W.a.w (we are watching) smart app: accommodating social perception towards public officers’ performance

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Abstract. This research is a continuation of previous research that is corruption early prevention is expanded by using expert system to analyze data and produce information to build decision. The research method used is neuroresearch method through three stages of research, namely exploratory stage, explanatory stage and confirmatory stages. The exploratory research finds W.a.W’s Principles and W.a.W’s Units of Assessment as the basis for the preparation of the application. Stages of explanatory research in the form of W.a.W’s design of IT and confirmatory research stages are the design of expert system W.a.W. Expert System uses this formulation to generate dynamic standard value for each category and current social perception.

1. Introduction
The impact of good governance value in reducing the public officers’ misconduct has been a trending topic over the last ten years. However, not many discussions include the role of society as one of the objective components although, some scholars set aside this element as the secondary consideration in terms of impartial respondents resulting bias information. Moreover, some developed countries with certain governmental ideology tend to separate society from political environment to neutralize any possibility of conflict. On the other hand, Organisation for Economic Co-operation and Development (OECD) has been developing a framework emphasizing government’s transparency to public in which societal perception towards government is built amongst the society.

Accordingly, there are three elements that trigger good societal perception: (i) law enforcement, (ii) infrastructure development, and (iii) fair treatment. In its political application, these aspects shall be distorted by corrupted nature infecting both personally and systemically. In this context, there is a belief to transform social perception into a more supervision function as it is the most independent opinion towards government’s performance. Therefore, a tool in form of a smart application corresponding modern world requirements must be built to facilitate societal perception. Furthermore, the tool used must be able to present an impartial information because political partiality does exist.

W.a.W Smart App. is the extension of CEP’s theoretical construct for presidential Decision Support System (DSS). This research aims to build an Information and Technology (IT) construct of W.a.W Smart App. including the assessment system with accountable data and resources. This IT model is
expected to accommodate public’s perception towards the government performance (personal and organizational) through an application without sacrificing the reliability of information. This research is expanded from previous research that using DSS to build decisions, but for this research uses Expert System (ES) to analyze the data and generate information to build decision. Furthermore, this application is designed to support the CEP that is constructed for presidential Expert System (ES) purposes [1].

2. Research Method
This research is developed using Neuroresearch. Neuroresearch is a research methodology approach that combine quantitative and qualitative techniques. This research conducts using three steps namely exploratory, explanatory, and confirmatory. This research methodology already use in previous research, that focus on Corruption Early Prevention blue print by implementing decision support system [2]. This research is also conducted using exploratory research. That is doing literature review regarding to W.a.W to produce construct theoretical W.a.W’s technology principles to be implemented. This research use Expert System to analyze and summarize the data.

3. Result and Analysis
3.1. W.a.W’s Principles
As an information system, W.a.W is grounded on two frameworks that was developed from basic internal control designed by COSO (Committee of Sponsoring Organizations of the Treadway Commission). In terms of framework development, W.a.W is not built on COBIT (Control Objective for Information and related Technology) due to its purposes that emphasises on the validation of data source. In this aspect, COBIT is mainly designed to bridge the gap between control requirements, technical issues and business risks which enables clear policy development and good practice for IT control throughout organizations. COBIT also emphasizes regulatory compliance, helps organizations to increase the value attained from IT, simplifies implementation of the enterprises’ IT governance and control framework [2].

Due to its needs to trace both users and targeted personnel, W.a.W is equipped with a Occupational Fraud Detection by Social Network Analysis (OFD-SNA). According to Lookman and Nurcan (2015), SNA is an emerging framework that enables fraud examiner to inter-connect interaction patterns between person-to-person. This method is successful for a problem-solving application, mainly in several economic crime issues i.e. business strategy, fraud detection, and counter terrorism. In other words, SNA provides interaction patterns between people in the forms of data collection and graph visualization [3]. Furthermore, as the SNA’s coverage enabling fraud examiners to detect the insider fraud through networking organization, computer algorithms pattern, and auditable raw data [4], it is assumed that SNA will also be able to uncovered the users’ data based on the tips [5].

Another framework is also implemented for the purpose of data base security named CIA (Confidentiality-Integrity-Availability) triad [6]. Confidentiality is the first requirement for data security which protects the data from being stolen or reaching wrong target through restricted access [2]. Second, the data security must also built in a procedure that support consistency and accuracy [7]. According to Houck et al., (2006) Other requirements for data integrity are backup files for restoration system and permission of access control. The last component that is the most important thing for fraud detection is availability, as it is a fundamental aspect that protect both integrity and confidentiality [8]. In this context, availability comprises all aspects including the originality of the software adopted which has been the requirement for admissibility of forensic reporting [9].

As an easy-use application, W.a.W offers a platform offers both respondents and analysts a set of investigative tool that lead respondents to provide their accounts which are arranged unbiasedly. Through investigative interviewing interface, respondents are allowed to choose and raise their interested cases [10]. On the other hand, W.a.W attempts to treat respondents as independent whistle-blower to be interviewed as witness interviewee [9]. According to Wells (2013), there are two hints in gathering comprehensive materials from interview: (i) informal approach is prioritized and (ii) the use...
of introductory and informational questions are necessary to be conducted in sequence. However, well-performed closing stage of interview must be conducted to reconfirm facts, obtain additional clues, and retain goodwill [11]. Therefore, According to Ord, Shaw and Green (2011) W.a.W’s questions’ configuration is grounded on opened and closed questions. Closed question is a type of inquiry that is able to lead respondents’ focuses into a certain field of information with minimum distraction [12], [13] and detect respondents’ inconsistencies which eliminates biased informants [13], [14]. Based on these traits, the closed question is suitable for both introductory and closing stages which are also equipped with multi-part-patterned question between both stages to validate the information [15]. Meanwhile the opened question is more flexible type which allows users to information related to person-to-person linkages, alleged motivation, and other related societies’ suspicions [13]. At the end, the system is set to evaluate all information through automated summarizing system and syncing all summarized information to specific target in terms of producing decisive output.

Last but not least, filtering system is pivotal for the information objectivity. The aspect of objectivity has been an issue for all surveying tools in political corruption fields. A research done in China finds that there are gaps and discrepancies between corruption perception between national, regional, and local areas even though, the questions lead to the same purposes [16]. Another finding related to the deficiency of perception is the critiques addressed to Corruption Perception Index (CPI) published by Transparency International (TI). According to Andersson and Heywood (2009), the main issue of CPI is in the unclarified definition of corruption as a factor to deteriorated corporate governance which led to diffused data articulation [17]. However, the use of perception has been considered as an empirical approach in the field of research. The use of Delphi method in both research applications and techniques [18], [19] and investigative auditing especially in anti-fraud risk assessment program [20] have one main requirement which is identifiable respondents with sufficient capacity.

Corruption perception is a very subjective type of information which needs a rigorous-selective filtering system that reduces bewildermint in decision making process in terms of matching perception and reality [21]. This can easily be done through social-partiality and personal-bi data analysis [4]. Both of these techniques aim to both (i) reveal respondents’ inclination in either striking-down or elevating a public officer [22], [23] and (ii) form an output contained with subjective information from respondents that possess sufficient capacity in providing such information [17], [24], [25]. In processing the big data collection, Stanfield (2009) provides simplest clues related to big-volume data discovery in the field of computer forensics. In reacting upon wide range of data discovery, forensic analysts usually undertake two alternatives: (i) gathering similar output from varied perspectives (in this context: all society elements, groups, and organization) and/or deleting similar output from similar perspectives [26].

3.2. W.a.W’s Units of Assessment

As it is revealed, that the nature of society perception is limited only as a set of supporting information for direct information provided through industry and retail society which means that, numerical analysis towards the social perception must get through the screening system. There are commonly three aspects to assess the public officers’ performance: (i) growth of public infrastructure, (ii) convenience of public services, and (iii) financial transparency of officers [27]. All these facts must be viewed in a framework that represents three areas in which society is always concern at i.e. politics, economics, and regulations. According to Adams (1981), reflecting from the politics circumstance United States of America (USA), which is a fair representation of the majority of politic practices [24], “Iron Triangle” can be used to view a modern politics that embraces politicians, regulators, and certain industrial parties [28].
Based on three indicators, it is revealed that the dimensions and indicators for the assessment system are completely structured. The table below depicts the relationship between the both groups.

### Table 1. Relationship Between Dimension and Indicators of W.a.W Assessment System

| W | a | W | Dimensions                      |
|---|---|---|---------------------------------|
|   |   |   | D.1 Infrastructure              |
|   |   |   | Growth                          |
|   |   |   | D.2 Public Services Quality     |
|   |   |   | Financial Transparency         |
| I.1 Politics | I.1 related with D.1 | I.1 related with D.2 | I.1 related with D.3 |
| I.2 Economics  | I.2 related with D.1 | I.2 related with D.2 | I.2 related with D.3 |
| I.3 Regulation | I.3 related with D.1 | I.3 related with D.2 | I.3 related with D.3 |

3.3 W.a.W’s Design of IT

Expert System is a computer program that act as an expertise to analyse and assist problems, the program has a specific expertness [29] such as to diagnose mental health disorder [30], [31] or to discover a knowledge [32]. Expert system is one of artificial intelligence branch that aim to understand the expertise knowledge and build the computer program from it. This knowledge is transforming into rule-based and used while generate inference or reasoning. Previous research [27] focusing on how to generate decision from respondent tends, but this research focusing on how to transform expertise knowledge in Table 1 to inference of Expert System (ES), while all the data input are dynamic from smart phone as shown in Figure 2a.

![Figure 1. Iron Triangle: Political Economy of Regulation](image1.png)

![Figure 2a](image2.png)
3.3.1. Generate Rule-Based
Rule-based are specific factor as a measurement of social perception to government, this rules are divided into nine, which is explain below in detail:

Rule 1: IF “Government related with Infrastructure Growth and Politics”
Rule 2: IF “Government related with Infrastructure Growth and Economics”
Rule 3: IF “Government related with Infrastructure Growth and Regulation”
Rule 4: IF “Government related with Public Services Quality and Politics”
Rule 5: IF “Government related with Public Services Quality and Economics”
Rule 6: IF “Government related with Public Services Quality and Regulation”
Rule 4: IF “Government related with Financial Transparency and Politics”
Rule 5: IF “Government related with Financial Transparency and Economics”
Rule 6: IF “Government related with Financial Transparency and Regulation”

Rules are displayed in several questions in expert system. Questions are accessed using smart phone by respondent. Respondent must be answered between 1 to 4 for each question, 1 is very negative and 4 is very positive.

3.3.2. Generate Reasoning (Inference)
Reasoning is the main expertise knowledge in term of how to generate the conclusions. This research uses probabilistic as basic reasoning. As mention before each of respondent answered are recorded at database, the conclusion generates dynamically according to current respondent answer.
W.a.W Expert System’s Reasoning starts with getting the average data for each respondent, this average calculates with $X_i = \sum^n_{i=1} A_{1 \ldots n}$ (1). ‘A’ is answered for each question. Next step is generating average all the respondent using formula $\bar{X} = \sum^n_{i=1} X_i$ (2). While ‘X’ is average value from each respondent in (1). To get the amount of respondent diversity this research uses formula of standard deviation $s = \sqrt{\frac{\sum (X_i - \bar{X})^2}{n}}$ (3). Value of ‘$X_i$’ comes from (1) and ‘$\bar{X}$’ comes from (2). Table 2 describe sample data from respondents. There are 10 respondents that answer each rule, from rule number 1 until 10.

| Sample | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | $X_i$ | $X_i - \bar{X}$ |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----------------|
| 1      | 3   | 3   | 4   | 4   | 4   | 3   | 4   | 4   | 4   | 3.6  | 1               |
| 2      | 3   | 3   | 3   | 3   | 3   | 4   | 3   | 3   | 3   | 3.1  | 0.25            |
| 3      | 4   | 4   | 3   | 3   | 3   | 4   | 3   | 3   | 3   | 3.3  | 0.49            |
| 4      | 2   | 2   | 3   | 3   | 2   | 3   | 2   | 2   | 2   | 2.3  | 0.09            |
| 5      | 2   | 3   | 2   | 3   | 3   | 3   | 2   | 2   | 2   | 2.4  | 0.04            |
| 6      | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 3    | 0.16            |
| 7      | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 2   | 1.1  | 2.25            |
| 8      | 3   | 2   | 3   | 2   | 2   | 3   | 2   | 2   | 2   | 2.4  | 0.04            |
| 9      | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 2    | 0.36            |
| 10     | 3   | 3   | 3   | 2   | 2   | 3   | 3   | 3   | 3   | 2.8  | 0.04            |

Inference generates average value of answer for each respondent using (1), and label as yellow in Table 2. The average for all the respondent data is formulated by (2), and by using data in Table 2 will simulate as below:

$\bar{X} = 3.6 + 3.1 + 3.3 + 2.3 + 2.4 + 3 + 1.1 + 2.4 + 2 + 2.8$

$\bar{X} = 2.6$

Inference needs to generate amount of respondent diversity using (3), and after calculating the deviation between $X_i - \bar{X}$ as label as green at Table 2, the calculation for standard deviation (3) as below:
\[ s = \sqrt{0.45 + 0.25 + 0.49 + 0.09 + 0.04 + 0.16 + 2.25 + 0.04 + 0.36 + 0.04} \]
\[ s = 0.69 \]

Next step Inference will generate control value, but Inference needs to generate each factor of control value namely ‘range’ and ‘interval’. This control value helps to make a standard value for each category in (5). Inference generates ‘range’ value by subtracting the maximum and minimum value of \( X_i \), to get the ‘range’ value is following the formula \( \text{Range} = X_{i,\text{max}} - X_{i,\text{min}} \) (4). The calculation by using data above as below:

\[ \text{Range} = 3.6 - 1.1 \]
\[ \text{Range} = 2.5 \]

After calculating ‘range’, ‘interval’ generates by using this formula \( \text{interval} = \frac{\text{Range}}{\Sigma \text{category}} \) 5). By using (5) according to data before, Inference generates the ‘interval’ as below:

\[ \text{Interval} = \frac{2.5}{4} \]
\[ \text{Interval} = 0.51 \]
\[ \text{Interval} = 1 \]

Category at (5) is number of choices for questions. Inference generates control value by using \( \text{Interval} \times \text{Category} \geq \text{Range} + 1 \) (6). If it is true and \( (\text{Interval} \times \text{Category}) - \text{Range} + 1 = 2 \) than first category (in this case is 1, that indicate very negative) is \( X_{i,\text{min}} - 1 \) and last category (in this case is 4, that indicate very positive) is \( X_{i,\text{max}} + 1 \). If it is true and \( (\text{Interval} \times \text{Category}) - \text{Range} + 1 = 3 \) than first category (in this case is 1, that indicate very negative) is \( X_{i,\text{min}} - 1 \) and last category (in this case is 4, that indicate very positive) is \( X_{i,\text{max}} + 2 \). If it is true and \( (\text{Interval} \times \text{Category}) = \text{Range} + 1 \) than first category (in this case is 1, that indicate very negative) is \( X_{i,\text{min}} \) and last category (in this case is 4, that indicate very positive) is \( X_{i,\text{max}} \). From the data above, standard value for each category as below:

\[ \text{Interval} \times \text{category} \geq \text{Range} + 1 \]
\[ 1 \times 4 \geq 2.5 + 1 \]

1 (very negative) : 1.1 – 1.9
2 (negative) : 1.95 – 2.75
3 (positive) : 2.8 – 3.55
4 (very positive) : 3.6 – 4.45

Final Inference calculation is generating the current social perception to government according to data in Table 2. This perception value is following this formula \( \bar{X} - t_p \frac{s}{\sqrt{n}} < \mu < \bar{X} + t_p \frac{s}{\sqrt{n}} \) (7). While \( t_p \) is the value from ‘t Table’ where \( df = n - 1 \). By using data we can get range for social perception as below:

\[ 2.6 - \left( 2.262 \times \frac{0.69}{\sqrt{10}} \right) < \mu < 2.6 + \left( 2.262 \times \frac{0.69}{\sqrt{10}} \right) \]
\[
2.6 - \left(2.262 \times \left( \frac{0.69}{3.16} \right) \right) < \mu < 2.6 + \left(2.262 \times \left( \frac{0.69}{3.16} \right) \right)
\]

\[
2.6 - (2.262 \times 0.22) < \mu < 2.6 + (2.262 \times 0.22)
\]

\[
2.6 - 0.5 < \mu < 2.6 + 0.5
\]

\[
2.1 < \mu < 3.1
\]

To generate the conclusion, Expert System Inference is mapping value \(\mu\) at (7) into category standard value and decided this value is in which category, for this case the social perception is in third category (positive).

Expert System uses this formulation to generate dynamic standard value for each category and current social perception. This value will change dynamically according to the newest input from customer. By using this Expert System social perception to government is valid.

4. Conclusions and Recommendation

Expert System is a full power computer program to mimic knowledge skills to summarize conclusions. This knowledge then turns into useful conclusions in decision making. The rules for social perception produce nine rules, each rule has four categories of answers 1 (very negative), 2 (negative), 3 (positive), and 4 (very positive). An arrangement is approximated by probabilistic to ensure each valid value matches the current data, this inference can result in a tendency for a condition of social perception dynamically.

Through expert systems, communities respond as their perceptions of government performance over time. Automatically the system built in the W.a.W apps will generate any incoming information and provide conclusions and types of social interventions that should be implemented by the government. Any addition of a community response will alter the fluctuating and dynamic conclusions that give the consequences of the current state. Up to date conclusions will help the government in responding rapidly to the phenomena that occur in the community. With this pattern, W.a.W application becomes a smart system in implementing new policies to prevent unhealthy practices affecting government performance in Indonesia.

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