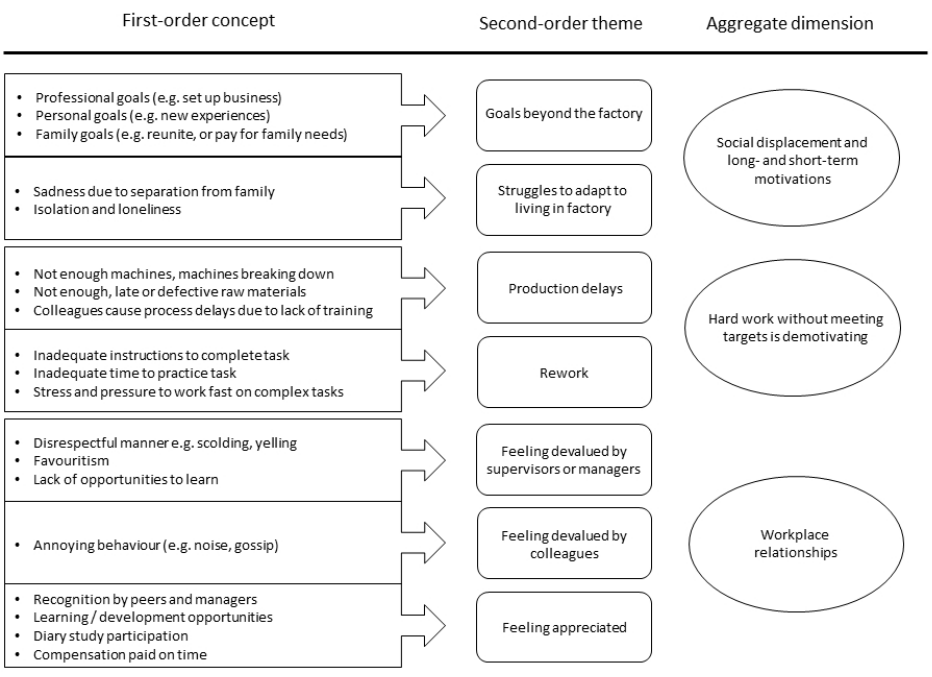
References

Adler, P., Brown, D., Dehejia, R., Domat, G. and Robertson, R. (2017), "Do factory managers know what workers want?", *Asian Development Review*, Vol. 34 No. 1, pp. 65-87, https://doi.org/10.1162/adev_a_00081

Akhter, S., Rutherford, S. and Chu, C. (2019), "Sufferings in silence: Violence against female workers in the ready-made garment industry in Bangladesh: a qualitative exploration", *Women's Health*, Vol. 15, pp. 1-10.

Anner, M. (2012), "Corporate social responsibility and freedom of association rights", *Politics and Society*, Vol. 40 No. 4, pp. 609-644, https://doi.org/10.1177/0032329212460983

Anner, M. (2017), "Monitoring workers' rights: the limits of voluntary social compliance initiatives in labor repressive regimes", *Global Policy*, Vol. 8 S3, pp. 56-65, https://doi.org/10.1111/1758-5899.12385

Bellingan, M., Tilley, C., Batista, L., Kumar, M. and Evans, S. (2020), "Capturing the psychological well-being of Chinese factory workers", *International Journal of Operations and Production Management,* Vol. 7/8, pp. 1269-1289, https://doi.org/10.1108/ijopm-06-2019-0492

Benoît-Norris, C., Cavan, D.A. and Norris G.A (2012), "Identifying social impacts in product supply chains: overview and application of the social hotspot database", *Sustainability*, Vol. 4, pp. 1-10.

Benuyenah, V. and Pandya, B., 2020. "*Meaning of 'employee happiness' within the context of complex organisations? An explanatory review on the UAE labour force", Rajagiri Management Journal,* Vol. 14 No. 2, pp.169-180.

Chamberlain, G. (2019), "Schoolchildren in China work overnight to produce Amazon Alexa devices", *Guardian,* Aug 8, 2019, https://www.theguardian.com/global-development/2019/aug/08/schoolchildren-in-china-work-overnight-to-produce-amazon-alexa-devices

Chamberlain, G. (2022), "Alexa whistleblower demands Amazon apology after being jailed and tortured", *Observer*, Jan 30, 2022, https://www.theguardian.com/technology/2022/jan/30/alexa-factory-whistleblower-i-was-tortured-and-jailed-now-amazon-should-apologise

Chan, J. (2013), "A suicide survivor: the life of a Chinese worker", *New Technology, Work and Employment*, Vol. 28 No. 2, pp. 84-99, https://doi.org/10.31219/osf.io/dzsa2

Cheng, E. (2021), "China's factories automate as worker shortage looms", CNBC, April 9, 2021, https://www.cnbc.com/2021/04/09/chinas-factories-automate-as-worker-shortage-looms.html

Cottini, E., Kato, T., Westergaard-Nielsen, N. and Forschungsinstitut zur Zukunft der Arbeit (2011), "Adverse workplace conditions, high-involvement work practices and labour turnover", *Labour Economics*, Vol. 18 No. 6, pp. 872-880, https://doi.org/10.2139/ssrn.1515134

Dean, J. and Ting-I, T. (2010), "Suicides spark inquiries", *Wall Street Journal*, May 27, 2010, https://www.wsj.com/articles/SB10001424052748704026204575267603576594936

Du, H., Bernardo, A. and Yeung, S. (2015), "Locus-of-hope and life satisfaction: The mediating roles of personal self-esteem and relational self-esteem", *Personality and Individual Differences*, Vol. 83, pp. 228-233.

Du, H., Li, X., Lin, D. and Tam C.C. (2015), "Collectivistic orientation, acculturative stress, cultural self-efficacy, and depression: a longitundinal study among Chinese internal migrants", *Community Mental Health Journal*, Vol. 51, pp. 239-248.

Dutton, J.E. (2003), "Fostering high-quality connections", *Stanford Social Innovation Review*, Vol. 1 No. 3, pp. 54-57.

Earley, P.C. (1994), "Self or group? Cultural effects of training on self-efficacy and performance", *Administrative Science Quarterly*, Vol. 39 No. 1, pp. 89-117, https://doi.org/10.2307/2393495

Egels-Zandén, N. (2014), "Revisiting supplier compliance with MNC codes of conduct: recoupling policy and practice at Chinese toy suppliers", *Journal of Business Ethics*, Vol. 119 No. 1, pp. 59-75, https://doi.org/10.1007/s10551-013-1622-5

Fisher, C.D. (2003), "Why do laypeople believe that satisfaction and performance are correlated? Possible sources of a commonsense theory", *Journal of Organisational Behaviour*, Vol. 24, pp. 753-777, https://doi.org/10.1002/job.219

Fisher, C.D. (2014), "Conceptualising and measuring wellbeing at work", in Chen, P.Y. and Cooper, C. (Ed.s.), *Work and Wellbeing*, Wiley & Sons, https://doi.org/10.1002/9781118539415.wbwell018

Fisher, C.D., (2000), "Mood and emotions while working: missing pieces of job satisfaction?" *Journal of Organizational Behavior*, Vol. 21 No. 2, pp.185-202.

Gallagher, M.W., Lopez, S.J., and Preacher, K.J. (2009), "The hierarchical structure of well-being", *Journal of Personality*, Vol. 77 No. 4, pp. 1025-1050, https://doi.org/10.1111/j.1467-6494.2009.00573.x

Gioia, D.A., Corley, K.G. and Hamilton, A.L. (2013), "Seeking qualitative rigor in inductive research", *Organizational Research Methods*, Vol. 16 No. 1, pp. 15-31, https://doi.org/10.1177/1094428112452151

Glendon, L. (2013), "Winners and losers in the complex web of global supply chains", *Journal of Business Continuity and Emergency Planning*, Vol. 6 No. 4, pp. 322-328.

Guan, X. and Frenkel, S. (2018), "How HR practice, work engagement and job crafting influence employee performance", *Chinese Management Studies*, Vol. 12 No. 3, pp. 591–607.

Hamnett, C. (2020), "Is Chinese urbanization unique?", *Urban Studies*, Vol. 57 No. 3, pp. 690-700, https://doi.org/10.1177/0042098019890810

Hewamanne, S. (2018), "Sewing their way up the social ladder? Paths to social mobility and empowerment among Sri Lanka's global factory workers", *Third World Quarterly*, Vol. 39 No. 11, pp. 2173-2187.

Hsu, M. and Chen, F.H. (2015), "The cross-level mediating effect of psychological capital on the organizational innovation climate-employee innovative behavior relationship", *Journal of Creative Behavior*, Vol. 51 No. 2, pp. 128-139.

Jacka, T. (2014), *Rural women in urban China: Gender, migration, and social change*, Taylor & Francis, https://doi.org/10.4324/9781315701028

Jaesok, K. (2015), "From 'country bumpkins' to 'tough workers': the pursuit of masculinity among male factory workers in China", *Anthropological Quarterly*, Vol. 88 No. 1, pp. 133-161.

Joo, B. and Lee, I. (2017), "Workplace happiness: work engagement, career satisfaction and subjective well-being", *Evidence-based HRM*, Vol. 5 No. 2, pp. 206-221.

Krekel, C., Ward, G. and De Neve, J.-E. (2019), "Employee wellbeing, productivity, and firm performance", *SSRN Electronic Journal*, https://doi:10.2139/ssrn.3356581

Leblebici, D. (2012), "Impact of workplace quality on employee's productivity: case study of a bank in Turkey", *Journal of Business, Economics and Finance*, Vol. 1 No. 1, pp. 38-49.

Levi, M.T. (2019), "Employment of the weak: the role of a multinational factory in the life trajectory of early school leavers in Samoa", *The Contemporary Pacific*, Vol. 31 No. 2, pp. 417-446.

Locke, R.M. (2013), *The Promise and limits of private power: promoting labor standards in a global economy*, Cambridge University Press, https://doi.org/10.1017/cbo9781139381840.002
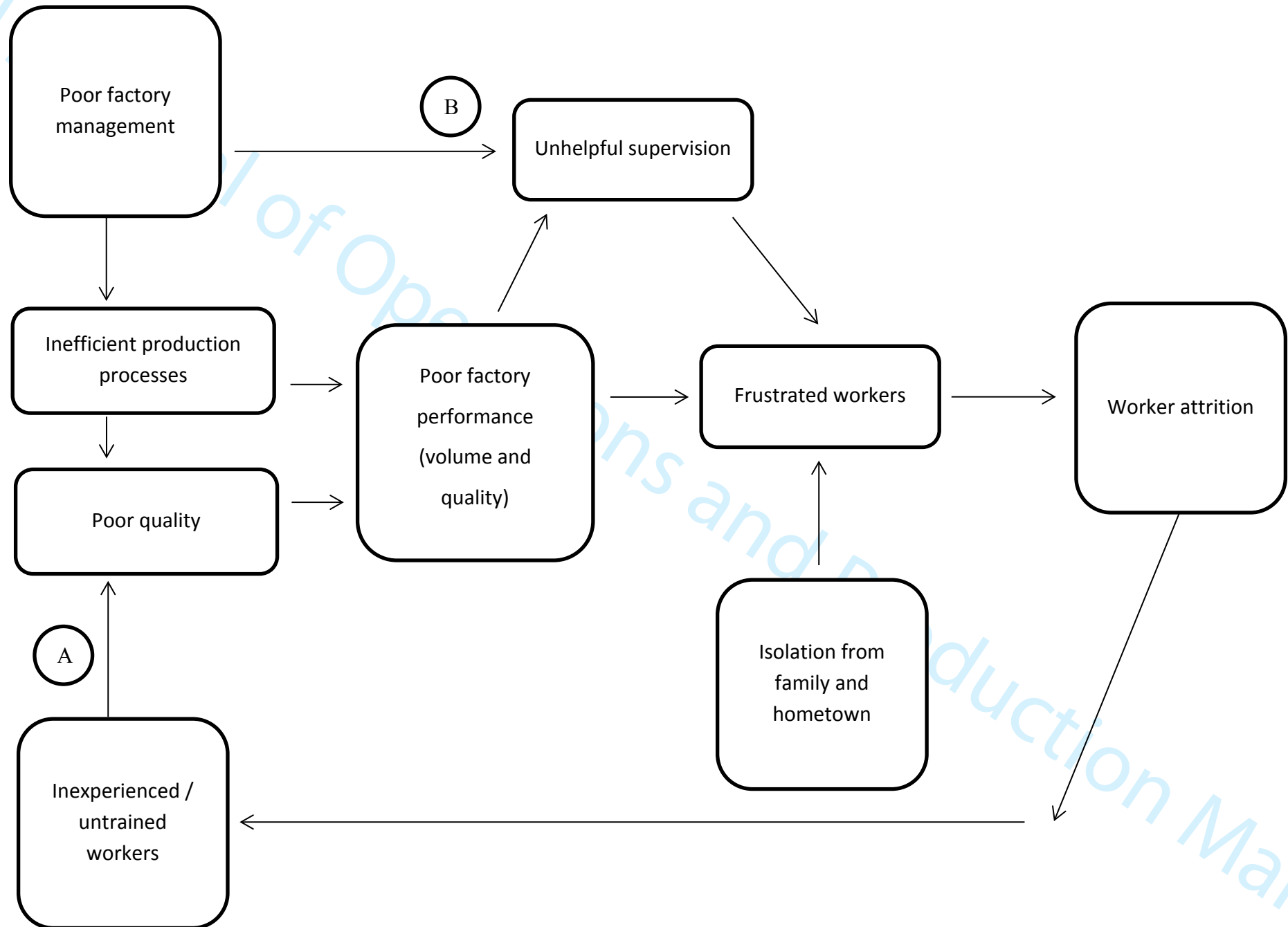
Luthans, F. (2002), "Positive organizational behavior: developing and managing psychological strengths", *Academy of Management Executive*, Vol. 16 No. 1, pp. 57-72.

Luthans, F. (2002), "The need for and meaning of positive organizational behavior", *Journal of Organizational Behavior*, Vol. 23 No. 6, pp. 695-706.

Luthans, F. and Youssef, C.M. (2007), "Emerging positive organizational behavior", *Journal of Management*, Vol. 33 No. 3, pp. 321-349, https://doi.org/10.1177/0149206307300814

Luthans, F., Avey, J.B., Clapp-Smith, R., and Li, W. (2008), "More evidence on the value of Chinese workers' psychological capital: a potentially unlimited competitive resource?", *The International Journal of Human Resource Management*, Vol. 19 No. 5, pp. 818-827, https://doi.org/10.1080/09585190801991194

Luthans, F., Avolio, B.J., Walumbwa, F.O., and Li, W. (2005), "The psychological capital of Chinese workers: exploring the relationship with performance", *Management and Organization Review*, Vol. 1 No. 2, pp. 249-271, https://doi.org/10.1111/j.1740-8784.2005.00011.x

Luthans, F., Youssef, C.M. and Rawski, S.L. (2011), "A tale of two paradigms: the impact of psychological capital and reinforcing feedback on problem solving and innovation", *Journal of Organizational Behavior Management*, Vol. 31 No. 4, pp. 333-350.

Luthans, F., Youssef, C.M., Sweetman, D.S. and Harms, P.D. (2013), "Meeting the leadership challenge of employee well-being through relationship PsyCap and health PsyCap", *Journal of Leadership and Organizational Studies*, Vol. 20 No. 1, pp. 118-133. https://doi.org/10.1177/1548051812465893

Manaf, A.M., Shariffadeen, T., Buyong, M. and Idid, S.A. (2019), "The relationships of individual well-being and working environment with job satisfaction among factory workers in Malaysia", *Intellectual Discourse*, Vol. 27 No. 1, pp. 221-243.

Mazzetti, G., Schaufeli, W.B., Guglielmi, D. and Depolo, M. (2016), "Overwork climate scale: psychometric properties and relationships with working hard", *Journal of Managerial Psychology*, Vol. 31 No. 4, pp. 880-896.

Mozur, P. (2012), "Life Inside Foxconn's Facility in Shenzhen", *Wall Street Journal,* Dec 19, 2012, https://www.wsj.com/articles/BL-CJB-17008

Nel, P, and Kotzé, M. (2017), "The influence of psychological resources on mineworkers' levels of burnout in a remote and isolated mining town in South Africa", *The Extractive Industries and Society*, Vol. 4 No. 4, pp. 885-892, https://doi.org/10.1016/j.exis.2017.10.002

Nolzen, N. (2018), "The concept of psychological capital: a comprehensive review", *Management Review Quarterly*, Vol. 68 No. 3, pp. 237-277.

O'Rourke, D. (2003), "Outsourcing regulation: analyzing nongovernmental systems of labor standards and monitoring", *Policy Studies Journal*, Vol. 31 No. 1, pp.1-29, https://doi.org/10.1111/1541-0072.00001

Perera-Desilva, V.N. (2015), "Psychological counselling for women garment factory workers of Sri Lanka", *Asian Journal of Women's Studies*, Vol. 21 No. 1, pp. 65-76.

Plutchik, R. (1980), "A general psychoevolutionary theory of emotion", in Plutchik, R. and Kellerman, H. (Ed.s.), *Emotion: Theory, Research and Experience – Theories of emotion,* pp. 3-33, Academic Press, https://doi.org/10.1016/b978-0-12-558701-3.50007-7

Pouramini, Z. and Fayyazi, M. (2015), "The relationship between positive organizational behavior with job satisfaction, organizational citizenship behavior, and employee engagement", *International Business Review*, Vol. 8 No. 9, pp. 57-66.

Qadeer, F. and Jaffery, H. (2014), "Mediation of psychological capital between organizational climate and organizational citizenship behavior", *Pakistan Journal of Commerce and Social Science*, Vol. 8 No. 2, pp. 453–470.

17

Rego, A., Owens, B., Yam, K.C., Bluhm, D., Cunha, M.P., Silard, A., Martins, L.G.M., Simpson, A.V. and Liu. W. (2019), "Leader humility and team performance: exploring the mediating mechanisms of team PsyCap and task allocation effectiveness", *Journal of Management*, Vol. 45 No. 3, pp. 1009-1033.

Rogers, Z.S. (2016), *The impact of supply chain CSR performance on firm value*, Arizona State University thesis.

Schwarz, U.v.T., Hasson, H. and Tafvelin, S. (2016), "Leadership training as an occupational health intervention", *Safety Science*, Vol. 81, pp. 35-45, https://doi.org/10.1016/j.ssci.2015.07.020

Short, J.L., Toffel, M.W. and Hugill, A.R. (2014), "Monitoring the monitors: how social factors influence supply chain auditors", *SSRN Electronic Journal,* https://doi.org/10.2139/ssrn.2469953

Sinkovics, N., Hoque, S.F. and Sinkovics, R.R. (2016), "Rana Plaza collapse aftermath", *Accounting, Auditing and Accountability Journal*, Vol. 29 No. 4, p. 617, https://doi.org/10.1108/aaaj-07-2015-2141

Siu, K. (2017), "Labor and domination: worker control in a Chinese factory", *Politics and Society*, Vol. 45 No. 4, pp. 533-557, https://doi.org/10.1177/0032329217714784

Siu, O.L., Bakker, A.B. and Jiang, X. (2014), "Psychological capital among university students: relationships with study engagement and intrinsic motivation", *Journal of Happiness Studies*, Vol. 5 No. 4, pp. 979-994.

Unger, J. and Siu, K. (2019), "Chinese migrant factory workers across four decades: shifts in work conditions, urbanisation, and family strategies", *Labor History*, Vol. 60 No. 6, pp. 765-778.

Vadivukarassi, M., N. Puviarasan and P. Aruna. (2017), "Sentimental analysis of tweets using Naive Bayes algorithm", *World Applied Sciences Journal,* Vol. 35 No. 1, pp. 54-59.

Vogel, D. (2010), "The private regulation of global corporate conduct: achievements and limitations", *Business and Society*, Vol. 49 No. 1, pp. 68-87, https://doi.org/10.1177/0007650309343407

Warr, P. and Nielsen, K. (2018), "Wellbeing and work performance", in Diener, E., Oishi, S., and Tay, L. (Ed.s.), *Handbook of Well-being*, DEF Publishers.

Yang, C. and He, C. (2017), "Transformation of China's 'world factory': production relocation and export evolution of the electronics firms", *Tijdschrift Voor Economische en Sociale Geografie*, Vol. 108 No. 5, pp. 571–591

Zelenski, J.M., Murphy, S.A. and Jenkins, D.A. (2008),"The Happy-Productive Worker Thesis Revisited", *Journal of Happiness Studies*, Vol. 9, pp. 521–537, https://doi.org/10.1007/s10902-008-9087-4

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First-order concept	Second-order theme	Aggregate dimension

- Professional goals (e.g. set up business)
- Personal goals (e.g. new experiences)
- Family goals (e.g. reunite, or pay for family needs)

Goals beyond the factory

- Sadness due to separation from family
- Isolation and loneliness

Struggles to adapt to living in factory

Social displacement and long- and short-term motivations

- Not enough machines, machines breaking down
- Not enough, late or defective raw materials
- Colleagues cause process delays due to lack of training

Production delays

- Inadequate instructions to complete task
- Inadequate time to practice task
- Stress and pressure to work fast on complex tasks

Rework

Hard work without meeting targets is demotivating

- Disrespectful manner e.g. scolding, yelling
- Favouritism
- Lack of opportunities to learn

Feeling devalued by supervisors or managers

- Annoying behaviour (e.g. noise, gossip)

Feeling devalued by colleagues

Workplace relationships

- Recognition by peers and managers
- Learning / development opportunities
- Diary study participation
- Compensation paid on time

Feeling appreciated

254x190mm (96 x 96 DPI)

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Poor factory
management

          B
                    Unhelpful supervision

Inefficient production
processes
                              Poor factory
                              performance          Frustrated workers          Worker attrition
                              (volume and
Poor quality                  quality)

          A
                                        Isolation from
                                        family and
                                        hometown

Inexperienced /
untrained
workers
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Tables for *Uncovering the link between worker well-being and factory performance:*

A longitudinal study with workers in China

Table I: Interventions addressing some of the identified work-related issues

Intervention	Worker skills training	Line leader training	Out of scope
Issues seen in the pilot diaries	Rework caused by task complexity and insufficient training	Rework due to workers' poor self-worth and fear of asking for help	Rework due to poor-quality raw materials or overworked workers
	Demotivation due to poor self-worth and lack of learning opportunities	Lack of hope or a sense of the broader purpose of individual tasks	Machine breakdowns, late raw materials
	Frustration at targets not met	Inadequate training for daily tasks	Workers' long-term aspirations not achieved
	Slow colleagues, unsure how to perform their tasks, leading to blame	Poor supervision relationships, including shouting and scolding	Personal relationships
	Deteriorating colleague relationships, stressful work environment	Lack of team spirit or camaraderie in factory	Social displacement, loneliness, missing family

Table II: The two-phase research approach

Phase One	**Phase Two**
January to May 2019	*June to December 2019*
• Set up data collection from factories • Set up data collection from workers using daily digital diaries • Develop a sentiment scoring method to convert individual workers' qualitative data into an overall measurement of worker well-being in a factory	• Develop interventions to improve worker well-being • Run interventions in two of the factories • Use measurements of worker sentiment and factory performance to quantify impacts • Analyse the results to test the outcomes against the hypotheses

Table III: Summary of four participating factories

	Intervention Factories A & B		Control Factories C & D	
Location (Province)	Guangdong	Guangdong	Jiangsu	Jiangsu
Products	Cut and sew products: bag, luggage, pad, etc.	Plastic/metal/ wooden hangers	Home fitness products: Yoga mat, gym ball, jumping rope dumb bell, etc.	Diatomaceous earth products: Water absorption mat, deodorant and decoration
Years of operation	23	18	8	49
Production area (Square metre)	60,000	13,000	10,000	30,000
Number of workers	800	300	200	200
Number of diarists	270 (33.75% of workforce)	116 (38.6% of total workforce)	32 (16% of total workforce)	48 (24% of total workforce)
Number of diary entries	6230	2965	273	220
Sales market (2020)	America: 47% Europe: 23% Asia: 18% China: 12%	America: 60% Europe: 20% Asia: 15% China: 5%	America: 48% Europe: 21% Asia: 20% China: 11%	America: 23% Europe: 22% Asia: 38% China: 17%

Data from intervention factories was combined and processed as one dataset, as was the control data.

Table IV: The training interventions

Item	Worker training	Line leader training
Start date	23 May 2019	5 July 2019
End date	6 July 2019	5 July 2019
Frequency	Daily	One-off
Training protocol	A daily session of training tailored to the day's specific task on the production line. 1. *Work skills training* (10 minutes): On each production line the line leader demonstrated how to sew different parts of the bag, for example, or to complete item assembly. Depending on orders, there are new products in production approximately every two days. 2. *Q&A* (5 minutes): If any individual workers had difficulty with a certain task, the line leader then trained each separately.	An in-depth all-day session. 1. *Benefits of using supportive communication with workers* (30 minutes): Expert explanation of why this type of communication is important and how it can help to improve work performance. 2. *Goal setting* (2 hours): How to set clear goals and deliverables daily and how to communicate those to the team. 3. *Coaching and developing workers* (1 hour): Expert illustration of using communication to achieve better motivation and engagement from workers. 4. *Recap* (30 minutes): Role play, discussion, advice. 5. *Q&A* (30 minutes): The expert or a factory owner answered any questions.

Table V: Data types

Source	Type of data	Use in the study
Diaries	Voice messages left by workers daily, captured as text and translated	Evidence of impacts on workers' well-being Comparison of sentiment and subject focus before and after intervention
Factory-level metrics	Data collected from factories monthly: • rework rate • product attrition rate • order delay rate • worker attrition rate	Understanding impacts of well-being on performance and retention before and after intervention

Table VI: Sentiment summary for the whole year (2019)

Sentiment	Frequency (n=16390)	Percentage
Happy	3294	34%
Neutral	3681	38%
A little down	1453	15%
Unhappy	1260	13%

Table VII: Impact of our training interventions on sentiment scores

Sentiment *(% of entries)*	Factories with interventions		Factories without interventions (Control)	
	Pre-intervention	**Post-intervention**	**Pre-intervention**	**Post-intervention**
	36.9%	38.4%*	29.8%	29.9%
Happy	29.7%	38.8%**	40%	43%
Neutral	19.9%	12%**	10%	11.4%
A little down	13.4%	10.7%**	17.2%	20%
Unhappy	36.9%	38.4%*	29.8%	29.9%
*Difference is significant at p<0.10. **Difference is significant at p<0.05.				

Table VIII: Impact of our training interventions on second-order well-being themes

Dimensions	Second-order themes	Factories with interventions		Factories without interventions (Control)	
	(% of entries)	*Before (Mar-May)*	*After (Jun-Dec)*	*Before (Mar-May)*	*After (Jun-Dec)*
	Number of relevant diary entries	n=534	n=928	n=36	n=64
Operational inefficiency	Production delays	15.7%	9.2%**	13.8%	25.0%
	Rework	10.3%	5.7%**	0.0%	0.0%
Workplace relationships	Feeling appreciated	32.8%	50.4%**	38.9%	20.3%**
	Feeling devalued by supervisors	4.7%	4.1%	5.5%	6.2%
	Feeling devalued by colleagues	11.8%	6.3%**	10.8%	9.4%
**Difference between before and after is significant at p<0.05					

Table IX: Impact of training interventions on factory performance

Performance (mean)	Factories with interventions		Control factories	
	Before (Jan-May)	*After (Jun-Dec)*	*Before (Jan-May)*	*After (Jun-Dec)*
Months	n=10	n=14	n=10	n=14
Rework rate	0.721%	0.610%**	0.421%	0.308%
Product attrition rate	0.091%	0.082%	1.237%	1.136%
Order delay rate	1.379%	1.173%	0.866%	0.728%
**Difference between before and after is significant at p<0.05.				

Table X: Impact of combined training interventions on worker attrition

	Factories with interventions	
	Before (Jan-May)	*After (Jun-Dec)*
Performance (mean) Months	n=10	n=14
Worker attrition rate	3.870%	1.364%**
**Difference between before and after is significant at p<0.05. Equivalent data was not supplied by control factories.		