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Analysis Of Labor Reduction Due To The Development Of Advanced Technology In Ngalian Village

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ABSTRACT

Technological advancement is reshaping rural labor markets by improving production efficiency while also reducing demand for certain forms of manual labor. This study examines how advanced technology influences workforce reduction and livelihood adaptation in Ngalian Village, Tirta District, Pekalongan Regency, with particular attention to agricultural laborers, textile workers, and residents whose income depends on local production activities. A qualitative single-case approach was employed using in-depth interviews guided by questions on work experience, perceived technological change, employment impacts, and adaptation strategies. The interview available narratives were analyzed thematically to identify recurring patterns concerning displacement, productivity, livelihood transition, and social consequences. The findings indicate a dual effect. Technology can make work faster, easier, and more efficient, yet labor-saving machinery can also reduce employment opportunities, intensify job insecurity, and create uncertainty for households that depend on daily or weekly earnings. Affected residents respond by shifting occupations, trading, farming, sewing, opening small businesses, working as couriers, migrating, and improving skills to remain employable. The study highlights that technological change should not be treated solely as either a threat or an opportunity. Its local consequences depend on workers' capacity to adapt and on the availability of skills development, livelihood diversification, and institutional support. These findings provide practical insight for village stakeholders in preparing inclusive workforce adaptation strategies.

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1. INTRODUCTION

Technological change has become an important driver of production restructuring because firms and communities increasingly use digital systems, automated equipment, and modern machinery to improve quality, speed, and cost efficiency [1], [2]. Evidence from developing countries shows that digital adoption

can alter the composition of employment and the organization of work, while the employment consequences of automation vary across industries, occupations, and institutional contexts [3], [4]. These developments make technological change a productivity opportunity, but they also raise questions about who benefits, which tasks are displaced, and how workers adjust.

For workers, the transition may create insecurity when machines reduce the need for routine or labor-intensive tasks. Previous studies associate workforce reduction with job insecurity, anxiety, and declining perceptions of employment stability [5]. More recent research also distinguishes automation-related occupation insecurity from general job insecurity and shows that workers' perceptions of technological replacement can affect well-being and career expectations [6]. At the broader level, the literature does not support a single deterministic effect of technology on employment; outcomes depend on the type of technology, the level of analysis, and workers' opportunities to move into new tasks or occupations [7].

The rural context requires particular attention because livelihood choices are often linked to agriculture, small-scale industry, informal work, and locally available employment. Studies in Indonesia show that technological change can reshape livelihoods and encourage occupational adaptation [8], while communities affected by economic or environmental change may respond through job switching, migration, and diversification [9]. Research on rural digitalization in Indonesia further demonstrates that technology can generate both new opportunities and new capability requirements [10]. Long-term adaptation studies also emphasize that capacity building and the ability to integrate new knowledge are more important than treating technology adoption as a one-time event [11].

Ngalian Village, Tirto District, Pekalongan Regency, illustrates this tension. Local livelihoods are connected to agricultural labor and textile-related work, while residents increasingly encounter machines and technologies that can replace or reorganize manual tasks. Human resources remain central to industrial performance [12], but employment restructuring can create legal, economic, and social consequences when workers lose access to stable jobs [13]. For affected workers, resilience and the ability to develop alternative livelihoods become important responses to employment disruption [14].

The existing literature has discussed digitalization, automation, job insecurity, and rural livelihood change, but relatively little attention has been given to how these processes are experienced simultaneously at the village level by workers connected to agriculture and textile production. This study therefore contributes a site-specific qualitative perspective by linking three dimensions that are often examined separately: perceived workforce reduction, the economic and social consequences of technological change, and the adaptation strategies used by residents. It also interprets local experience in relation to evidence that firms may use workforce adjustment to improve efficiency [15]-[18] and to wider debates about labor-eliminating technological change and technological unemployment in developing economies [19]-[22].

The study aims to examine how advanced technology is associated with workforce reduction in Ngalian Village, identify the economic, social, and psychological consequences reported in the available interview narratives, and describe the strategies used by residents to adapt. The novelty of the study lies in its local, single-case account of the dual role of technology as both a source of productivity improvement and a trigger for livelihood transition. The findings are expected to inform village stakeholders, employers, and workforce-development actors when designing reskilling, livelihood-diversification, and social-support initiatives.

2. RESEARCH METHOD

This study used a qualitative single-case study design to understand how technological development is associated with workforce reduction and livelihood change in Ngalian Village, Tirto District, Pekalongan Regency, Central Java. The case-study approach was selected because the phenomenon is closely connected to the village's local employment structure, particularly agricultural labor and textile-related work. The interview material available for this manuscript represents residents with direct experience of technological change in their work or livelihood, including agricultural workers, textile-sector workers, and self-employed tailoring activities.

Data were collected primarily through in-depth interviews guided by questions on work history, changes in work processes, perceived effects of advanced technology, employment consequences, and adaptation strategies. The study also used relevant literature to contextualize the interview findings. The source manuscript does not preserve complete field metadata on the exact number of informants, interview dates, interview duration, recording procedures, or verbatim transcription. These details are therefore not reconstructed in the revised manuscript and are acknowledged as a limitation rather than replaced with unsupported information.

The available interview narratives were examined through thematic analysis. The analytical process was organized into four steps: repeated reading of the available narratives, identification of meaningful statements related to technological change and work, grouping of similar statements into recurring themes,

and interpretation of the themes in relation to the research objectives and previous studies. The resulting themes focused on workforce displacement, productivity and time efficiency, livelihood adaptation, and socio-economic consequences. To maintain analytical transparency, the results section presents a thematic summary table based only on evidence already reported in the manuscript.

Research ethics were addressed by emphasizing voluntary participation, confidentiality, and responsible use of interview information, as stated in the original methodological description. Credibility was supported by comparing recurring patterns across the available narratives and by interpreting them alongside relevant literature. Formal member checking, triangulation with employer records, and independent coding were not documented in the available source material and are therefore not claimed. This methodological limitation is considered when interpreting the findings and formulating recommendations.

3. RESULTS AND DISCUSSION

Ngalian Village is located in Tirto District, Pekalongan Regency, Central Java. The local employment structure described in the interview narratives is closely connected to agricultural labor and textile-related work. The available accounts indicate that technological change is experienced in two directions: machines and modern equipment can make production faster and easier, but labor-saving technologies can also reduce the need for certain manual tasks and narrow employment opportunities for some residents.

Thematic reading of the available interview narratives produced four recurring themes: workforce displacement, productivity improvement, livelihood adaptation, and socio-economic consequences. Because the original field documentation does not contain a complete informant roster or verbatim transcript set, the evidence below is presented as a structured summary of statements already reported in the manuscript rather than as reconstructed quotations.

Table 1. Thematic Summary of Interview Findings

Theme	Evidence reported in the manuscript	Interpretation
Workforce displacement	Manual agricultural and textile tasks are increasingly supported or replaced by machines; some residents report reduced employment opportunities.	Technology changes the demand for particular forms of manual labor.
Productivity improvement	A self-employed tailoring account states that machines make work easier, smoother, and faster when production targets must be completed.	Technology can improve speed and production efficiency for workers able to use it.
Livelihood adaptation	Residents respond through trading, farming, sewing, small business, courier work, migration, and skills improvement.	Adaptation occurs through occupational mobility and livelihood diversification.
Socio-economic consequences	The manuscript reports difficulty finding work, income uncertainty, reduced interaction, and higher livelihood risk.	Employment change affects household security and community relationships as well as jobs.

3.1. The impact of the development of advanced technology on workforce reduction

The first theme concerns workforce displacement. Residents connected to agricultural and textile work described a gradual shift from human labor toward machinery and more sophisticated production tools. This finding is consistent with the broader literature showing that automation can substitute for particular tasks even when its net employment effect differs across sectors and levels of analysis [4], [7]. In developing economies, labor-eliminating technologies may create adjustment pressures when workers have limited access to alternative occupations or social protection [19]–[21]. The Ngalian case therefore supports the view that the effect of technology is not simply a reduction in total employment, but a reconfiguration of tasks and opportunities.

At the same time, the available narratives show a productivity benefit. A resident involved in self-employed tailoring reported that machines make work easier, smoother, and faster, particularly when production targets must be completed within limited time. This illustrates the dual character of technological change: the same technologies that reduce dependence on manual labor can also increase output and support workers who are able to use them. Similar debates in the literature emphasize that digital transformation can generate productivity gains while simultaneously creating pressure for workers to upgrade skills and reposition themselves in changing labor markets [3], [22].

The employment transition also has psychological and economic implications. The manuscript reports difficulty in finding replacement work, uncertainty over daily or weekly income, and concerns about

job continuity. These patterns are consistent with studies linking workforce reduction and automation-related insecurity to anxiety, lower job satisfaction, and concerns about occupational continuity [5], [6], [24]. Accordingly, technology-related workforce change should be assessed not only through efficiency indicators but also through its effects on household security and workers' perceived ability to remain employable.

3.2. Strategy for Facing Advanced Technology

The second major theme is adaptation. Residents reported several responses after employment disruption, including trading, returning to farming, sewing in convection activities, opening small businesses, becoming package couriers, and migrating to other areas to seek employment. These strategies resemble livelihood diversification and occupational mobility documented in other Indonesian rural settings [8], [9]. The findings also align with research showing that rural technology adoption is an ongoing adaptation process in which households combine new knowledge with existing resources rather than simply accepting or rejecting technology [11].

For Ngalian Village, adaptation is therefore closely related to capability development. Residents who remain in the textile sector attempt to improve skills so they can continue working alongside more advanced equipment. This pattern supports the argument that rural digitalization can stimulate new practices while also creating new requirements for digital literacy and technical competence [10]. It also reinforces the importance of reskilling and upskilling in discussions of the future of work [22]. Local training programs should therefore focus on practical machine operation, digital literacy, entrepreneurship, and transferable skills that allow workers to move between occupations.

Adaptation also requires institutional support. Individual resilience alone may be insufficient when job opportunities are limited or when workers face legal and economic vulnerability after employment loss [13], [14]. Village government, local employers, training providers, and community organizations can reduce transition costs by improving access to skills training, job information, micro-enterprise support, and social assistance. Such support can help technological change become a pathway to productivity improvement without leaving affected workers to absorb the adjustment costs independently.

3.3. Making Advanced Technology an Opportunity for a More Advanced Workforce

The third theme concerns the possibility of turning technology into an opportunity. The findings do not indicate that technology is uniformly harmful. Instead, its effect depends on whether residents can access the skills, capital, information, and employment pathways needed to use technology productively. Earlier studies have similarly shown that technological change can reshape production systems and rural occupations rather than producing a single linear outcome [23], [25].

This interpretation also explains why some residents choose migration or occupational change when local work becomes less available. Moving to another job or area can be an adaptive strategy, but it may also weaken everyday social interaction and create new household risks. The local evidence therefore expands the literature by showing that the consequences of automation are experienced through linked economic and social adjustments: changes in work opportunities are followed by changes in livelihood strategies, mobility, and community interaction.

Overall, the Ngalian case supports recent reviews that describe the employment effects of automation as context dependent [4], [7]. Technology can replace specific tasks, improve productivity, and generate new forms of work at the same time. The policy implication is not to resist technological development, but to manage the transition through inclusive skill development and livelihood diversification so that productivity gains are accompanied by realistic employment pathways for affected residents.

4. CONCLUSION

The study shows that technological development in Ngalian Village has a dual effect on local work. In the agricultural and textile-related livelihoods described in the available interview narratives, machines can improve speed and efficiency, but labor-saving technologies can also reduce demand for some manual tasks and contribute to uncertainty for workers who depend on local employment. The main themes identified were workforce displacement, productivity improvement, livelihood adaptation, and socio-economic consequences.

Residents respond to employment disruption by changing occupations, trading, farming, sewing, opening small businesses, working as couriers, migrating, and improving skills. These responses indicate that technological change should be accompanied by practical support for reskilling, digital literacy, entrepreneurship, job matching, and livelihood diversification. Village government, local employers, and training institutions can use these findings to design transition programs that help workers benefit from technological change while reducing the risks associated with job displacement.

This study is limited by its single-case design and by incomplete field metadata in the source manuscript. The exact number and characteristics of informants, interview duration, recording and transcription procedures, and formal member-checking or triangulation activities were not fully documented and therefore were not reconstructed in this revision. The findings should consequently be interpreted as a context-specific qualitative account rather than a statistically generalizable estimate. Future research should document participant characteristics in detail, involve multiple stakeholder groups, triangulate interviews with employment or village records, and follow livelihood changes longitudinally to evaluate how workers adapt over time.

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