Evaluating Quality of Communication Strategies Relating to Management of Corporate Reputation

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ABSTRACT
As expectations of customers are changing, businesses are trying innovative ways to meet changing needs of customers. Corporate communication strategies to sell organizational brand and to manage reputation are getting greater attention. Therefore, maintaining organizational reputation needs organs and processes to support effective communication strategies. Communication strategies, as linkages of the organization, should play an important role in management of reputation. Some researchers and scholars have discussed communication strategies based on organizational operations and customer focus, but evaluating corporate communication strategies with respect to management of reputation has not been substantively addressed. This paper focuses on corporate communication strategies with regard to the management of reputation. The research identified indicators of corporate communication strategies and found that they have a correlation with management of reputation. An evaluation model based on matter-element analysis with Back Propagation (BP) algorithm was also developed. Model results show that organizations can increase effectiveness of communication strategies by improving internal factors, stakeholder support and technological factors. The research was limited to one organization, a public university. An evaluation based on more than one organization can give greater insights on applicability of the proposed model. Future research can practically apply the model by developing software or that can be user-friendly for business organizations to be able to easily evaluate communication strategies.

Keywords: BP algorithm; corporate communication strategies; evaluation model; management of reputation; matter-element analysis.

1. INTRODUCTION
Corporate communication is defined as management function that provides a framework for effectively coordinating both internal and external communication (Lipińska, 2018). It aims to establish and maintain favourable reputation with stakeholders (Frandsen & Johansen, 2018). According to Feldner and Fyke (2018) corporate communication follows a set of strategies that are related to organizational policies, of which management of corporate reputation is a key policy aspect. Organizations use different communication strategies to direct the course of action in
relaying information and to determine success in the achievement of organizational goals and objectives.

According to Kucukusta, Perelygina, and Lam (2019), corporate communication strategies outline the goals of communication, help in identifying stakeholders and in defining key messages. It pinpoints potential communication methods and vehicles for communicating information for a specific purpose and specify the mechanism that will be used to obtain feedback on strategy (Wang & Huang, 2020). Corporate communication strategy helps to avert communication crisis, organizes the information that needs to be communicated, identifies concerns that may be raised and ensures proper audiences are reached (Cheng, 2018). Good corporate communication strategy is important in reputation management (Pollák, Dorčák, & Markovič, 2019). Reputation refers to an assessment of an institute created by its publics, who are the affected populace or those that have an effect on an organization (González-Rodríguez, Martín-Samper, Köseoglu, & Okumus, 2019). A flawed repute may contribute towards the disappearance of valued customers and this can directly affect the livelihood of the institution (Becker & Lee, 2019).

In literature, much attention has been paid to the definition of corporate communication and reputation management. Research on corporate communication strategies has focused on internal factors such as vision, mission, values and policies (Furi, 2018; Steyn, 2018; Syaifuddin & Rizal, 2018). Due to changing business environment and technological advances, researchers have turned to discuss influence of technological factors of communication strategies on reputation management (Cerkez, 2020; Kim, Park, & Kim, 2019; Makemuengthong, 2017). A great deal of research also focus on role of stakeholder interest in shaping communication strategy (Estaswara, 2020; Matsika, 2017; Kim & Krishna, 2017). Furthermore, evaluation of effects of corporate communication strategies on reputation has also been done a lot. Johan and Noor (2013) evaluated three communication strategies of advertising, public relation and corporate social responsibility and found that positive correlation between the variables and corporate reputation. Cheng (2016) developed a model of understanding crisis communication strategies based on different types of stakeholders and found that corporate reputation is preserved by monitoring, analyzing and understanding stakeholders’ needs and desires and effectively addressing them. It has also been shown that there is need for proper communication plan that substantively addresses needs of each group of stakeholders (Gwebu, Wang, & Wang, 2018). Research has shown that information is relay and sharing has been reshaped through adoption of new technologies and putting in place support infrastructure. Adoption of new technologies such as artificial intelligence, machine learning, augmented reality, virtual reality, live video streaming and chat-bots have greatly improved communication and reputation management by organizations through more interactive and immersive experiences when engaging stakeholders (Lalić, Stanković, Gračanin, & Milić, 2019).
However, there is lack of agreement on what determinants of corporate communication strategies are necessary for effective management of corporate reputation. Different characteristics of corporate communication strategies for reputation management have been evaluated by various researchers. This shows that there is variance in agreement concerning the level of contribution of the determinants to corporate reputation. Therefore, this research focuses on identifying characteristics of corporate communication strategies as an effort to start addressing this notable concern.

Mathematical methods such as difference-score model (i.e. perceived minus expected communication service), have been used by some researchers to evaluate quality of communication strategies in areas including assessment of discrepancies (de Haan, Prinzie, Sentse, & Jongerling, 2018). Perception-only measurement and Choquet integral have also been used to evaluate communication strategies when generating user content (Hasan, Khan, & Farooqi, 2019; Pasi, Viviani, & Carton, 2019).

Organizations and departments can be ranked in terms of the quality of their communication strategies based on optimal ranking model using matter-element analysis with back propagation (BP) algorithm proposed in this research (Cai, 1999; Rumelhart, Durbin, Golden, & Chauvin, 1995; Yu, et al., 2018). Matter-element analysis has an advantage of not requiring translation of the original values of the criteria ratings into the range of \([0, 1]\) through normalization process. It also maintains the integrity of the information regarding evaluation criterion. BP algorithm efficiently trains large amount of data samples to obtain optimal weights of each evaluation criterion. Furthermore, matter-element analysis is very consistent when used with BP neural network. Evaluating communication strategies based on this model can preserve the integrity and accuracy of the system. Therefore, the approach of evaluating communication strategies relating to management of corporate reputation could be very effective.

2. COMMUNICATION STRATEGIES FOR REPUTATION MANAGEMENT

Reviewed literature focuses on effects of corporate communication strategies on reputation management. We shall discuss determinants of corporate communication strategies that are necessary for effective management of corporate reputation. A number of researchers have explored management of corporate communication. According to Lee, Lim, and Drumwright (2018) corporate reputation is related to corporate ability and social responsibility which is the character of the firm in maintaining stakeholder expectation and interests. Corporate ability refers to firm's professional capability of producing and delivering services and products (Tsai, Lin, Ma, & Wang, 2015). A number of researchers have linked value-based integrated framework for improved service delivery to organizational vision, mission, values and policies which are internal factors (Aladwan & Alshami, 2021; Lubis & Lubis, 2020;
Muller & Ndevu, 2017). According to Madsen and Ulhoi (2021), corporate communication strategy that shapes identity and image is also anchored on organizational mission, vision, values and policies. It is therefore reasonable to conclude from the reviewed literature that good corporate communication strategies are based on internal factors which are organizational mission, vision, values and policies.

Various studies have been conducted to establish the role of stakeholder expectations and interest in shaping corporate communication strategies related to management of reputation (Artemova, 2020; Balmer, 2017; Haarhoff, 2019). According to Volk and Zerfas (2018), challenges related to communication and reputation management can be overcome by formulating communication strategies that assist in crisis mitigation and establishment of a good relationship with all stakeholders (Volk & Zerfass, 2018). Stakeholder interest can be safeguarded through stakeholder analysis and good communication plan for effective stakeholder engagement, a key factor for success of the organization (Milani, 2019; Mikhieieva & Waidmann, 2017). Stakeholder analysis is important because it enables the organization to effectively address stakeholder interests, reduce negative impact and formulate strategies to manage negative stakeholders (Brennan & Merkl-Davies, 2018). According to Wang (2016) communication plan, by clarifying who will communicate with whom, when and how, ensures that the organizational services and projects are on track, within budget and aligned with stakeholder expectations and interest. It can therefore be understood that apart from internal factors, stakeholder analysis and communication plan are stakeholder interest factors that influence corporate communication strategies related to management of reputation.

A great deal of research acknowledge the role of technological factors in corporate communication and management of reputation (Caviggioli, Lamberti, Landoni, & Meola, 2020; Knight & Nurse, 2020; Lalić, Stanković, Gračanin, & Milić, 2019). Several researchers have also identified adoption of new media such as social media as one of technological factors related to corporate communication and reputation management (Bhattacharjee, 2020; Krohn, 2020; Mehra & Nickerson, 2019). New technologies for social networking of sustainable businesses are supported by appropriate technological infrastructure (Jacob & Teuteberg, 2021). Technological infrastructure that supports modern communication include social media listening, artificial intelligence in auto responders and voice to text solutions (Kotras, 2020; Reile, 2019).

The three criteria of evaluation of corporate communication strategies have been found to be internal, stakeholder interest and technological factors. Under each criterion there is a set of variables called attributes of the criterion. Figure 1 illustrates the evaluation criteria and their attributes.
3. METHODOLOGY

Evaluation model was built in five steps: data collection, definition of matter-element, optimization of weights, relationship degree and determination of grades.

3.1. Data collection

Evaluation table for data collection was designed as illustrated in Table 1. Each criterion was to be rated by respondents and the weights of items \( u_i \) and criteria \( x_i \) be given. Membership degrees of criteria belonging to each evaluation grade was obtained. The data was then input to neural network in the step for calculating weights.

Table 1 The evaluation table

<table>
<thead>
<tr>
<th>Item ( u_i )</th>
<th>Weights ( u_i )</th>
<th>Criterion ( x_i )</th>
<th>Rating</th>
<th>Weights ( x_i )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Internal factors</td>
<td></td>
<td>Mission</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Stakeholder interest factors</td>
<td></td>
<td>Stakeholder analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Technology factors</td>
<td></td>
<td>Adoption of new media</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1: Three evaluation criteria and their respective factors
3.2. Matter-element Analysis

Matter-element is expressed as a three-tuple denoted by $R(N,C,X)$ where $N$ is the number of criteria to be evaluated; $C$ stands for the criteria of matter; and $X$ represents the corresponding values of the criteria. According to Cai (1998), if a matter has $n$ attributes, denoted by $C_1, C_2, \ldots, C_n$ and the corresponding values of the attributes are $X_1, X_2, \ldots, X_n$, the matter is known as $n$-dimensional matter-element.

In the case of corporate communication strategies, matter-element matrix with eight attributes can be expressed as shown in Equation 1.

$$
R = \begin{bmatrix}
N & C_1 & X_1 \\
& C_2 & X_2 \\
& C_3 & X_3 \\
& C_4 & X_4 \\
& C_5 & X_5 \\
& C_6 & X_6 \\
& C_7 & X_7 \\
& C_8 & X_8 
\end{bmatrix}
$$

(1)

Where, $N$ represents criteria of communication strategies; $C_1, C_2 \ldots C_8$ represent the attributes mission, vision, … technological infrastructure and $X_1$ to $X_8$ are the scores of $C_2$ to $C_8$, which are rated by expert respondents.

Matter-element matrices can be divided into classical field matter-element matrices and controlled matter-element based on the ranges of general and maximum values of each criterion (Liu, Gan, & Yang, 2020; Zhang, Li, & Chai, 2020). Classical field matter-element, $R_j$, is defined as $R_j(N_j, C_i, X_{ji})$ where $N_j$ is the standard of matter and $C_i$ is the criterion with $X_{ji} < a_{ji}, b_{ji}$ as its range of values called the classical field. Controlled field matter-element is defined as $R_p(N_p, C_i, X_{pi})$ where $X_{pi} < a_{pi}, b_{pi}$ is the range of whole values of matter corresponding to the criterion $C_i$. $R_p$ represents the controlled field matter-element matrix (Xiao, 2018; Ma, et al., 2018). $R_j$ and $R_p$ are expressed as shown in Equation 2.
Each of the ranges was divided into 5 grades of rating giving value of $j$ as 5. This results into five graded classical matter-element matrices.

The controlled matter-element matrix is given in Equation 3.

$$R_p(N_p, C_i, X_{pi}) = \begin{bmatrix} N_p & C_1 & X_{p1} \\ C_2 & X_{p2} \\ C_3 & X_{p3} \\ C_4 & X_{p4} \\ C_5 & X_{p5} \\ C_6 & X_{p6} \\ C_7 & X_{p7} \\ C_8 & X_{p8} \end{bmatrix} = \begin{bmatrix} N_p & C_1 & \langle a_{p1}, b_{p1} \rangle \\ C_2 & \langle a_{p2}, b_{p2} \rangle \\ C_3 & \langle a_{p3}, b_{p3} \rangle \\ C_4 & \langle a_{p4}, b_{p4} \rangle \\ C_5 & \langle a_{p5}, b_{p5} \rangle \\ C_6 & \langle a_{p6}, b_{p6} \rangle \\ C_7 & \langle a_{p7}, b_{p7} \rangle \\ C_8 & \langle a_{p8}, b_{p8} \rangle \end{bmatrix}$$ (3)
3.3. BP Algorithm

BP algorithm was used for weight optimization. Weighting has direct impacts on the effectiveness of evaluation. We apply outstanding learning function of neural network developed by Wang, Wang and Wang (2000). The researchers note that for greater reliability, optimal weights for the criteria can be obtained by training data collected from the expert respondents. In the current research, the weights were calculated by training data in BP network. Figure 2 illustrates the network configuration. Nodes of input layer were 8, hidden layers were 2, nodes of hidden layer were 4 and one node of output layer.

In Figure 2, $x_1$ represents “mission”, $x_2$ represents “vision”, $x_3$ represents “values”, $x_4$ represents “policies”, $x_5$ represents “stakeholder analysis”, $x_6$ represents “communication plan”, $x_7$ represents “adoption of new media” and $x_8$ represents “technological infrastructure”.

Neural network has interconnected nodes where each node acts as a processing unit and every unit responds to the inputs and weights of the units in the previous layer (Lee, Saro, 2004). Equation 4 represents the process in neural network.

$$U_j^l = \sum_{i=1}^{n} V_i^l \cdot w_{ij} - \theta_j, i = 1,2,\ldots,B; j = 1,2,\ldots,5$$

Where, $w_{ij}$ represents linking weights between nodes $i$ and $j$, $V_i^l$ is the input from nodes $i$ and $\theta_j$ represents the threshold value of node $j$. It is noted that $V_i^l = f(U_i^l)$
and excitation function is given by \( f(x) = \frac{1}{1 + \exp(-\alpha x)} \) where \( \alpha > 0 \) and \(-\infty \leq x \leq \infty\). Global error of the network is given by \( E = \frac{1}{2} (d_1 - y_1)^2 \) where, \( d_1 \) is the desired output, and \( y_1 \) is the actual output. Modifying connection weights decreases error. The connection weights are represented as shown in Equation 5.

\[
w_{ij}(N + 1) = -\alpha \frac{\partial E}{\partial w_{ij}} + \lambda \Delta w_{ij}(N - 1), \quad 0 < \alpha < 1, \quad 0 < \lambda < 1
\]

Where is \( \alpha \) coefficient of learning, \( \lambda \) is the coefficient of momentum and \( N \) is number of times of learning.

In this research the process was iterated until lowest global error of the network was obtained or until an acceptable level was reached. To obtain the information about the relationship between the inputs and the outputs the influence from the node \( j \) in the hidden-layer on the output \( y_1 \) was analyzed. Absolute value of degree of importance of node \( j \) to \( y_1 \) with respect to the other nodes in the hidden-layer is given by Equation 6.

\[
\left( \frac{\partial y_1}{\partial v_j} \right) = \left| f'(U^R_i)w_{jk} \right| = \left| w_{jk} \right| \\
\left( \frac{\partial y_1}{\partial v_i} \right) = \left| f(U^R_i)w_{jk} \right| = \left| w_{jk} \right|
\]

From Equation 6, the degree of importance from node \( j \) in the hidden layer to \( y_1 \) is given by \( u_{jk} = \frac{|w_{jk}|}{\sum|w_{jk}|} \). Similarly, the degree of importance of node \( i \) in the input layer to hidden layer (node \( j \)) is given by \( u_{ij} = \frac{|w_{jk}|}{\sum_j|w_{jk}|} \). The influence of input \( i \) on output \( y_1 \) is expressed as illustrated in Equation 7.

\[
u_{i1} = \sum_j u_{ij} * u_{jk}
\]

Where for \( u_{i1} \), \( i = 1, 2, \ldots, 8 \) are the ranks of each criterion.

Modular of range for \( (a_{ji}, b_{ji}) \) is given by \( d = |X_{ij}| = (a_{ji}, b_{ji}) = |b_{ji} - a_{ji}| \). Distance between pairs of points \( X_i \) and \( X_{ji} \), and \( X_i \) and \( X_{pi} \) are given as shown in Equation 8.

\[
\rho(X_i, X_{ji}) = \frac{|X_i - (a_{ji} + b_{ji})|}{2} - (b_{ji} - a_{ji}) \\
\rho(X_i, X_{pi}) = \frac{|X_i - (a_{pi} + b_{pi})|}{2} - (b_{pi} - a_{pi})
\]

Membership degree of each criterion corresponding to each evaluating grade is given in Equation 9.
\[ K_j(X_i) = \begin{cases} \frac{-\rho(X_i, X_{ji})}{d}, & X_i \in X_{ji} \\ \rho(X_i, X_{ji}), & X_i \notin X_{ji} \end{cases} \]

Where \( K_j(X_i) \) is the relationship degree of \( i^{th} \) criterion corresponding to the \( j^{th} \) estimating grade. Equation 10 illustrates the final comprehensive relationship degree for each matter-element to be estimated in the evaluation grade.

\[ K_j(N_0) = \sum_{i=1}^{n} K_j(x_i)w_i \]

Where \( K_j(N_0) \) is the comprehensive relationship degree of matter-element \( N_0 \) to the grade \( j \) and \( w_i \) is the importance of the criterion \( i \). The value of relationship degree signifies the membership degree of the matter-element corresponding to the evaluating grades. The bigger the value the more satisfying the outcome. If \( K_j(N_0) \) is less than -1, the matter-element does not fit the evaluating grades and does not conform to the evaluation grades. If \( K_j(N_0) \) is between -1 and 0, the matter-element does not adjust to the evaluating grades but fits to the evaluation grades and if \( K_j(N_0) \) is between 0 and 1, matter-element fits within the evaluation grades. \( K_j(N_0) > 1 \) shows that the matter-element is above the maximum value in the evaluation grades. This matter-element consists of lots of potentialities to be developed.

### 3.4. Application

Step 1: Respondent rating of criteria and attributes

A stratified sample of 112 respondents was drawn from a target population of 1223 students and staff in the Faculty of Media and Communication (Faculty A) and another sample of 128 was drawn from population of 1426 students and staff in the Faculty of Business (Faculty B).

Respondents from the two different faculties of a university were requested to rate their level of agreement on the influence of each of the attributes on effectiveness of communication strategies in their faculties in the management of university reputation. Respondent rating was based on Likert Scale of 1-5 where 1-Strongly disagree, 2-Disagree, 3-Neutral, 4-Agree and 5-Strongly agree. Modal ratings for each attribute and each Faculty were noted. Matter-element corresponding to the faculties were obtained for analysis.
Step 2: Distribution of grades

Distribution of the grades was done as shown in Table 2. The figures were obtained after focused group discussion of the grading scale with a team of communication experts. Classical and controlled matter-element were the expressed.

<table>
<thead>
<tr>
<th>criteria</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1</td>
<td>[4.5,5]</td>
<td>[3.5,4]</td>
<td>[2.5,3]</td>
<td>[1.5,2]</td>
<td>[0.5,1.5]</td>
</tr>
<tr>
<td>X2</td>
<td>[4.5,5]</td>
<td>[3.5,4]</td>
<td>[2.5,3]</td>
<td>[1.5,2]</td>
<td>[0.5,1.5]</td>
</tr>
<tr>
<td>X3</td>
<td>[4.3,5]</td>
<td>[3.3,4]</td>
<td>[2.4,3]</td>
<td>[1.5,2]</td>
<td>[0.5,1.5]</td>
</tr>
<tr>
<td>X4</td>
<td>[4.5]</td>
<td>[3.2,4]</td>
<td>[2,3]</td>
<td>[1.5,2]</td>
<td>[0.5,1.5]</td>
</tr>
<tr>
<td>X5</td>
<td>[4.7,5]</td>
<td>[3.8,4]</td>
<td>[2.7,3]</td>
<td>[1.6,2]</td>
<td>[0.5,1.6]</td>
</tr>
<tr>
<td>X6</td>
<td>[4.5,5]</td>
<td>[3.5,4]</td>
<td>[2.5,3]</td>
<td>[1.0,2]</td>
<td>[0.5,1.0]</td>
</tr>
<tr>
<td>X7</td>
<td>[4.5,5]</td>
<td>[3.5,4]</td>
<td>[2.5,3]</td>
<td>[1.5,2]</td>
<td>[0.5,1.5]</td>
</tr>
<tr>
<td>X8</td>
<td>[4.5,5]</td>
<td>[3.5,4]</td>
<td>[2.5,3]</td>
<td>[1.5,2]</td>
<td>[0.5,1.5]</td>
</tr>
</tbody>
</table>

Step 3: Filling of evaluation table and giving of membership degree

Communication experts filled in the evaluation table (Table1), defined membership degree of each criterion belonging to different evaluating grades and used Analytical Hierarchical Process (AHP) to give weights to criteria as shown in Table 3.

<table>
<thead>
<tr>
<th>Items and Weights</th>
<th>Data for training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight $u_i$</td>
<td>Weight $x_i$</td>
</tr>
<tr>
<td></td>
<td>1    2   3    4   5</td>
</tr>
<tr>
<td>$u_1$</td>
<td>0.559</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>$u_2$</td>
<td>0.2353</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>$u_3$</td>
<td>0.2059</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The sample data was input into the net in MATLAB and training weights was done. Summary input and parameter settings in MATLAB was done as shown below.

```
Weight = 2*rand(1,5)-1;
for epoch = 1:10000
    Weight = SGD_method(Weight, input, correct_Output);
end
save('Trained_Network.mat');
```

By using MATLAB neural network toolbox, the best weight of each criterion was as shown in Table 6.

Step 4: We defined the relationship network toolbox, the best weight of each criterion was as shown in Table 6.

According to Equations 4 to 6 and the data from Table 2 to Table 3, the evaluation results are shown in Table 4.

## 4. RESULTS

Table 4 illustrates modal ratings of communication strategies for management of reputation for the two faculties. The weights were also indicated as estimated in Step 3. Internal factors had the highest weight of 0.559 followed by stakeholder interest factors that had weight of 0.2353 and, lastly, technology factors which had estimated weight of 0.2059.

### Table 4: Modal ratings for the two faculties

<table>
<thead>
<tr>
<th>Item u_i</th>
<th>Weights u_i</th>
<th>Criterion x_i</th>
<th>Faculty A</th>
<th>Faculty B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Internal factors</td>
<td>0.559</td>
<td>Mission</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vision</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Values</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Policies</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2. Stakeholder interest factors</td>
<td>0.2353</td>
<td>Stakeholder analysis</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Communication plan</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>3. Technology factors</td>
<td>0.2059</td>
<td>Adoption of new media</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Technological infrastructure</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

MATLAB output was as shown in Table 5 below. The trained weight of internal factors was 0.4896, stakeholder interest factor had weight of 0.2513 and technology factor had trained weight of 0.2591. Results of weight training shows that trained, optimal weights for both stakeholder and technology factors were higher than estimated weights.
Table 5: The trained weights of criteria

<table>
<thead>
<tr>
<th>x1</th>
<th>x2</th>
<th>x3</th>
<th>x4</th>
<th>u1</th>
<th>x5</th>
<th>x6</th>
<th>u2</th>
<th>x7</th>
<th>x8</th>
<th>u3</th>
</tr>
</thead>
<tbody>
<tr>
<td>ω</td>
<td>0.4854,0.5002,0.4854,0.4786</td>
<td>0.4896</td>
<td>0.5116,0.4889</td>
<td>0.2513</td>
<td>0.5465 , 0.4854</td>
<td>0.2591</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6 illustrates that all values of $K_f(N_0)$, are between -1 and 0. This means that the matter-element fits to the evaluation grades. According to matter-element analysis theory, both Faculties A and B belong to the 'strongly agree' grade, meaning that respondents strongly agreed that corporate communication strategies in the faculties are related to reputation management. From the figures in Table 6, Faculty A has better communication strategies compared to Faculty B since $K_f(N_0)$ of -0.08649 for Faculty A is greater than -0.13540 for Faculty B.

Table 6: The relationship degree of each criterion

<table>
<thead>
<tr>
<th>Faculty Grade</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty A</td>
<td>-0.08649</td>
<td>-0.29188</td>
<td>-0.8718</td>
<td>-0.3890</td>
<td>-0.3918</td>
</tr>
<tr>
<td>Faculty B</td>
<td>-0.13540</td>
<td>-0.32011</td>
<td>-0.7203</td>
<td>-0.2518</td>
<td>-0.5704</td>
</tr>
</tbody>
</table>

5. DISCUSSIONS

Results of this research shows that evaluation criterion of internal factors, $u_1$, whose attributes were mission, vision, values and policies had greatest weight of 0.4896 than other two criteria. This means that internal factors greatly influence management of corporate reputation. These results corroborate findings of previous research that internal factors are key to successful communication strategies for improved reputation (Feldner & Fyke, 2018; Gwebu, Wang, & Wang, 2018).

Stakeholder interest and technological factors were found to be closely related to organizational mission, vision and policies and are, therefore, important for corporate communication that safeguards reputation. Individual trained model weights of the attributes of stakeholder interest and technological factors proposed in this research shows an interesting view for those researchers who are interested corporate communication and management of reputation. These weights were higher than individual trained weights for internal factors. This is interesting in the sense that it points to the stakeholder and technology oriented communication as a new modern direction of reputation management in business. Several researchers confirm this view that both technology, especially social media, and stakeholder aspects of corporate communication contributes to successful reputation management (Artemova, 2020; Haarhoff, 2019; Kotras, 2020). The issues underlying increasing supply chain flexibility might be an appropriate area to explore.
CONCLUSIONS

The research focused on corporate communication strategies with regard to the management of reputation. It identified indicators of corporate communication strategies and established their evaluation criteria using a model based on matter-element analysis with Back Propagation (BP) algorithm. Model results show that organizations can increase effectiveness of communication strategies by improving internal factors, stakeholder support and technological factors. Internal factors such as mission, vision, values and policies have been found as key to effective corporate communication for management of reputation.

Model can be used for comparison of quality of communication strategies among different firms or among different departments of an organization. Implication of the research for practitioners is that they can apply the model to compare their communication strategies and therefore be able to find ways of improving or competing with peers.

This research was limited to one organization. An analysis based on more than one organization can give greater insights. Future research can advance the model by finding out ways of developing software or applications based on artificial intelligence that can be user-friendly to be able to easily evaluate communication strategies.

REFERENCES


Artemova, A. (2020). Sustainability communication on social media: a study on the most sustainable brands in Finland.


Kotras, B. (2020). Opinions that matter: the hybridization of opinion and reputation measurement in social media listening software. Media, Culture & Society, 42(7-8), 1495-1511.


**APPENDICES**

```matlab
clc; close all; clear all;

% Defining Excitation Function
function y=Sigmoid(x)
    y=1/(1+exp(-x)); % Excitation function
end

% Defining weighting method using SGD_method
function Weight=SGD_method(Weight, input, correct_Output);
    alpha=0.9;
    N=8;
    for k=1:N
        transposed_Input = input(k,:); % Transposing the matrix
        d=correct_Output(k); % Defining distance
        Weighted_Sum = Weight*transposed_Input; % Getting product of inputs and weights
        output = Sigmoid(Weighted_Sum);
        error = 0.5*(d - output).^2;
        delta = output.*(1-output).*error;
        dWeight = alpha*delta*transposed_Input;
        Weight(1)=Weight(1) + dWeight(1);
        Weight(2)=Weight(2) + dWeight(2);
        Weight(3)=Weight(3) + dWeight(3);
        Weight(4)=Weight(4) + dWeight(4);
        Weight(5)=Weight(5) + dWeight(5);
        Weight(6)=Weight(6) + dWeight(6);
        Weight(7)=Weight(7) + dWeight(7);
        Weight(8)=Weight(8) + dWeight(8);
    end
end

% Defining inputs
input=[0.2 0.2 0.2 0.2 0.2;
        0.4 0.3 0.1 0.2 0;
        0.2 0.2 0.2 0.2 0.2;
        0.3 0.2 0.2 0.1 0.2;
        0.4 0.2 0.2 0.2 0;];
```
0.2 0.4 0.1 0.1 0.2;
0.2 0.3 0.3 0.1 0.1;
0.2 0.2 0.2 0.2 0.2;
);
correct_Output = [0.263
0.263
0.211
0.263
0.563
0.437
0.5
0.5
];
Weight = 2*rand(1,5)-1;
for epoch = 1:10000 % Setting parameters, maximum epoch as 10000
    Weight = SGD_method(Weight, input, correct_Output); % Weighting criterion
end
save('Trained_Network.mat') % Saving as matlab data

% Testing the model
load('Trained_Network.mat') % Load saved data
input = [0.2 0.2 0.2 0.2 0.2;
0.4 0.3 0.1 0.2 0;
0.2 0.2 0.2 0.2 0.2;
0.3 0.2 0.2 0.1 0.2;
0.4 0.2 0.2 0.2 0;
0.2 0.4 0.1 0.1 0.2;
0.2 0.3 0.3 0.1 0.1;
0.2 0.2 0.2 0.2 0.2;
];
N=8; % define number of inputs
for k=1:N
    transposed_Input = input(k, :);
    weighted_Sum = Weight*transposed_Input;
    output = Sigmoid(weighted_Sum)
end