

DEMATEL Method in Implementing Green Business Process Management (BPM) in Micro, Small and Medium Enterprises in Kendari City

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Abstract

MSMEs are often considered the biggest contributors to environmental damage and produce more waste than other businesses. This is because MSMEs, in general, are still focused on achieving economic performance. Research sampling was carried out using the Slovin formula. The number of samples in this study was 96.68 or 100 UMK as samples. The collected data was analyzed using the DEMATEL method, which is used to analyze cause-and-effect relationships between a set of factors that influence a decision-making process. Based on the results of this research, "green attitude" has the highest interaction and the strongest impact. Improving the behavior of individuals, including managers, customers, and employees of the organization, is a top priority. Environmentally conscious behavior influences environmentally friendly organizational strategies and governance. Environmental knowledge and awareness influence environmentally conscious behavior; this shows that with increasing environmental knowledge and awareness in organizations, environmentally friendly behavior also increases.

Keywords: DEMATEL, Green BPM, Green Economy, UMKM

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1. Introduction

Environmental pollution is a serious problem in today's business world. The IPCC report states that greenhouse gas emissions have reached the highest levels in human history. This phenomenon emphasizes the importance of balancing economic, social, and environmental performance. Economic performance is no longer measured by increasing output but is also needed to help solve society's social and environmental problems. Micro, small, and medium

enterprises (MSMEs) play an important role in a country's economy. In Germany and 16 other regions, SMEs are the backbone of the economy. In one region, SMEs accounted for 99.5% of business units and created an added value of 42% in 2017.

In Indonesia, the total population of MSMEs in 2021 will reach 65.4 million business units, with the number of workers absorbed reaching 97% of the Indonesian workforce. However, with this significant contribution, MSMEs are often considered the biggest contributors to environmental damage and produce more waste than other businesses. Many MSMEs do not fully understand environmentally friendly production processes, which leads to the use of resources and technology that are not environmentally friendly and wasteful and inefficient waste disposal. Globally, MSMEs in the European Union contribute to 56.4% of pollution by producing more than half of greenhouse gas emissions. Indeed, MSMEs, in general, are still focused on achieving economic efficiency, resulting in a lack of awareness of environmental issues.

Economic growth will not be sustainable without considering the pollution, waste, and risks that economic activities, production techniques, and consumer patents pose to the environment and, ultimately, to society. In running a company's business and operations, environmental issues must remain a concern. Companies must, therefore, look for solutions that take environmental factors into account by ensuring the ecological safety of products and production processes while maintaining economic efficiency. As a consequence, companies must be increasingly involved in pro-ecological readiness by including the concept of sustainable development in their development strategies

By overcoming these environmental problems, business actors can monitor their business processes, identify and evaluate performance against various environmental indicators, as well as design and implement environmentally friendly business processes within the company and its environment. Environmentally friendly business process management (Green BPM) is a management action taken to monitor and minimize environmental impacts at each production stage. In other words, Green Business Process Management (Green BPM) is the sum of all management activities supported by information systems that help monitor and reduce the environmental impact of business processes in the design, improvement, implementation, or operational stages. Green BPM emphasizes the importance of resource utilization processes for business sustainability, so the aim of Green BPM itself is to optimize business processes while still respecting sustainability aspects.

Determining the standards that influence the implementation of Green BPM in this situation is very important. These criteria will be used as a basis to measure the extent to which a company has adopted sustainable business practices. However, determining these criteria is not an easy task because many interrelated variables need to be considered. Currently, the sustainability of MSMEs no longer relies on increasing production, which is the only measure of company success, but also on increasing results that accompany environmentally based business processes. The Trial and Evaluation Laboratory of Decision-Making (DEMATEL) method is an analytical tool that is able to find and measure the relationship between variables that influence a system. In this research, DEMATEL can be used to understand the complexity of the relationships between criteria that influence the implementation of GBPM, thereby helping organizations develop sustainable business processes. Therefore, this research aims to

determine the criteria that influence the implementation of green BPM in small and medium enterprises in the city of Kendari.

2. Literature Review

Green BPM is a process management approach that adds sustainability to traditional performance measures such as time, cost, quality and flexibility. The sustainability of a business depends on how the business processes are implemented to produce products and services directly (Sohn et al., 2023).

The Green Business Process Management concept involves incorporating sustainability into the conventional performance metrics of time, money, quality, and flexibility. The methods used in business operations to generate goods and services have a direct impact on sustainable business practices (Van Der Aalst et al., 2023)

Several researchers have carried out several studies related to green BPM, but each has its own characteristics. Both in terms of research methods, research stages, obstacles that must be overcome, and research subjects. However, issues related to the readiness of MSMEs to implement green BPM have not been widely discussed in previous research.

The study by Mortaz Hejri et al. (2022) entitled Factors Affecting Green Business Process Management Readiness in the Iranian Banking Industry examines how business process management can be implemented in an environmentally friendly manner in the banking sector. By using the fuzzy DEMATEL method, the results obtained show that the green perception factor is the factor that has the most influence on the readiness to implement green BPM in Iran's banking sector.

Research by Marie Sohn et al. (2023) entitled Environmentally Friendly Business Process Management for Sustainable Business: A Case Study of Manufacturing Small and Medium Enterprises (SMEs) in Germany shows that SME sustainability is based on six green BPM factors, namely environmentally friendly attitudes, strategy, management values, models, monitoring and optimization. Then, identify related interests, pressures, and constraints that can encourage or hinder environmentally friendly BPM activities. Use targeted sampling to select SMEs and conduct interviews with them.

According to research by Wysocki, J (2021). In his research entitled Green Innovation Initiatives in the Manufacturing SME Sector in Poland, he obtained the following results: based on empirical research on a sample of 342 manufacturing companies, green initiatives have been able to provide measurable benefits for companies while maintaining economic and environmental goals. Meanwhile, this research focuses more on examining the criteria that have the greatest influence on implementing green BPM in MSMEs using the DEMATEL method.

Of the many reviews mentioned, no one has discussed the factors that influence the implementation of green BPM in MSMEs using the DEMATEL method. Thus, it can be concluded that the research carried out is still relatively new and there is still little research carried out before. In developing this research, six Green BPM Readiness Factors were used, namely Green Attitude, Green Strategy, Green Governance, Green Awareness, Green Monitoring, Green Technology (Opitz et al,2014; Mortaz Hejri et al.,2022)

Green attitude is related to the company's philosophy in implementing green BPM in the long term. In this philosophy, the company is committed to comprehensively reducing negative impacts in every business process. (Opitz et al. 2014). This variable emphasizes assessing the attitude of individuals and companies toward sustainability.

Green strategy is related to planning, processing, and controlling business processes for sustainable goals (sustainability goals). All employees are directed to work based on this strategy to achieve this goal. (Opitz et al. 2014). The development of sustainable business strategies and the integration of business and environment are emphasized in this variable.

Furthermore, green governance is a governance model created based on a predetermined strategy. Governance is a management structure that contains each employee's main duties and functions in carrying out business processes. (Opitz et al. 2014). The development of organizational sustainability policies and procedures is a dimension of this variable.

Green awareness is related to MSME owners' understanding of environmental issues. Have MSME owners ever received information or education about the sustainability process? (Mortaz Hejri et al.,2022). Efforts to increase organizational awareness of social and environmental responsibility.

Green monitoring is monitoring each business process to determine whether an environmental impact is produced in each company's business process (Opitz et.al.,2014). The development of an environmental performance monitoring system and corrective actions are emphasized in this variable.

Green technology is related to technology that makes the best use of available energy and provides special equipment for operation (Mortaz Hejri et al.,2022). Development and integration of green technologies is the focus of this variable.

3. Research Methods

The theoretical framework of this research is based on a valid literature review and literature study. Finally, various books, journals and articles are used to review theoretical concepts of the problem under study. This research is applied research whose aim is to identify the criteria that most influence the implementation of environmentally friendly business process management in the MSME sector, and the results and insights of this research can help MSMEs in managing environmentally friendly business processes in the MSME sector. To reduce negative impacts on the environment and reduce costs.

The questionnaire was used to find out the opinions of MSMEs regarding the main criteria that influence their decision to implement green business process management in their business processes. Questionnaires were distributed to 100 MSMEs that had been obtained from interviews. Next, the data based on the results of this filling will be processed using the DEMATEL method.

A sample of interest for the study was chosen from a hundred SMEs from Kendari City by using purposive sampling. Research sampling was carried out using the Slovin formula. In the Kendari City Small and Medium Industry Profile for 2020, released by the Kendari City Central Statistics Agency (BPS), the number of IMK businesses/companies in Kendari City operating commercially was recorded at 2,919 businesses/companies so that using the Slovin formula the number of samples in this study was 96.68 or 100 IMK as a sample. The collected data was

analyzed using the DEMATEL method which is used to analyze cause-and-effect relationships between a set of factors that influence a decision-making process,

The main steps in the DEMATEL method include:

1. Identify the factors that will be used in decision-making.
2. Assess dependency between factors by collecting data on the causal relationship between factors
3. Build a cause-and-effect map that represents the relationship between factors
4. Identify key factors
5. Summing up the results.

In summary, the DEMATEL method is concluded as follows:

Step 1: calculate the average matrix. In this stage, respondents are asked to determine their assessment scale to find out how much impact and effectiveness each criterion influences each other using a 0-4 Likert scale, which represents no influence, some influence, moderate influence, and strong influence.

Calculating the average matrix can be done using the following equation:

$$A = a_{ij} = 1/H \sum_{k=1}^H x_{ij}^k \quad (1)$$

The notation x_{ij} represents the respondent's confidence level that factor i affects factor j . if $i=j$, it indicates that the diagonal component is equal to zero. The notation k represents the number of respondents, and then $X^1, X^2, X^3, \dots, X^H$ is the matrix of respondents H so that the average matrix equation A can be constructed as above.

Step 2: normalize. The a_{ij} matrix is obtained from normalizing the direct matrix D with the equation:

$$S = \frac{1}{\max \sum_{j=1}^n a_{ij}} \quad (2)$$

Determine the initial direct-relations matrix that has been normalized. Initial direct-relations matrix D should be normalized by:

$$D = A \times S \quad (3)$$

Step 3: Calculate the total influence matrix. The total influence matrix T is symbolized as $T = D(I - D)^{-1}$ where I is symbolized as the identity matrix.

Define r and c to be $n \times 1$ and $1 \times n$ vectors representing the number of rows and number of columns of the total relation matrix T , respectively. Let r_i be the number of rows i in matrix T , then r_i summarizes the direct influence and indirect influence given by factor i to the other factors. If c_j shows the number of the j th column in the T matrix, then c_j shows the direct or indirect influence by factor j of other factors. If $j = i$, the sum $(r_i + c_j)$ shows the total influence

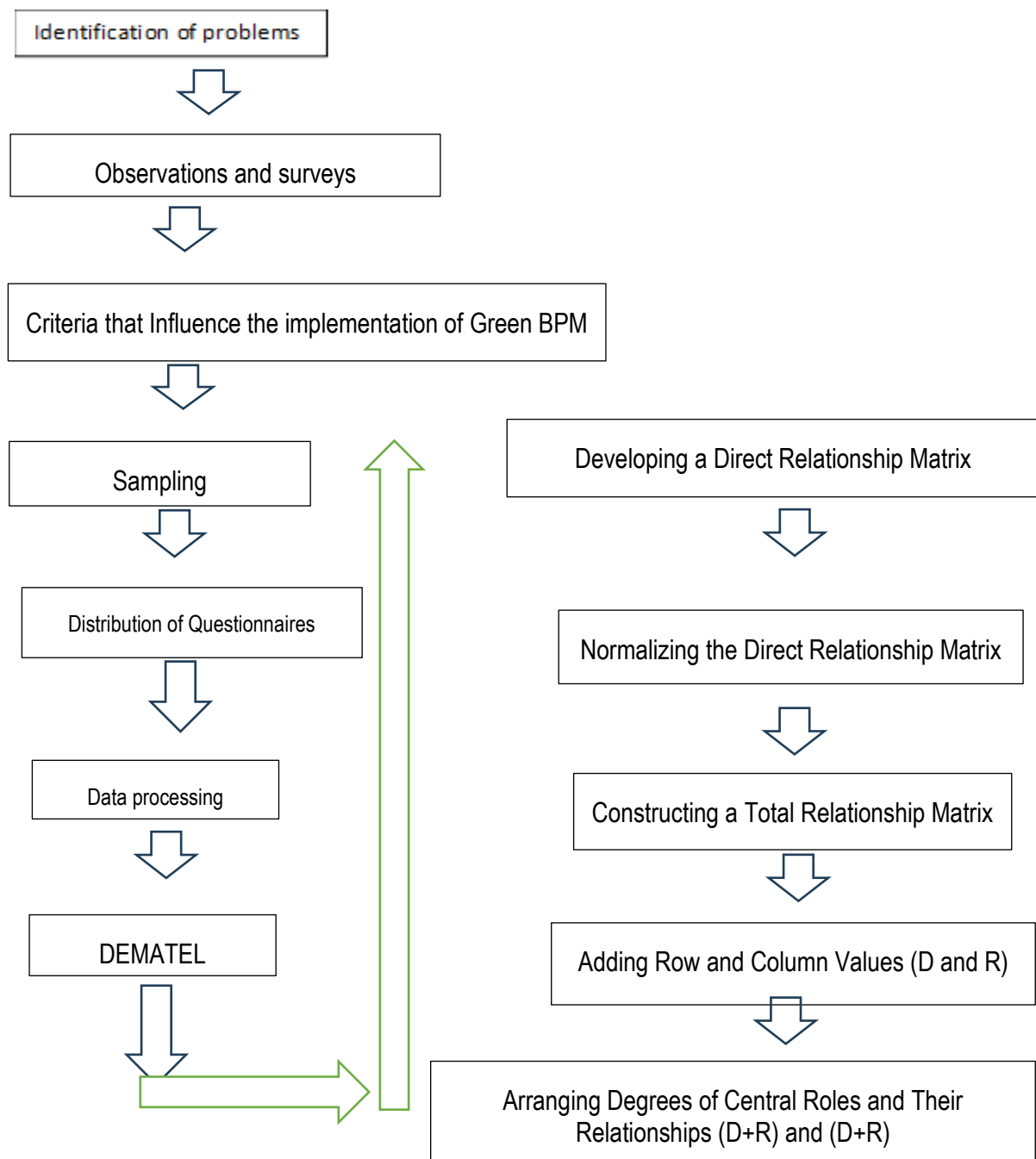
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of factor i . If the result $(r_i + c_j)$ is positive, then factor/criterion, i influence the other factors/criteria. Conversely, if factor/criterion i is negative, it indicates that factor/criterion other factors/criteria influence me.

Step 4: Determine the threshold value

The next step is to determine the threshold value first. Only values greater than the threshold value are selected. The threshold value is obtained by calculating the average of the elements in the T matrix.

The research steps can be seen in full in the diagram below:



4. Results And Discussion

4.1. Results

4.1.1. Determination of criteria

In developing this research, six Green BPM Readiness Factors were used, namely Green Attitude, Green Strategy, Green Governance, Green Awareness, Green Monitoring, Green Technology. In this research, the criteria used to determine the criteria that most influence the implementation of green BPM in MSMEs are as follows:

Table 1 List of Criteria

A	<i>Green Attitude</i>
B	<i>Green Strategy</i>
C	<i>Green Governance</i>
D	<i>Green Awareness</i>
E	<i>Green Monitoring</i>
F	<i>Green Technology</i>

4.1.2. Data Processing Using the DEMATEL Method

Data processing from the questionnaire results to determine the most influential criteria using the DEMATEL method is carried out in the following stages:

The first step is to find the average of the matrix.

The average matrix A is obtained based on equation (1) so it is obtained as follows:

Table 2 average matrix equations

A =	0,00	1,63	2,15	1,97	2,30	2,04
	1,58	0,00	2,06	2,32	2,39	2,08
	1,89	1,93	0,00	2,04	2,42	2,47
	1,34	2,10	2,05	0,00	2,18	2,18
	1,90	2,00	2,16	1,76	0,00	2,19
	2,10	1,91	2,14	1,90	2,20	0,00

The next step is to calculate the normalization of direct matrix A by adding up all the row and column elements to obtain the highest value. Then all row and column elements are divided by the highest value to obtain the following results:

Table 3 normalization of direct matrix A

$$D = A \times \frac{1}{\max \sum_{j=1}^n a_{ij}}$$

0	0,14186	0,187119	0,171453	0,20017	0,177546
0,13751	0	0,179286	0,201915	0,20801	0,181027
0,16449	0,16797	0	0,177546	0,21062	0,21497
0,11662	0,18277	0,178416	0	0,18973	0,18973
0,16536	0,17406	0,18799	0,153177	0	0,190601
0,18277	0,16623	0,186249	0,165361	0,19147	0

The next step is to calculate the T matrix with the following equation:

Table 4. T Matrix Calculation

$$T = D(I-D)^{-1} =$$

1,07371	1,2748	1,405169	1,331065	1,50455	1,440332
1,2243	1,18348	1,434526	1,387174	1,5478	1,479218
1,27451	1,35773	1,3165	1,401208	1,5858	1,538153
1,15843	1,28338	1,374596	1,162708	1,47139	1,424277
1,21	1,29208	1,399113	1,312372	1,3309	1,442766
1,24314	1,30845	1,421923	1,34375	1,51724	1,307386

Based on Table 5, it can be concluded that the importance of the six criteria is prioritized as $E > C > F > B > D > A$ based on the value $(r + c)$, where monitoring is the most important criterion with a value of 16.94492, while the attitude or behavior of MSME actors is supportive. implementation of green economy-based production is the least important criterion with a value of 15.21372. In contrast to importance, (A) green attitude, (B) green strategy, and (C) green governance are causes, while (D) green awareness, (E) green monitoring, and (F) green technology are recipients based on value $(r - c)$.

Table 6 The sum of influence given and received among these six criteria on dimensions.

Variable	Ri	Ci	Ri+Ci	Ri-Ci	Identify
A (green attitude)	8,02963	7,18409	15,21372	0,845535	cause
B (green strategy)	8,2565	7,69993	15,95643	0,556568	cause
C (green governance)	8,47391	8,35183	16,82573	0,122079	cause
D (green awareness)	7,87479	7,93828	15,81307	-0,06349	effect
E (green monitoring)	7,98723	8,95769	16,94492	-0,97045	effect
F (green technology)	8,14189	8,63213	16,77402	-0,49024	effect

Based on the values $(Ri + Ci)$ and $(Ri-Ci)$ that have been obtained, a casual diagram is created with the value $(Ri+Ci)$ as the horizontal axis and the value $(Ri-Ci)$ as the vertical axis. By using Microsoft Excel, the following casual diagram is obtained:

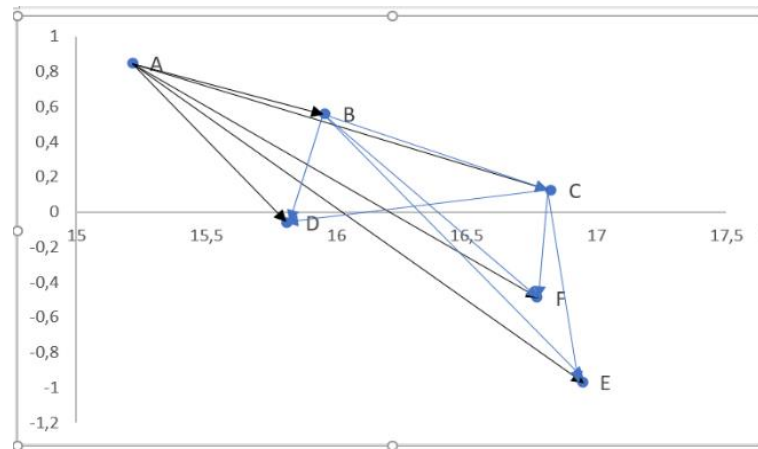


Fig.1. The digraph of showing causal relations among these six criteria

In short, MSMEs in Kendari City must pay more attention to the four influences (A, B, and C) than to those affected (D, E, and F). Attitude (A) is the main criterion because it is not only the most influential but also not influenced by other criteria.

Analysis of the relationship between criteria can be determined from the calculation results ($R_i - C_i$). If $(R_i - C_i) > 0$ or positive, then criterion x is part of the casual group, which means that this criterion has more influence than receiving influence from other criteria. Meanwhile, if $(R_i - C_i) < 0$, then this criterion is an affected criterion. Based on table 3 above, it is found that the criteria for attitude (A), strategy (B) and governance (C) are positive, therefore these criteria have an influence on the other criteria. Meanwhile, the criteria for awareness (D), monitoring (E) and technology (F) have negative values, which means they receive more influence from other criteria.

4.2. Discussion

To assist SMEs in determining their Green BPM maturity levels and providing guidance for them to increase their maturity, we created a Green BPM maturity model in this study. Next, we developed a thorough understanding of the manufacturing SMEs' Green BPM maturity state in Kendari. Through six, we were able to learn more about their Green BPM procedures, fundamental elements of Green BPM and highlighted the advantages, challenges, and obstacles they encounter with Green BPM.

Currently, businesses face a significant challenge in reconciling ecological and economic factors. Consumers are starting to consider sustainability more and more when making final purchases. Due to the aforementioned complexity, companies find it difficult to assess whether their operations are environmentally friendly.

The results of our study have various managerial ramifications for SMEs looking to implement Green BPM practices. SMEs' green mindset offers fertile ground for developing a specific green strategy that complements their business plan.

We developed our classes, "Green Attitude," "Green Strategy," "Green Governance," "Green Awareness," "Green Monitoring," and "Green Technology," which add the "green" element to the fundamental business processes.

The interviews have demonstrated that managers need outside incentives, ideas, knowledge, and expertise to move their company to the next higher level of Green BPM. Like any research report, there are limitations to the current study that must be noted. One of their inherent limitations is the inability of case studies' conclusions to be applied to different contexts.

Though no prior account has yet integrated the research on sustainability in SMEs and Green BPM, the overall goal of this study is not the generalizability of findings but rather the creation of first impressions of the level of Green BPM in SMEs. Another drawback is that SMEs were not randomly chosen for the interviews. Rather, the SMEs were chosen according to what they did for the environment. Nevertheless, the authors took the required steps and noted that the sampled SMEs fairly depict the distribution of SMEs in Kendari City. In the future it is necessary to sample SMEs according to their occupational characteristics.

5. Conclusion

Based on the results of this research, "green attitude" has the highest interaction and also the strongest impact. Improving the behavior of individuals, including managers, customers, and employees of the organization, is a top priority. Environmentally conscious behavior influences environmentally friendly organizational strategies and governance. Environmental knowledge and awareness influence environmentally conscious behavior; this shows that with increasing environmental knowledge and awareness in organizations, environmentally friendly behavior also increases.

MSME owners who care about the environment play an important role in encouraging employees to participate in environmental programs. As owners become more aware of environmental issues, their commitment to environmentally friendly behavior increases, and employees are increasingly required to comply with environmental laws and regulations. How MSME owners and employees view the environment is also influenced by how they behave.

Studies show that changing behavior into habits makes people behave environmentally friendly. Organizational culture depends on policies and activities; if employees know these things, they will behave in an environmentally friendly manner. Individual factors, such as attitude or motivation, are crucial for sustainable business procedures. Behaviors and attitudes related to business process management are shaped and identified by cultural values and collective beliefs. Therefore, organizations should inform managers and employees about the importance and impact of their behavior on the environment, and they should also provide annual reports on reducing environmental impacts. Apart from providing training, companies can create motivated strategies to encourage their employees to behave environmentally friendly. This can be done with the help of new technologies such as media and social networks.

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