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The role of top management commitment, employee empowerment and total quality management in production waste management and enhancing firm performance

Shania Vanessa Wijaya^a, Zeplin Jiwa Husada Tarigan^{a*} and Hotlan Siagian^a

^a*School of Business and Management, Petra Christian University, Surabaya, East Java Indonesia*

ABSTRACT

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The company seeks the role of internal function and external partnership to eliminate or reduce the waste generated and its impact on the environment. Internally, Top management needs to commit and actively increase the participation of employees in implementing total quality management and production waste management to enhance business performance. This study surveyed the companies engaged in the industry sector producing finished products while generating waste in the production process. Data collection is carried out using online questionnaires through Google Forms with data analysis using PLS software. One hundred and thirty-six (136) manufacturing companies located in East Java, Indonesia. The results of the data analysis indicated that top management commitment significantly influences firm performance, employee empowerment, and total quality management. Employee empowerment impacts total quality management and production waste management. Total quality management positively influences production waste management and firm performance. In addition, production waste management significantly impacts the firm performance. In addition, top management commitment indirectly affects firm performance through the mediating role of total quality management. However, the mediating effect of production waste management is insignificant in translating top management commitments to firm performance. The result provides a theoretical contribution to developing green supply chain practices and sustainability. Furthermore, the practical contribution provides insight for top management companies that production waste management can improve performance with high management commitment and employee empowerment.

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1. Introduction

Indonesia's economic growth shows a high GDP level (5%) except during the Covid-19 period in 2020 (-2.1%). Furthermore, according to *the Asian Development Outlook*, Indonesia's economic outlook will experience growth of up to 5%. This finding shows that the Indonesian economy will experience higher growth, and competition among companies in all sectors, especially manufacturing, will experience high growth (Guo et al., 2019). In addition, the Indonesian government has made environmental protection regulations that must be followed by business actors (Tarigan et al., 2020). Therefore, the company is expected to be able to carry out its company operations by paying attention to an environmentally friendly system (Graham et al., 2014). Thus, it will reduce the level of pollution and waste and has a positive impact on economic development (Guo et al., 2019). In addition, globalization and liberalization today require every company to practice a business model that pays attention to environmental sustainability and is the initial requirement for doing global business (Graham et al., 2014).

This commitment is necessary because implementing an environmentally friendly oriented system requires company policies and collaboration from employees (Donate et al., 2020). Implementing a system oriented toward environmental protection

* Corresponding author

E-mail address zeplin@petra.ac.id (Z. J. H. Tarigan)

requires significant investments and top management commitments to employee empowerment efforts to implement total quality management (Ahmed & Idris, 2021; Singh & Sangwan, 2011). Top management is responsible for establishing the company goals regarding cost efficiency, flexibility, responsiveness, productivity, and quality improvement (Siagian et al., 2022). Furthermore, top management is also responsible for enhancing employee morale, motivation, and competitiveness in the pursuit of customer satisfaction (Ahmed & Idris, 2021; Strotmann et al., 2017). A strong top management commitment can influence the company's operational system, such as employee empowerment, the delegation of authority, implementation of quality systems, resource allocation, and reduction of pollution and waste levels, ultimately improving company performance (Ahmed & Idris, 2021; Santoso et al., 2022). Research from Ahmed & Idris (2021) and Singh & Sangwan, (2011) on the manufacturing industry in Sudan states that top management commitments can improve employee empowerment and implement a total quality system efficiently.

In implementing manufacturing efficiency, employee communication is vital in the running according to green manufacturing principles (Basana et al., 2022). Thus, employees are expected to have a moral attitude toward food waste and always prevent food processing waste (Luu, 2020). This finding needs to be realized by minimizing the tendency of rejection and dysfunction of system implementation toward reducing food waste (Singh & Sangwan, 2011). For companies that implement ISO 9001, the most vital aspect in fulfilling TQM (total quality management) is employee empowerment. In the TQM concept, employees as human resources need to be involved because they play an essential role in implementing organizational strategies to achieve the target goals that have been set (Ahmed & Idris, 2021; Graham et al., 2014). Increasing the contribution of employee engagement needs to be improved through providing financial and performance feedback as well as sharing knowledge for the search for practical and competitive solutions in a proactive atmosphere (Donate et al., 2020; Hosain, 2014; Jeong & Shin, 2019; Perin et al., 2016).

Top-level management commitment and employee empowerment can significantly shape the success of total quality management (Ahmed & Idris, 2021). The entire integrated function can be controlled and audited with the TQM to achieve quality standardization (Ochiri et al., 2015; Singh & Sangwan, 2011). According to research by Guo et al. (2019) of 200 Yangtze River, China manufacturing companies, an excellent total quality management system can encourage sustainable waste management to form a sustainable company amid competition. Furthermore, implementing TQM takes place in pluralism and not individualism, meaning that TQM will be successful if all interested parties are equally committed (Li et al., 2006; Ochiri et al., 2015). In this modern era, TQM is implemented by implementing ISO 9001, prioritizing the right attitudes, leadership, processes, raw materials, environment, and skills to minimize product failure (Graham et al., 2014; Nguyen & Le, 2020). In supporting the implementation of TQM, big data management is needed to encourage the achievement of traceability for the evaluation, control, and coordination of activities to reduce production waste sustainably (Annosi et al., 2021; Gandomi & Haider, 2015; Ishijima et al., 2021).

An excellent management system will support sustainable waste management so that a company can maintain its sustainability amid industrial competition. According to research from Guo et al. (2019) on 200 manufacturing companies in the Yangtze River, China, the TQM program will run stably and successfully only when all interested parties, including management, are committed to streamlining TQM (Li et al., 2006; Ochiri et al., 2015). One of the efforts implemented in the food industry is the ISO 9001 system which sets the achievement of *Total Quality Management* as the primary target (Nguyen & Le, 2020). To minimize product failure, TQM requires the right attitude, leadership, processes, raw materials, environment, and skills (Graham et al., 2014; Kebede-Adem & Viridi, 2021; Al-Jarrah et al., 2023).

Any operational process from primary production to the final consumer level will inevitably produce waste due to the disposal process (Caldeira et al., 2019). The latest finding, according to Annosi et al. (2021), the efficiency of the production process is relatively low, where around 30% (88 million tons) of production output will become waste in the food supply chain. In response, the treatment of production waste needs to be optimized to reduce storage space, energy use, and labor costs (Caldeira et al., 2019). Meanwhile, waste treatment is also needed to maintain environmental sustainability through waste allocation to landfill, natural resource preservation, energy efficiency, and emission reduction to save costs and increase profits (Ochiri et al., 2015). According to research in Vietnam, especially in five (5) economic sectors (Textiles, fisheries, chemicals, construction materials, food), stated that waste reduction will increase *cost* efficiency to enhance firm performance (Nguyen & Le, 2020; Tarigan et al., 2019). Regular management of organizations and resources can create added value to increase the company's competitiveness (Ahmed & Idris, 2021; Graham et al., 2014). According to the research of Donate et al. (2020), located in Spain, implementing human resources systems, total quality management (TQM), and efficient innovation capabilities will improve firm performance. Companies should pay attention to investment in intangible assets, which means that companies must pay attention to aspects of quality and innovation and exploit knowledge more efficiently to increase the company's competitive advantage (Potnuru et al., 2019; Novitasari & Tarigan, 2022).

Based on the explanation above, this research determines five primary objectives to examine: first, top management's influence in improving employee empowerment, total quality management (TQM) implementation, and firm performance. Second, the impact of employee empowerment on improving total quality management implementation and production waste management. Third, assessing the influence of total quality management implementation on production waste management. The fourth is to test the impact of total quality management implementation on firm performance. Finally, the fifth examines

the effect of production waste management on firm performance. The rest of the paper is structured as follows: the literature review in section 2, the hypotheses development in section 3, the research methods in section 4, the analysis and discussion in section 5, and finally, the conclusions in section 6.

2. Literature Review

Industry competition has changed the paradigm of customer demand for high-quality, delicious, lower-priced foods, organic foods, balanced nutrient content in food, and efficient food supply (Nguyen & Le, 2020). The procurement of raw materials or components that the company needs no longer relies on domestic sources but seeks global supplies to ensure the availability of supplies necessary to continue the company's operations. This strategy implies the competition for raw materials will be tighter between local and international companies for the guaranteed supply. Still, due to scarcity, there is increasing competition between local and international companies (Graham et al., 2014). The company strives to build management commitment and employee participation to implement total quality management and production waste management, which ultimately impacts improving performance.

2.1. Management Commitment

The commitment of top management is closely related to the successful implementation of TQM. The tangible form of management's commitment to TQM can be measured through value creation and goals to facilitate implementation while prioritizing quality and adequate resource supplies (Ahmed & Idris, 2021). Managers must always pay attention to top management's commitment, middle management's responsibility, and employee empowerment measures to implement TQM (Singh & Sangwan, 2011) successfully. The best results from implementing TQM can be achieved if the management and implementers of TQM are fully committed to the planning, implementation, and evaluation (Ahmed & Idris, 2021).

Management commitment is about the commitment to the company's resource allocation (Tarigan et al., 2020). Active participation by top management in the quality improvement process facilitates the inclusion of quality into the company's strategy. When management does not commit, they become reluctant to change the production system as part of the TQM program (Jena et al., 2019). Management is the driving force of any organizational initiative where creating values, goals, and systems is necessary to direct the company's operations and activities. It includes funding training programs, assigning task forces to facilitate programs, and budgeting reward systems (Graham et al., 2014). According to Luu (2020), change and human resource management (HRM) are carried out through clear communication among HRM practices.

Managers must develop organizations and enhance innovation capabilities through supply chain facilities development (Donate et al., 2020). Management commitments are essential to encourage awareness, knowledge management, and climate development (Luu, 2020). The manager's primary role is not about control but the commitment to ensure workers do what they are requested. Leadership is more about improving workers' performance, machinery utilization, and quality. The principle of leadership is to eliminate the causes of failure and help employees to do a better job with less effort (Donate et al., 2020). Strong leadership leads to a healthy organization and reflects actions corresponding to the organization's written vision and mission statements (Graham et al., 2014). Waste management strategies will ideally be carried out based on management commitments, so a manager must address waste minimization efforts (Ochiri et al., 2015). This study uses measurement items for management commitment as follows: cost efficiency, the formation of management systems, how much upper-level management directs resources, both human resources, and materials, to improve quality, decentralization of tasks and responsibilities, and creating visible value through vision-mission (Ahmed and Idris, 2020).

2.2. Employee Empowerment

According to TQM, employee empowerment is carried out by encouraging employees to be as optimal as possible to find and apply problem-solving to quality problems, including identifying issues and taking resolution initiatives by delegating authority to allocate resources (Ahmed & Idris, 2021). To obtain an adequate commitment from all employees, it must involve them during the manufacturing process (Graham et al., 2014; Basana et al., 2022). Employee empowerment will provide freedom to take responsibility for ideas, decisions, and outcomes to replace an old-fashioned, rigid, and bureaucratic system (Rafique et al., 2022). The unsuccessful empowerment of employees is generally caused by the failure of continuous training to build teamwork and the mismatch of top management commitments, thereby lowering employee trust (Ahmed & Idris, 2021). Employees play a vital role in implementing organizational strategies, so great performance in all organizations starts from fulfilling employee satisfaction (Ahmed & Idris, 2021; Potnuru et al., 2019). Empowerment involves employees setting specific goals to achieve the company's vision and implement environmental projects (Singh & Sangwan, 2011). The principle of green manufacturing becomes the basis for reducing food waste in connection with optimizing product processing which further improves the company's performance (Luu, 2020; Xie et al., 2020; Santoso et al., 2022). The success of employee empowerment is marked by teamwork to overcome environmental problems through active employee involvement to continuously support the achievement of the company's vision and mission (Singh & Sangwan, 2011). Organizations need highly motivated workers, so companies need to provide returns in the form of salary eligibility and other facilities to meet the living needs of employees. The essential employee empowerment system that has a significant impact is feedback and rewards so that performance will improve both in achievement and psychologically (Hosain, 2014). The right communication

program will encourage employees to develop a positive perception of optimizing raw material resources and minimizing food waste (Luu, 2020). The existence of programs for employees, such as year-end employee parties or gatherings, will strengthen and unite all employees socially to develop relationships outside the work environment and bring out a sense of belonging (Halbesleben & Neveu, 2014).

Employee empowerment that goes hand in hand with teamwork will enable employees to contribute more, especially to meet the achievements of individuals, groups, and organizations in a social relationship (Donate et al., 2020). Empowering employees through rewarding employees for sharing and acquiring knowledge with each other will increase the quality and amount of knowledge about users and customers for the company through the development of external relationships (Donate et al., 2020; Perin et al., 2016). Irresponsible waste of resources requires revamping and developing practical and economically competitive solutions (Halbesleben & Neveu, 2014). Therefore, continuous teamwork is needed for problem-solving and new ideas that are proactive (Jeong & Shin, 2019). This study sets out measurement items for employee empowerment variables are employee responsibility for achieving the company's vision and mission, fulfillment of employee duties and responsibilities according to KPIs, positive perceptions of employees towards resource optimization, employee willingness to take corrective actions for waste (Ahmed and Idris, 2020).

2.3. Total Quality Management Implementation

The principle of TQM is the integration of overall organizational functions and processes to improve the quality of goods and services from synergistic relationships between departments (Ochiri et al., 2015). Companies that have implemented ISO must have implemented good planning for all processes. Implementing and controlling them adequately through audits is the principle of total quality management (Nguyen & Le, 2020). The output of implementing TQM performance needs to be linked to successful inspections, quality control, quality assurance, and standardization (Ishijima et al., 2021). The company shows total quality management by implementing ISO, which becomes an international regulation related to the environment (Nguyen & Le, 2020). The formation of a good organization comes from the commitment of management time, employees, and financial resources (Singh & Sangwan, 2011). The application of TQM aims to promote sustainable development (kaizen system) to improve efficiency and optimization of business processes so that the expected lean manufacturing concept is formed (Ochiri et al., 2015).

The implementation of TQM recognizes the role of everyone in the organization so that modern TQM is pluralistic and prioritizes team performance (Ochiri et al., 2015). TQM applies the right attitude, adequate skills, efficient processes, appropriate raw materials, and leadership by paying attention to human resource management and business processes to ensure customer satisfaction (Al-Jarrah et al., 2023; Li et al., 2006). TQM is divided into two (2): hard and soft (Ali & Johl, 2021). According to research by Ahmed & Idris (2021), the soft TQM aspect that most affects variations in employee job satisfaction is employee empowerment. Established goals and corrective actions are determined through a participatory approach (Strotmann et al., 2017). Manufacturing practices involving employees and management commitment affect company performance significantly (Hosain, 2014; Tarigan et al., 2019). TQM has core components: basic principles, tools and results, core values, techniques, principles, procedures, and tools (Ali & Johl, 2021). The total orientation of the organization is to satisfy customers and create value for various stakeholders, namely customers, employees, shareholders, and society (Al-Jarrah et al., 2023).

Regarding strategic programs, success is determined based on top-level management as a path for adopting and implementing innovations in organizational activities (Singh & Sangwan, 2011; Novitasari & Tarigan, 2022). TQM requires the right attitude, leadership, processes, raw materials, environment, skills, and more to prevent defects and ensure high-quality products and/or service offerings (Graham et al., 2014). This study uses measurement items for Total quality management is the existence of good integration between departments, involvement of all departments to produce quality goals, involvement of each department to produce quality goals, and departmental responsibility in maintaining product quality (Donate et al., 2020).

2.4. Production Waste Management

Production waste is any waste disposal that does not provide added value for consumers (Fan et al., 2019). Waste reduction will create an efficient and effective system to satisfy employees and improve company performance (Luu, 2020). The principle of waste is unnecessary disposal due to errors, poor communication, and the number of defective products or materials that cannot be repaired, used, or sold (Ochiri et al., 2015). Employees will continually develop their morality and responsibility to interpret raw material resources to minimize waste significantly (Luu, 2020). Increasing awareness of environmental issues has generated pressure to reduce the environmental impact involved in the production and consumption of service goods so that the manufacturing industry initiates measures to minimize production waste (Singh & Sangwan, 2011; Xie et al., 2020). The principle of TQM is to strive for as little waste as possible during the supply chain (Singh & Sangwan, 2011). Waste reduction aims to maintain environmental sustainability, comply with legal compliance, increase competitiveness, and improve customer service (Ochiri et al., 2015). Industry waste often occurs during the sales, marketing, and frontline employee processes. The existence of abundant resources and investment will encourage everyone to pursue

strategies to obtain proactive resources as additional resources. This proactive resource is expected to be a medium for transferring resources from one form to another to reduce the production waste generated (Luu, 2020). Waste reduction will mitigate negative environmental impacts but remain optimal in meeting customer needs (Ahmed & Idris, 2021). The goal of waste management is that institutions can save production and disposal costs to operate more economically (Strotmann et al., 2017). Widespread interest in reducing production waste from governments and non-governmental organizations has led to strategies from stakeholders to improve the sustainability of primary resources, reduction of raw materials ahead, and reduction of food waste in the entire food supply chain process. Food waste is caused by excessive production compared to existing market demand. The large display of food waste is also due to communication limitations in operational activities (such as production processes, handling, transportation, packaging, and storage of products). This also impacts products with a relatively short shelf life, such as refrigerated products (Annosi et al., 2021). Green manufacturing efficacy efforts will be able to activate individual environmental beliefs and attitudes to be able to adopt pro-environmental attitudes (Guo et al., 2019). This study uses measurement items for production waste management by emphasizing the application of environmental management activities that responsibly impact the environment, reduction of solid and liquid waste, reduction of gas emissions, and reduction of transportation. Warehousing costs to reduce industrial waste to provide added product value, waste management system minimizes waste and prod wasteful production burdens.

2.5. Firm Performance

Firm performance is an achievement the company obtains in a certain period by showing financial and operational performance (Tarigan et al., 2019). The company's performance is always evaluated by achieving the company's profit through the efficiency and effectiveness of the company on an ongoing basis (Nguyen & Le, 2020). Firm performance can be formed through increased non-material motivation to direct employees to long-term performance goals, assessment, and process control, which is then accompanied by measurable material feedback motivation (Hosain, 2014). Big data is emerging as a key means for performance optimization. Through big data management, the use of digital technology, and relevant information, better interaction, planning, and control are possible. Big data triggers change because it requires companies to rethink operations, control, and coordinate activities (Gandomi & Haider, 2015). It requires specific technical skills, such as extracting data, and managerial skills, such as interpreting data concerning organizational goals. A lack of specialized analytical skills or time constraints can hinder data management (Annosi et al., 2021).

The company's resources and expertise concentration include all financial, physical, human, and organizational access. These accesses play a role in developing manufacturing and delivering products or services to customers. Sustainable competitive advantage in a company must have added value and scarcity (Ochiri et al., 2015). Companies that have streamlined manufacturing will have a competitive advantage from positive operational results (Basana et al., 2022). The social competitiveness of the company is obtained from the orderly management of the organization and resources (Ahmed & Idris, 2021). Company performance can be optimized through quality policy, commitment, leadership, and quality management (Graham et al., 2014). The practice of a manufacturing plant ideally increases employee engagement, such as using manufacturing cells and total quality management, to affect various dimensions of empowerment and performance (Hosain, 2014). This study used measurement items for firm performance, which are: increasing sales turnover through the formation of competitiveness and value creation, cost efficiency for reducing COGS, formation of big data and continuous improvement for manufacturing streamlining, and reduction of defective products to provide a competitive advantage (Li et al., 2006).

3. Hypotheses Development

The improvement of company performance is characterized by the company's success in managing the environment. Initiating a change needs to be carried out through managing human resources, unity of vision, and employee empowerment (Halbesleben & Neveu, 2014). Management commitments related to empowerment avoid operational practice errors and minimize losses due to mistakes. The implementation of empowerment is closely related to the company's leadership and vision to achieve competitive advantage from employee engagement (Rafique et al., 2022). Management governance impacts the environmental policies of suppliers, employees, regulators, customers, and other stakeholders (Singh & Sangwan, 2011). A management system is needed primarily to encourage each group of employees to collaborate in achieving common goals in a team so that a strong, solid network is formed and based on mutual trust (Donate et al., 2020). In addition, it is necessary to decentralize the program so that every business-related individual, supplier, customer, and employee must be involved in the management program (Singh & Sangwan, 2011).

An employee plays a crucial role in implementing an organizational strategy. Excellent performance in all organizations starts with fulfilling employee satisfaction. Employee empowerment needs to involve management's commitment to applying problem-solving to problems related to quality, including identifying problems and taking the initiative to solve them through delegation of authority and allocating resources to employees to meet employee satisfaction (Ahmed & Idris, 2021). Management's commitment to implementing employee empowerment can be in the form of handling production problems, determining production goals or objectives, improving environmental work, motivating employee initiatives, and optimizing employee participation (Singh & Sangwan, 2011). A healthy and active company must always be involved in monitoring, auditing, and reporting program evaluations. Worker participation, teamwork, and employee empowerment are critical driving

systems for developing and implementing environmental systems (Singh & Sangwan, 2011). The proper management's commitment to employee empowerment will provide flexibility to make decisions, ideas, and results so that the manufacturing system becomes less rigid and bureaucratic. Appropriate employee empowerment will provide a framework including resources and technical support in every decision-making (Ahmed & Idris, 2021). Based on the explanation, the first hypothesis is established.

H₁: Top Management Commitment affects Employee Empowerment.

Management decisions are related to competitive environmental policies and strategies that should reflect a healthy, sustainable development goal. Establishing an ecological policy determines the direction and guidelines in the development of an organization (Singh & Sangwan, 2011). In practice, the urgency of the company's vision toward improving performance varies according to the beliefs and commitments of the company's management (Guo et al., 2019). Management commitment concerning leadership requires clarity of vision, long-term orientation, teaching, participatory change, employee empowerment, top management encouragement, commitment to employee development, and achievement of top management product quality (Graham et al., 2014). Implementing green sustainable complex practices, not only commercial demand, and environmental protection, increase corporate incentives but also the magnitude of corporate responsibility to pursue environmental sustainability through the TQM system (Guo et al., 2019; Ali & Johl, 2021). The commitment and character of environmental management play a critical role in providing environmental protection related to supply optimization to form a sustainable manufacturing industry. Management's commitment is maintained with more responsibility (Tarigan et al., 2020). It can maintain trust so that it strives to carry out sustainable production activities and operations to balance the conflict between the company's developers and the sustainability of the company and the environment (Agyabeng-Mensah et al., 2020). According to Singh and Sangwan (2011), it was found that manufacturing actors are not motivated to form TQM optimization without managerial commitment that can provide idealism of structure, goals, and incentives in the implementation of manufacturing. Therefore, the commitment of top management to the implementation of the TQM program is measured in various aspects, including the delegation to their subordinates through value creation and conveying the philosophy that quality gets high priority over cost and provides adequate resources for the implementation of TQM initiatives (Ahmed & Idris, 2021). Furthermore, management commitments are carried out consistently and appropriately at all organizational levels by the organization's vision and mission statement (Graham et al., 2014). In addition, management commitments related to establishing quality and environmental management systems, such as ISO 14001, help companies manage, coordinate, assess, and monitor environmental activities (Agyabeng-Mensah et al., 2020). Therefore, based on the explanation above, a study was carried out with the second hypothesis.

H₂: Top Management Commitment affects Total Quality Management.

Top Management level responsibilities affect individual principles and act as a catalyst for pro-environmental activities. Management that successfully identifies deficiencies will be more willing to adopt a better management plan that will later affect optimizing company performance (Guo et al., 2019). A TQM organization that wants to improve and achieve success must fully commit to the overall implementation, even from the top to the bottom floor of the factory (Ahmed & Idris, 2021). Management with high commitment will have a sense of responsibility for everything done so that management will always take positive steps in promoting ecological and technological innovation (Guo et al., 2019; Novitasari & Tarigan, 2022). Leadership closely relates to improving organizational performance regarding workers, machinery, and quality (Graham et al., 2014; Siagian et al., 2022). Full commitment to TQM needs to be implemented by both management and employees to improve company performance (Ahmed & Idris, 2021). The primary role of management is not just to control but to ensure that employees' work follows the empowerment system implemented. Leadership in management commitment must eliminate the causes of failure and help employees achieve better performance with less effort (Graham et al., 2014). Management commitment is essential in adopting and implementing innovation in an organization, especially environmental systems, to ensure the availability of raw material resources and employees to create a unified company unit (Singh & Sangwan, 2011). Based on the above, a third hypothesis was established.

H₃: Top Management Commitment affects Firm performance.

Workers are a source of ideas, innovation, expertise, experience, knowledge, and cooperation, so they must be utilized to realize innovative ideas, career satisfaction, and organizational commitment (Potnuru et al., 2019). Adopting the TQM program in an organization aims to ensure active employee engagement through cross-functional teamwork, implementation of employee advice, encouraging employees to provide advice, individual financial incentives, and group financial incentives (Ahmed & Idris, 2021). Human resource management requires employees to have the same vision and mission during the empowerment, so adequate training is necessary to establish the right TQM system (Singh & Sangwan, 2011). A high level of employee "work engagement" increases job satisfaction. Applying this TQM presents a positive and hopeful message to offer an opportunity for self-actualization in a challenging but satisfying work environment (Ahmed & Idris, 2021). Empowering innovation and human resources needs improvement to strengthen communication to optimize employee initiatives (Luu, 2020). Employee empowerment can build a healthy and respectful company culture. Besides, TQM practices can create a culture that encourages employees to work together in all company functions, thereby increasing personal

responsibility and a sense of accomplishment in job duties (Ahmed & Idris, 2021). Therefore, minimizing confusion, worry, and stress is crucial to motivate employees to always feel responsible and give their best attention (Hosain, 2014). Alyan (2022) found that there is an influence of intellectual contributions in its role in mediating information and communication technology. Based on the explanation above, a study of the fourth hypothesis was carried out.

H4: *Employee' Empowerment affects Total Quality Management.*

Product waste prevention can be done by articulating clear goals, establishing various channels to transmit waste prevention directives, considering technological systems, and offering training on buying and consuming (Singh & Sangwan, 2011). Communicating and regulating proper food waste prevention will form a unified concept of green manufacturing principles that build employee initiative awareness to reduce production waste (Luu, 2020; Santoso et al., 2022). The key to zero waste's success is tracing, recycling, composting, and energy conversion (Veleva et al., 2017). The removal of production waste relies heavily on employee work motivation based on policies that can change motivation, perception, and culture to change previous behaviors (Fan et al., 2019). Employee motivation and empowerment rely heavily on green manufacturing training, which includes methods and techniques to carry out operational processes in an environmentally friendly manner. Green manufacturing training provided to empower employees includes life cycle evaluation, clean and hygienic equipment operations, material recycling, and waste disposition (Xie et al., 2020).

Individual workers who carry out proactive resource management will always strive to convert additional resources to reduce food waste. Resources, including waste, will be able to be processed by transferring entities to form other entities (Luu, 2020). Employee doubt and uncertainty can be increased by providing relevant information about food waste prevention in various communication programs (Singh & Sangwan, 2011). Moral motivation needs to be developed to navigate feelings of guilt related to the waste of resources so that workers will give their best version through intellectual contributions and energy to reduce resource wastage (Luu, 2020). Based on the explanation above, a fifth hypothesis study was carried out.

H5: *Employee' Empowerment affects Production Waste Management.*

Excellent total quality management will provide a better range of internal and external communication quality so that there is enough information to implement the most appropriate production waste prevention. Production waste management is closely related to manufacturing efficiency systems to form a sustainable company (Guo et al., 2019). The implementation of the TQM program needs to be carried out with clear objectives, clear transmission channels, and knowledge related to information technology during food waste prevention. A transparent and clear system will allow the design of training, purchasing, and consuming supplies as efficiently as possible to minimize production waste (Luu, 2020). A good TQM system will always involve a win-win solution, where reductions in water and energy use reduce environmental impacts and costs (Petljak et al., 2018). Through TQM, any form of waste of production can be transformed into an output with a new value (Ishijima et al., 2021). The successful implementation of TQM is characterized by progress from the original state, reducing disability, increasing customer satisfaction, and making continuous improvements. The application of TQM focuses on gradual and constant improvement, increasing employee empowerment, meeting consumer expectations, problem-solving in teams, process management, close relationships with suppliers, top management commitment, and human resources training to minimize rework and waste (Kebede-Adem & Virdi, 2021; Siagian et al., 2022). Based on the explanation above, the sixth hypothesis is as follows:

H6: *Total Quality Management affects Production Waste Management.*

Green supply chain management implemented by the company in the form of ISO 14000 certification as total quality management in 890 companies in 8 economic sectors in Vietnam, thus increasing company performance by 0.209 (Nguyen & Le, 2020). Total quality management uses a five-phase concept, PDCA (Plan–Do–Check–Act), where continuous improvement is the goal. TQM strives for the quality of products and services on an ongoing basis to distribute responsibilities among all employees. TQM's approach focuses on customers and optimizes customer needs by exploiting group knowledge and experience. In this regard, integrating employees in developing and applying TQM minimizes food waste (Strotmann et al., 2017). TQM optimization is enhanced through training, teamwork, and motivation to achieve common goals (Donate et al., 2020). Quality and environmental management systems such as ISO 14001 help companies manage, coordinate, assess, and monitor manufacturing activities (Agyabeng-Mensah et al., 2020). The relationship between individual performance can improve the quality of TQM, giving rise to a feeling of competence and initiative in participatory efforts and decision-making to improve company performance (Hosain, 2014). An exemplary implementation of TQM will mediate external and internal relationships, thus helping companies to access information, technology, and knowledge resources more quickly. Attachment relationships, cooperation, linkages, partnerships, and collaborative networks will enhance the company's innovation and creativity capabilities (Donate et al., 2020). Finally, TQM, especially communication programs related to production optimization, will give TQM full of morale and confidence to transfer production waste to be more practical, further improving the company's performance (Luu, 2020). Based on the above, the seventh hypothesis is proposed.

H7: *Total Quality Management affects Firm performance.*

Green procurement, logistics, and manufacturing are green supply chain management in manufacturing companies that have received ISO 14000 certification as a context for implementing total quality management in 8 economic sectors, including industrial production, to improve company performance (Nguyen & Le, 2020). Food waste prevention that has been implemented so far is aimed at (1) redistribution of food for human and livestock consumption, (2) consumer education to prevent food waste, (3) improving the efficiency of the food supply chain by collaborating on each phase of the food supply chain, (4) implementing measures to prevent food waste through government and community programs nationally (Annosi et al., 2021). A higher level of supply chain integration allows for improved financial performance for each actor along the supply chain phase (Luu, 2020). In addition, several waste reduction strategies can improve transactional economic costs to maximize the company's optimal resources to remain competitive. Waste reduction is carried out through higher investment, increasing the number of production cycles, marketing optimization, and improving accounting financial performance to compete with competitors (Ochiri et al., 2015). An efficient production process will affect improvement, time reduction, cost, labor, and time savings. Manufacturing streamlining is done through waste reduction so that operational and resource efficiency will produce optimal output (Agyabeng-Mensah et al., 2020). Sustainable waste management becomes a strategic resource to give rise to opportunities for the minimization of production costs through reduced costs, costs of managing hazardous materials, and time and cost reductions for preserving energy, water, fuel, and other resources (Ochiri et al., 2015). The implementation of green manufacturing involves the vision of energy conservation, pollution control, emission reduction, and waste management to solve the damage to the ecological environment due to the company's production processes to create harmonious development and increase economic growth (Guo et al., 2019). Streamlining manufacturing through waste reduction will increase the company's competitiveness, which is closely related to the company's performance (Agyabeng-Mensah et al., 2020). Waste management refers to using waste resources to produce selling value products to increase cost efficiency during the production process (Guo et al., 2019). Leadership is one of the essential parts of the process for companies to practice ecological development strategies. Waste management is crucial to meet government environmental policies and practicing ecological development strategies. Waste minimization can be a bridge to reduce destructive effects due to the sustainable practice of green manufacturing (Guo et al., 2019). Based on the explanation above, the eighth hypothesis is proposed.

H₈: *Production Waste Management affects Firm Performance.*

4. Research Methods

This research is an explanatory study conducted to find an explanation of the relationship between variables. The explanatory concept measures the typical variance portion to provide a more complex predictive model. The implementation of this research is through a quantitative approach to measure the relationship between concepts in research. The samples used in this study were employees who worked in East Java manufacturing companies on medium and large scales. The samples in this study were selected carefully and accurately by only involving respondents with more than one year of experience working at the company where they worked. The sampling technique is purposive because it involves subjective characteristics to be felt to meet the study's objectives. This study involved senior staff with a level manager or supervisor level in all fields in an East Java manufacturing company who had worked for more than one year with the status of a permanent employee. This criterion is due to several considerations, including that each unit understands green manufacturing techniques to carry out waste reduction efficiency to increase efficiency sustainably.

The measurements for each variable are determined based on previous studies. First, top management commitment (TMC), used four indicators adopted from research as follows: our company management established values that are important for the company (TMC1), our company management system has run efficiently (TMC2), our company management ensured the involvement of all components in the company (TMC3), and our company management guarantees the availability of resources in carrying out operations (TMC4) (Ahmed & Idris, 2021; Singh & Sangwan, 2011). Second, Employee Empowerment (EE) is measured using five indicators: the company is responsible for the achievement of the company's vision and mission that has been set (EE1), company employees complete agreed tasks according to KPIs (EE2), company employees are responsible for agreed tasks (EE3), company employees always carry out operational processes optimally (EE4), and company employees make improvements to work (EE5) (Luu, 2020; Singh & Sangwan, 2011; Ahmed and Idris, 2021; Rafique et al., 2022). Third, Total Quality Management (TQM) is assessed using four indicators: the integration between departments within the company has been well established to achieve quality goals (TQM1), information in the company is easily obtained between departments related to production quality (TQM2), each department in the company is responsible for maintaining product quality (TQM3), and each department of the company is responsible for processing discrepancies in maintaining quality (TQM4) (Ochiri et al., 2015; Donate et al., 2020).

Production waste management (PWM) is a waste management system or defect products to initiate the formation of proactive resources (Luu, 2020; Ochiri et al., 2015; Petljak et al., 2018). The measurement items for PWM are proposed as follows: the waste management system running well (PWM1), the company's operational process has a waste handling system (PWM2), the company's operational process has a waste handling standard (PWM3), the company has handled waste well in cost efficiency (P W M4), and the company's waste handling reduces environmental impact (PW M5). Firm Performance (FP) is the performance of financial and operational performance through the efficiency and effectiveness of the company (Nguyen

& Le, 2020; Li et al., 2006). The measurement items for FP are that the company has unique and reliable value (FP1), has been running cost-efficient operations (FP2), has big reliable data (FP3), and has prevented the formation of defective products or production failures (FP4). Data collection in this study was carried out in a "cross-section" where data was collected at a certain period, representing the circumstances and activities at that time. Data processing is carried out using data analysis techniques, namely structural equation modeling using Smart Partial Least Square (PLS) software.

5. Analysis and Discussion

Data collection and information extraction are carried out using google form (online) facilities disseminated through broadcast WhatsApp and e-mail. As many as 136 of 156 companies surveyed are valid for further analysis, while 20 questionnaires were invalid because the companies did not generate waste in their process. The valid data is processed to assess the indicators' validity and reliability. The respondent profile based on the results of questionnaire distribution in the company is presented in Table 1.

Table 1
Respondent Profile

Profile	Description	Frequency	Percentage
Position	Owner	4	3 %
	Board of Directors	13	10 %
	General Manager	15	11 %
	Manager	11	8 %
	Supervisor	40	29 %
	Senior Staff	28	21 %
Work experience	1 to < 3 year	38	28 %
	3 to < 5 years	17	13 %
	5 to < 7 years	10	7 %
	7 to 10 years	18	13 %
	More than 10 years	53	39 %
	Division	Accounting/Finance	15
Marketing/Sales		49	36 %
R&D/QA/QC		8	6 %
Operational/Production		24	18 %
Purchasing/Export-Import		6	4 %
Engineering		6	4 %
Logistic		8	6 %
Planning Production Inventory Control		8	6 %
General Affairs/Human Resources		6	4 %
Business Development		4	3 %
Information Technology		2	1 %
Number of employees		20 to 100 employees	57
	More than 100 Employees	79	58 %
Industry Sector	Agronomic	7	5 %
	Apparel Manufacturing	8	6 %
	Building Materials	12	9 %
	Mining	6	4 %
	Cigarette Industry	2	1 %
	Consumer goods	82	60 %
	Cosmetics	2	1 %
	Electronic	1	1 %
	Wood, Leather, and Paper	8	6 %
	Printing & Packaging	5	4 %
	Automotive & Metal	3	2 %
	Types of Waste generated	Material waste	50
Finish Product waste		22	11 %
Process Production waste		41	21 %
Transportation		30	16 %
Energy		11	6 %
Equipment/Tools Operation System		5	3 %
Employee		6	3 %
Waiting Time		3	2 %
Return Product		13	7 %
Product Reject		5	3 %
Delivery Time		7	4 %

Based on Table 1, it was found that respondents with the position of supervisory and above represented 82% of total respondents. This finding shows that the respondents have adequate work experience to understand the operational conditions of the company, including waste management. In addition, various departments from which respondents came indicated the integration between departments, allowing a comprehensive tracing of activities in response to production waste that had been generated. Therefore, the respondents can identify and understand the subject matter of waste in their company. Data analysis includes descriptive and inferential analysis. The descriptive analysis assesses the mean and standard deviation, while inferential analysis examines the indicator's validity, reliability, and path coefficients of the relationship between constructs

using SmartPLS software. Table 2 demonstrates the analysis result covering outer model testing for convergent validity, discriminant validity, and reliability tests. Indicators are considered valid when the factor loading value exceeds 0.50. In addition, indicators are considered reliable when the composite reliability or Cronbach Alpha exceeds the value of 0.70. As shown in Table 2, all indicators and constructs are considered valid and reliable; hence further analysis of the hypotheses can proceed.

Table 2
Statistical Analysis of Mean, Validity, and Reliability

Items	Mean	Convergent Validity	Discriminant Validity (AVE)	Reliability	
				Cronbach Alpha	Composite
TMC	3.917		0.548	0.794	0.858
TMC1	4,081	0.791			
TMC2	3,676	0.702			
TMC3	3,890	0.780			
TMC4	4,022	0.812			
EE	4.069		0.542	0.719	0.826
EE1	4,125	0.708			
EE2	4,140	0.752			
EE3	4,154	0.773			
EE4	3,993	0.744			
EE5	3,934	0.723			
TQM	3.974		0.701	0.894	0.921
TQM1	3,882	0.776			
TQM2	3,926	0.791			
TQM3	4,066	0.739			
TQM4	4,022	0.794			
PWM	3.919		0.596	0.773	0.855
PWM1	4,296	0.841			
PWM2	3,948	0.859			
PWM3	3,765	0.831			
PWM4	4,122	0.830			
PWM5	4,061	0.825			
FP	3.881		0.601	0.779	0.857
FP1	4,007	0.733			
FP2	3,779	0.781			
FP3	3,846	0.733			
FP4	3,890	0.696			

The hypothesis is supported by data when the p-value is less than 0.05 or a t-statistic value exceeds 1.96. Table 3 demonstrates that all eight hypotheses are supported.

Table 3
Hypothesis Test Results

Hypothesis	Path Coefficient	T Statistics	P Values
TMC → EE (H1)	0.585	8.153	0.000
TMC → TQM (H2)	0.351	4.818	0.000
TMC → FP (H3)	0.230	2.660	0.008
EE → TQM (H4)	0.450	7.183	0.000
EE → PWM (H5)	0.263	2.781	0.006
TQM → PWM (H6)	0.356	3.819	0.000
TQM → FP (H7)	0.337	3.010	0.003
PWM → FP (H8)	0.222	2.071	0.039

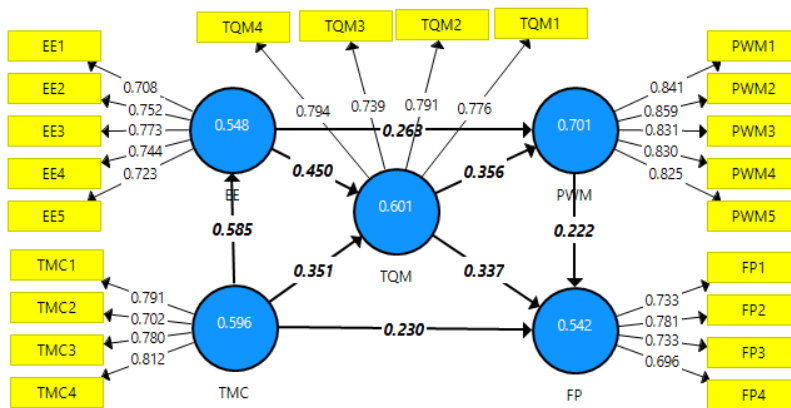


Fig. 1. Path Coefficient Results

The first hypothesis states that top management commitment (TMC) influences employee empowerment (EE). Analysis results confirmed the hypothesis by a path coefficient value of 0.585 and a t-statistic of 8,153 > 1.96 or p-value of 0.000 < 0.05. These results show a significant direct influence of top management commitment on employee empowerment in industry management. Top management commitment can positively and significantly enhance employee empowerment. The stronger the top management commitment, the more influential employee empowerment. Hence, employees will have more initiative and creativity in generating ideas. The employee empowerment system's success can increase employee satisfaction and create a mutually open work atmosphere between departments. The results of the study are in line with research that states that employee empowerment can strengthen initiatives and communication between employees throughout the implementation of the total quality management program (Ahmed & Idris, 2021; Singh & Sangwan, 2011; Luu, 2020; Hosain, 2014; Donate et al., 2020; Alyan, 2022).

The second hypothesis state that top management commitment affects total quality management. The result is indicated by a path coefficient of 0.351, with a t-statistic of 4,818 > 1.96 and a p-value of 0.006 < 0.05. These results show a significant direct influence of top management commitment and total quality management. Top management commitment can significantly improve the company's total quality management. In addition, a path coefficient value of 0.351 indicates a positive relationship directly proportional where the higher the top management commitment, the higher the total quality management implementation such as designing training, planning, developing, and consuming efficient raw materials to minimize production waste. Optimization of total quality management systems encourages further information processing to reduce the complexity of processing and practical processes. A good TQM can identify waste processing in production and transfer entities from waste to output with a new added value. These results are in line with research that states that TQM implementation can reduce unnecessary costs (Petljak et al., 2018; Guo et al., 2019; Luu, 2020; Petljak et al., 2018; Ishijima et al., 2021; Kebede-Adem & Viridi, 2021; Albloushi et al., 2022; Strotmann et al., 2017).

The third hypothesis that top management commitment affects firm performance is supported by the path coefficient value of 0.230 and t-statistic of 2,660 > 1.96 or p-value of 0.006 < 0.05. These results show a significant direct and positive influence of top management commitment on firm performance. Communication and the success of manpower will form a unified concept to encourage employee initiatives in reducing production waste. The motivation of employees to run green manufacturing will enable environmentally friendly operational processes. Employees who have been empowered will be highly motivated to contribute intellectually and energy to reduce resource waste significantly. These results are in line with research that states that employee empowerment encourages employees to provide the best version, especially intellectual contributions to reduce operational waste (Luu, 2020; Singh & Sangwan, 2011; Veleva et al., 2017; Fan et al., 2019; Xie et al., 2020; Strotmann et al., 2017).

Furthermore, the fourth hypothesis is supported by the coefficient value of 0.450 and a t-statistic value of 7.183 > 1.96. This result implies that employee empowerment positively influences total quality management implementation. Employee empowerment can substantially impact the success of total quality management implementation. The more effective the employee empowerment, the more successful the total quality management implementation will be. Implementing TQM and its interaction with top management commitment will enhance the involvement of employees in policy formulation, strategy formulation, and program quality improvement. The results of the study are in line with research that states that management's commitment can help companies implement TQM adequately (Agyabeng-Mensah et al., 2020; Singh & Sangwan, 2011; Guo et al., 2019; Graham et al., 2014). The fifth hypothesis states that employee empowerment affects production waste management. The result confirms this hypothesis with the path coefficient value of 0.263 and a t-statistic of 2.781 > 1.96. This result shows a significant direct and positive influence on employee empowerment and production waste management. Therefore, employee empowerment can significantly enhance production waste management. The more effective employee empowerment, the more successful the production waste management will be. Top management commitment will form an excellent two-way communication system in responding to problems and challenges so that the company's performance is faster, more responsive, agile, and efficient. On the other hand, management's commitment will also support employee empowerment, allowing quick and efficient decisions. The study's results support the research that states that employee empowerment affects production waste management (Singh & Sangwan, 2011; Donate et al., 2020; Ahmed & Idris, 2021). Moreover, this study confirmed the sixth hypothesis stating that total quality management affects production waste management. The path coefficient is 0.356, and the t-value is 3.819 > 1.96. These results show a significant direct influence of total quality management on production waste management. Therefore, total quality management can significantly impact production waste management. In addition, the path coefficient value of 0.356 indicates a positive relationship directly proportional where the higher the total quality management, the higher the value of production waste management. Waste conversion or waste of manufacturing processes can be minimized by redistribution, education, prevention, and increased efficiency. The expected output of this conversion is transactional economic costs to increase the company's brand image and competitiveness. Companies that care about the environment will receive social rewards from the community, where the company will be considered responsible and trustworthy in maintaining survival in the community. The results of this study are in line with research that states that waste reduction can increase competitiveness in the company's financial health performance (Nguyen & Le, 2020; Annosi et al., 2021; Luu, 2020; Ochiri et al., 2015; Agyabeng-Mensah et al., 2020; Guo et al., 2019).

Furthermore, the seventh hypothesis that total quality management affects firm performance, is supported by the path coefficient value of 0.337, which has a t-statistic of 3,010 > 1.96 and a p-value of 0.006 < 0.05. These results show a significant direct influence between total quality management and firm performance in the direction of company management. Therefore, total quality management can significantly impact improving firm performance in the company. In addition, a path coefficient value of 0.337 indicates a positive relationship directly proportional where the higher the total quality management, the higher the firm performance value. A good TQM also mediates internal and external relationships, thereby improving the accessibility of external and internal relationships. Collaborations, partnerships, and collaborative bonds can give rise to new ideas or creativity to convert waste into something worthwhile. The results of the study are in line with research that states that a good TQM allows easy access to information and collaborative networks to improve company performance with innovation and creativity (Donate et al., 2020; Nguyen & Le, 2020; Strotmann et al., 2017; Agyabeng-Mensah et al., 2020; Hosain, 2014; Luu, 2020).

Finally, the last hypothesis states that production waste management affects firm performance. The path coefficient is 0.222, and the t-statistic of 2,071 > 1.96. These results show a significant direct and positive influence of production waste management on firm performance in managing a company. Production waste management has a significant impact on improving firm performance in the company. In addition, a path coefficient value of 0.222 indicates a positive direct relationship. The more effective the production waste management, the more enhanced the firm performance. Management commitments carried out from upstream to downstream can adopt the shortcomings of a company's system so that system optimization targets can then be set. Management with a sense of responsibility will always expect significant progress from his company by taking positive ecological and technological promotion steps. The study results align with research that states that management's commitment can improve company performance with better governance and leadership (Guo et al., 2019; Graham et al., 2014; Ahmed & Idris, 2021; Singh & Sangwan, 2011). The research results, as discussed earlier, provide a practical contribution insight for the company's top management being concerned with production waste management. When managed properly, production waste management can provide a value-added contribution to improve company performance. Value added is significantly obtained through the active role of employees by implementing sustainable programs, including total quality management. The theoretical contribution of the research results is to enrich the concept of green supply chain practice and green sustainability with adequate production waste management.

6. Conclusion

The company always tries to maintain sustainability through compliance with regulations and changes in customer requests related to the environment. The company seeks to optimize the role of the internal and external parties to be more concerned about the environment through production waste management. The study results showed that top management commitment influences employee empowerment. Top management commitment positively impacts total quality management and management's involvement in policy formulation and total quality management. Top management commitment positively affects firm performance, generally related to implementation, monitoring, evaluation, and improvement for manufacturing efficiency. Employee empowerment has a positive impact on total quality management through the presence of employees who are full of initiative in problem-solving. Employee empowerment positively impacts production waste management with intellectual contributions and employee initiatives. In addition, Total quality management positively affects production waste management and firm performance related to evaluating resource waste, information accessibility, and collaboration networks to improve company innovation. Production waste management positively impacts firm performance by establishing a transactional cost economy to improve competitiveness and company image. In this study, employee empowerment and total quality management can be an excellent mediating variable between top management commitment to firm performance, where employees proactively form a sustainable system in the form of a manufacturing bureaucracy to improve company performance.

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