A method and a system for conducting one or more surveys for a plurality of participants is disclosed. Each survey includes one or more of a plurality of options and one or more issues. The method and system includes presenting one or more of the plurality of options and the one or more issues associated with each survey to the participants. Each participant then ranks one or more of the options and the issues to create one or more influential functions for each survey. Thereafter, one or more influential functions associated with a participant is aggregated across all participants to create a collective influential function for each survey. The collective influential function for each survey is based on one or more of a satisfaction score and a dissonance score. The possible potential outcomes associated with each survey are then ranked based on the collective influential function.
Present a plurality of options and one or more issues associated with each survey of a plurality of surveys to a plurality of participants

Rank one or more of the plurality of options and the one or more issues by the plurality of participants for each survey to create a plurality of influential functions for each survey, the plurality of influential functions including one or more influential functions associated with each participant of the plurality of participants

Aggregate one or more of the one or more influential functions associated with each participant across the plurality of participants to create a collective influential function for each survey, wherein the collective influential function for each survey is based on one or more of a satisfaction score and a dissonance score

Rank a plurality of potential outcomes associated with each survey based on the collective influential function associated with each survey

End

FIG. 1
FIG. 2

- **Gymnasium**
  - NO GYM: -40
  - SMALL GYM: +14
  - LARGE GYM: +40

- **Art Gallery**: 35

- **Performance Space**: 5

- **Municipal Offices**
  - NO MUNICIPAL OFFICES: -40
  - CONFERENCE ROOM ONLY: +14
  - FULL SUITE OF MUNICIPAL OFFICES: +40
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gymnasium Options</td>
<td></td>
</tr>
<tr>
<td>NO GYM</td>
<td>0</td>
</tr>
<tr>
<td>SMALL GYM</td>
<td>+30</td>
</tr>
<tr>
<td>LARGE GYM</td>
<td>+40</td>
</tr>
<tr>
<td>Art Gallery Options</td>
<td></td>
</tr>
<tr>
<td>Performance Space Op's</td>
<td></td>
</tr>
<tr>
<td>Municipal Office Options</td>
<td></td>
</tr>
<tr>
<td>NO MUNICIPAL OFFICES</td>
<td>-40</td>
</tr>
<tr>
<td>CONFERENCE ROOM ONLY</td>
<td>0</td>
</tr>
<tr>
<td>FULL SUITE OF MUNICIPAL OFFICES</td>
<td>+40</td>
</tr>
</tbody>
</table>

FIG. 3
FIG. 4
### Gymnasium

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO GYM</td>
<td>-40</td>
</tr>
<tr>
<td>SMALL GYM</td>
<td>+14</td>
</tr>
<tr>
<td>LARGE GYM</td>
<td>+40</td>
</tr>
</tbody>
</table>

### Art Gallery

### Performance Space

### Municipal Offices

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO MUNICIPAL OFFICES</td>
<td>-40</td>
</tr>
<tr>
<td>CONFERENCE ROOM ONLY</td>
<td>+14</td>
</tr>
<tr>
<td>FULL SUITE OF MUNICIPAL OFFICES</td>
<td>+40</td>
</tr>
</tbody>
</table>

---

**FIG. 5**
<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address Climate Change</td>
<td>15</td>
</tr>
<tr>
<td>Affordable</td>
<td>0</td>
</tr>
<tr>
<td>Economic Opportunity</td>
<td>15</td>
</tr>
<tr>
<td>Habitat Preservation</td>
<td>0</td>
</tr>
<tr>
<td>Health &amp; Fitness</td>
<td>40</td>
</tr>
<tr>
<td>Sense of Community</td>
<td>30</td>
</tr>
</tbody>
</table>

FIG. 6
METHOD AND SYSTEM FOR CONDUCTING ONE OR MORE SURVEYS

FIELD OF THE INVENTION

[0001] The invention generally relates to a method and system for conducting one or more surveys for a plurality of participants for identifying a collective outcome for each survey. More specifically, the invention relates to a method and system for identifying the collective outcome for each survey based on one or more of a satisfaction and a dissonance between participants for the collective outcome.

BACKGROUND OF THE INVENTION

[0002] Survey or polling systems are well known methods used for identifying solutions to problems associated with a large number of people. These methodologies are generally used to find a solution for a query where large numbers of participants are involved. These survey or polling systems provide multiple questions and multiple answers to these questions for the participants to choose. Potential solutions for simple and/or complex problems are determined by considering one or more questions and one or more corresponding answers simultaneously. The participants are asked to vote indicating their preferences for answers to these questions. Then, solutions to such questions are identified by analyzing the results of the survey or polling. Most of the existing analysis tools give importance to options chosen by the majority of participants. Thus, some participants who had chosen the options which are preferred only by a minority group of the participants are left unsatisfied. This creates an unequal satisfaction distribution between the participants and leads to unstable decisions that lack the full support of all participants.

[0003] Some methods and systems exist that consider the satisfaction of the participants while analyzing the results of a survey or poll. However, these methods or systems primarily focus on the options chosen by the majority of participants. For example, in a survey event, if three options are provided to a plurality of participants and participants are asked to choose from the provided options, normally, an option chosen by the maximum number of participants is selected as the final solution. This may leave a large number of participants who chose that option extremely satisfied, but on the other hand, causes the participants who did not choose that option to be extremely dissatisfied or unhappy.

[0004] When multiple surveys are conducted for the participants, it may so happen that a participant is left extremely dissatisfied with each collective outcome chosen for each survey associated with the multiple surveys. Since each survey is considered to be independent, the satisfaction or dissonance experienced by a participant in a previous survey is not considered when deciding on a collective outcome for a current survey.

[0005] Thus, there is a need for a method and system for determining a collective outcome that balances the satisfaction and the dissonance associated with all participants of a survey such that ensuring the greatest satisfaction for the greatest number takes into account the dissatisfaction that results from unfairness in the distribution of satisfaction in a chosen collective outcome. There is also a need for a method and system that considers satisfaction and dissonance experienced by a participant over previous surveys to decide on a collective outcome for a current survey.

BRIEF DESCRIPTION OF THE FIGURES

[0006] The accompanying figures, where like reference numerals refer to identical or functionally similar elements throughout the separate views and which together with the detailed description below are incorporated in and form part of the specification, serve to further illustrate various embodiments and to explain various principles and advantages all in accordance with the invention.

[0007] FIG. 1 illustrates a flowchart of a method of conducting one or more surveys in accordance with various embodiments of the invention.

[0008] FIG. 2 illustrates an exemplary embodiment of ranking a plurality of options and one or more issues associated with a survey by a participant in accordance with an embodiment of the invention.

[0009] FIG. 3 illustrates an exemplary embodiment of ranking a plurality of options and one or more issues of a survey based on a criterion in accordance with an embodiment of the invention.

[0010] FIG. 4 illustrates an exemplary embodiment of modifying an influent function by varying a rank associated with an option in accordance with an embodiment of the invention.

[0011] FIG. 5 illustrates an exemplary embodiment of modifying an influent function by varying a rank or weight associated with an issue in accordance with an embodiment of the invention.

[0012] FIG. 6 illustrates an exemplary embodiment of merging two or more influent functions in accordance with an embodiment of the invention.

[0013] FIG. 7 illustrates a block diagram of a system for conducting one or more surveys in accordance with various embodiments of the invention.

[0014] Skilled artisans will appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions of some of the elements in the figures may be exaggerated relative to other elements to help to improve understanding of embodiments of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0015] Before describing in detail embodiments that are in accordance with the invention, it should be observed that the embodiments reside primarily in combinations of method steps and system components related to a method and system for conducting one or more surveys for a plurality of participants. Accordingly, the system components and method steps have been represented where appropriate by conventional symbols in the drawings, showing only those specific details that are pertinent to understanding the embodiments of the invention so as not to obscure the disclosure with details that will be readily apparent to those of ordinary skill in the art having the benefit of the description herein.

[0016] In this document, relational terms such as first and second, and the like may be used solely to distinguish one entity or action from another entity or action without necessarily requiring or implying any actual such relationship or order between such entities or actions. The terms “comprises,” “comprising,” or any other variation thereof, are intended to cover a non-exclusive inclusion, such that a process, method, or apparatus that comprises a list of elements does not include only those elements but may include other elements not expressly listed or inherent to such process,
method, or apparatus. An element proceeded by "comprises . . . a" does not, without more constraints, preclude the existence of additional identical elements in the process, method, or apparatus that comprises the element.

[0017] Generally speaking, pursuant to various embodiments, the invention provides a method and a system for conducting one or more surveys for a plurality of participants. The one or more surveys are conducted to identify potential outcomes associated with a plurality of options and one or more issues associated with each survey. The method and system includes presenting one or more of a plurality of options and one or more issues associated with each survey to the plurality of participants. Here, an issue of the one or more issues includes two or more options. Each participant of the plurality of participants then ranks one or more of the plurality of options and the one or more issues to create one or more influential functions for each survey. Thereafter, one or more of the one or more influential functions associated with each participant is aggregated across the plurality of participants to create a collective influential function for each survey. The collective influential function for each survey is based on one or more of a satisfaction score and a dissonance score. On creating the collective influential function for each survey, a plurality of potential outcomes associated with each survey is ranked based on the collective influential function.

[0018] FIG. 1 illustrates a flowchart of a method of conducting one or more surveys in accordance with an embodiment of the invention. Each survey of the one or more surveys may be conducted at different instances of time to arrive at a collective outcome or collective decision for each survey. The one or more surveys correspond to a decision series D comprising a plurality of collective decisions made at different time instances such that:

\[ D = \{ D(t_1), D(t_2), \ldots, D(t_n) \} \]

where \( D(t) \) represents a collective decision made at time instance \( t \).

[0019] At step 102, a plurality of options and one or more issues associated with each survey of the one or more surveys is presented to a plurality of participants. Here, each issue of the one or more issues includes two or more options. The plurality of options and the one or more issues are defined by one or more of one or more participants and one or more administrators. An option of the plurality of options may be associated with a set of characteristics. The characteristics of an option \( a \) is defined as \( C(a) = \{ c_1(a), c_2(a), \ldots, c_n(a) \} \) where \( C \) is a set of alphanumeric phrases. For example, if option \( a \) is a car, then \( c_1 \) may be cost, \( c_2 \) may be mileage, \( c_3 \) may be color etc. The characteristics associated with an option may also be defined by taking a function of other characteristics associated with that option. For example, if option \( a \) is a house, \( c_1 \) is cost and \( c_2 \) is square footage, then a third characteristic, the cost per square foot can be defined as: \( C(a) = c_1(a)/c_2(a) \).

[0020] The plurality of options associated with a survey corresponds to a plurality of potential outcomes for the survey. A potential outcome is defined as a particular combination of one or more options of the plurality of options. As explained for the plurality of options above, the plurality of potential outcomes may also be associated with sets of characteristics. The sets of characteristics associated with the plurality of potential outcomes will not always be reducible to characteristics of the isolated options, but in some cases will arise from the interaction of characteristics of the isolated options across a potential outcome. For example, two participants may be deciding how to spend an evening; what restaurant to have dinner at, what movie to see, etc. A characteristic that does not arise from any of the options in isolation might be how far away the restaurant is from the closest movie theatre that is playing the movie they choose, which in turn interacts with the type of transportation to generate an approximate travel time. \( C(O) \) represents the set of characteristics for a potential outcome \( O \) where \( C \) is a set of alphanumeric phrases, for each potential outcome \( O \). \( A \) is an alphanumeric phrase. Here, \( A \) is the set of all possible sets of \( a \), where \( A \) is the set of options associated with a survey.

[0021] The net characteristics associated with an outcome include characteristics associated with the options that comprise the outcome and also characteristics that arise as a result of interaction of characteristics of the isolated options across an outcome. The net set of characteristics associated with an outcome is given by:

\[ C(O) = C(O) \cup C(O') \]

[0022] Moving on, \( P = \{ P_1, P_2, \ldots, P_n \} \) represents the set of participants associated with the decision series \( D \), wherein \( |P| \) is the number of participants participating in the decision making process and \( x \in P \) represents a participant \( x \) in the set of participants \( P \).

[0023] The plurality of options present for making a decision \( D \) is indicated as a set of options \( A \) such that \( A = \{ a_1, a_2, \ldots, a_n \} \). \( |A| \) represents the number of options for the decision \( D \). \( A' \) is the set of all possible sets of \( A \) and \( A'' \) is the set of all possible sets of \( A' \) and their subsets.

[0024] As stated earlier, potential outcomes are defined as different combinations of the plurality of options. However, not all possible combinations of options may result in a useful potential outcome. Many combinations might result in impossible or impractical potential outcomes. In other words, many combinations may lead to non-actionable outcomes. The non-actionable outcomes therefore need to be eliminated from consideration. To eliminate the non-actionable outcomes, one or more of one or more participants or one or more administrators may specify one or more constraints or one or more rules. Constraints may be framed as Boolean logical relations between options and groups of options. Rules can be framed as mathematical or logical functions based on influential functions and characteristics associated with options or outcomes. If Boolean logical relations are used to determine non-actionable outcomes, a function \( L \) mapping from the set of outcomes \( A \) to true or false, \( L: A \rightarrow \{ T, F \} \) is defined. Thus, \( L : C(O) \rightarrow \{ T, F \} \) is a constraint on the set of outcomes, such that each possible combination of options is given a true/false value indicating whether it is actionable or not. Similarly, other constraints may be defined using rules that are defined by one or more of the one or more participants and one or more administrators. For example, an organization may decide to have gender equity on its board. In elections to the board where each voter rates all the candidates, a rule can be defined that eliminates any outcomes that comprise a combination of candidates that is not gender balanced or exceeds the size of the board.

[0025] Thus, by applying constraints, a subset \( O' \) of \( A' \) is determined to be the set of actionable outcomes. Here, the set of actionable outcomes are actionable for the plurality of participants as a whole and not to any individual participant. Since, \( O' \subset A' \) such that \( O \rightarrow O'' \) for logical constraints \( L \).

[0026] An issue of the one or more issues associated with a survey includes two or more options. In other words, issues are ways of grouping options, generally into non-overlapping categories. An issue may be considered a set which covers all options belonging to that issue. An "issue set" is a set of issues such that every option belongs to one or more issues in an issue set. Issue sets are closed when no options belong to more than one issue. Closed issue sets can be nested to create "issue domains". That is, there can be a tree hierarchy of closed issue sets which together form a single "issue
domain’. For example, in a shopping environment, one issue domain may have “food” containing all the options desired, and under that issue might be sub-issues such as “meat” or “vegetables” which in turn may be divided into sub-issues such as “organic” or “processed”, etc.

[0027] Take an issue \( u \) to be a subset of the total set of options \( A \), i.e., \( u \subseteq A \). \( A \) represents a closed issue set wherein \( \bigcup_{i} \bigcup_{j} u \subseteq A' \). Here, \( A \) is a partition of \( A' \) into non-overlapping sets such that \( \bigcup_{i} \bigcup_{j} u \subseteq A \). A closed issue set \( U_j \) may be a subordinate to a closed issue set \( U_i \), if \( U_j \subseteq U_i \), that is, for every \( u \in U_j \), \( u \subseteq v \) for some \( v \in U_i \). \( U \) is an issue domain, wherein \( U' \) is a nested series of issue sets represented as:

\[ U' = \{ U_i, \ldots, U_j \} \quad \text{and} \quad U_i \subseteq U_j \subseteq \ldots \subseteq U_j \]

[0028] At step 104, the plurality of participants rank one or more of the plurality of options and the one or more issues associated with each survey of the one or more surveys. Optionally, the plurality of participants may rank the one or more of the plurality of options and the one or more issues associated with each survey based on a criterion. Ranking one or more of the plurality of options and the one or more issues associated with each survey by a participant includes assigning one or more of a numerical score, a percentage weight and a function over a numeric range associated with a characteristic associated with an option. In an embodiment, assigning a function over a numeric range may include a participant using a graphic interface to draw a continuous line over an x-axis. Ranking also includes choosing a word or phrase such as “highly support” where that word or phrase corresponds to a numerical score or percentage weight. A range of the ranks to be allocated to the one or more issues and the one or more options may be predetermined. For example, ranks may be chosen from a range of, but not limited to, 1-10 and 0-100. The range of ranks associated with issues may be different than the range of ranks associated with options. The range of these ranks may be defined by the plurality of participants. Ranking the plurality of options and the one or more issues associated with a survey by the plurality of participants creates a plurality of influential functions. Here, each participant of the plurality of participants may be associated with one or more influential functions as described later. An influential function associated with a survey is defined as a function that orders a plurality of potential outcomes associated with the survey.

[0029] In an embodiment, ranking the plurality of options by a participant creates an influential function for the participant. An influential function \( \Phi \) is a function that maps each outcome to \( R \). Based on the ranking provided by a participant to the plurality of options, a value for an outcome is determined by summing the ranks corresponding to options that belong to that outcome. Thus, the influential function is defined as:

\[ \Phi(O) = \sum_{a \in O} \Phi(a) \]

[0030] In another instance, a participant may provide a ranked list of the options. This means that a participant may create an ordered list that specifies the participant’s most preferred option, the participant’s second most preferred option and so on. If \( \#(a) \) is the rank number of an option \( a \) and \( n \) is the total number of options, then an influential function \( \Phi(a) \) is defined as:

\[ \Phi(a) = \frac{1 - \#(a)}{n} \]

[0031] Sometimes, an influential function is needed to map an option or an outcome not onto a single value of \( R \), but to a range within \( R \). This might occur in situations where one of the characteristics associated with an option or an outcome is a number that can fall within a range. For example, the amount of support for purchasing an item might vary depending on the price characteristic which can vary. That is, the support might be a function of the price. These ranges may be referred as \([\text{\{in\}}] \subseteq R \) to \([\text{\{out\}}] \subseteq R \). \([\text{\{in\}}] \) is the range associated with the characteristic. \([\text{\{out\}}] \) is usually the range for voting that is selected. \( \Phi^* \) is a characteristic function mapping \([\text{\{in\}}] \) to \([\text{\{out\}}] \) for the characteristic of an option or an outcome.

[0032] In another embodiment, a participant may rank the plurality of options and the one or more issues to create an influential function associated with the participant. FIG. 2 illustrates an exemplary embodiment of ranking the plurality of options and the one or more issues by a participant. Referring to FIG. 2, “Gymnasium”, “Art Gallery”, “Performance Space”, and “Municipal Offices” represent four issues. Each of these issues further includes two or more options. As shown in FIG. 2, “No Gym”, “Small Gym”, and “Large Gym” are options associated with the issue “Gymnasium”. Each participant assigns a level of support or importance for the plurality of options and the one or more issues by ranking the plurality of options and the one or more issues as illustrated in FIG. 2. Each participant independently assigns a rank to each of the plurality of options and also to each issue.

[0033] In another embodiment, an influential function \( \Phi \) may be created based on the ranking provided by a participant associated with the plurality of outcomes, wherein that influential function is not expressed as an influential function associated with the plurality of outcomes. If a participant modifies or merges that influential function \( \Phi \) based on one or more issues elsewhere or otherwise applies adjustments using methods that require the influential function to be expressed as an influential function associated with options, then an influential function \( \Phi' \) can be found wherein

\[ \sum_{a \in O} \frac{\Phi(O) - \sum_{a \in O} \Phi'(a)}{\Phi(a)} \]

is minimized, and \( \Phi \) may be adjusted using those same methods to create a new influential function \( \Phi_{\text{new}} \). Based upon the effect of the adjustments applied to \( \Phi \), a new influential function \( \Phi_{\text{new}} \) based on \( \Phi \) may be created such that \( \Phi_{\text{new}} = \Phi^* (\Phi_{\text{new}} \Phi) \). Modifying and merging influential functions to create other influential functions is explained in detail later.

[0034] Given an issue domain \( U' \), the influential function generated as a result of ranking the plurality of options and the one or more issues is given by:

\[ \Phi(a) = w(u(1,a)) + \cdots + w(u(n,a)) \cdot R(a) \]

where,

\[ R(a) = \text{the rank given by a participant to an option } a, u(i,b) \]

is the set in \( U_i \) such that \( b \subseteq a \), and \( w(u(i,b)) \) is the rank or weight given to \( u(i,b) \). In a scenario, \( w(u(1,a)) + w(u(n,b)) \) if option \( a \) and option \( b \) belong to the same issue. In this case,
w(u) is the weight of that issue. Generally, a set of weights for issues is determined such that:

\[ \sum_{u \in U} w(u) = 1 \]

for each issue u in a closed issue set U. In other words, issue weights are expressed as percentages that add up to 100% for each issue set.

[0035] In another embodiment, a participant may rank the plurality of options (hereinafter referred to as "options") and the one or more issues (hereinafter referred to as "issues") associated with each survey based on one or more criteria. In this case, the one or more criteria may be defined by one or more of one or more participants and one or more administrators. FIG. 3 illustrates an exemplary embodiment of ranking the options and issues of a survey based on a criterion. Here, participants rank the options and issues by considering the criterion "Environment". For example, a participant may rank the issue "Gymnasium" by considering what impact a Gymnasium may have on the environment. If the participant believes that a Gymnasium may adversely affect the environment in some way, the participant could show less support for a Gymnasium by assigning a lower rank to the issue "Gymnasium". Similarly, each issue and its corresponding options associated with a survey are ranked by each participant of the plurality of participants. More than one criterion may be provided to the participants. For example, a second criterion "Cost" may also be defined for the participants. Each participant then ranks the issues "Gymnasium", "Art Gallery", "Performance Space" and "Municipal Offices" and the corresponding options based on the impact they may have on the criterion "Cost".

[0036] When a participant ranks the options and issues associated with a survey based on a criterion, an influence function is created for that participant for that survey. Similarly, for each criterion, an influence function is created for the participant. Thus, a participant may be associated with a plurality of influence functions wherein the number of influence functions corresponds to the number of criteria. A participant may publish one or more influence functions associated with the participant to be used by other participants.

[0037] In another embodiment, an influence function \( \phi_i \) corresponding to a ranking of options and issues for issue domain \( U \) over the set of options A may be converted into an influence function \( \phi_k \) corresponding to a ranking of options and issues for a different issue domain \( U_k \) over the same set of options A. Take \( V = \{ \phi_1, \ldots, \phi_n \} \) is the set of influence functions associated with options and issues for issue domain \( U_k \) such that \( \phi_1(a) = w_i(u(s(a))) \) for all the options a in A, where \( 0 \leq w_i(u(s(a))) \leq 1 \) and then choose \( \phi_2(a) \) in \( V \) such that \( \{ \max (R(a), a \in A) - \min (R(a), a \in A) \} \) is minimized.

[0038] In an embodiment, ranks for options and issues may be recommended to a participant based on a trust network associated with the participant. To build a trust network, in one embodiment, participant accounts may be created for each participant in a social network. The participant accounts may then be approved by one or more administrators and appropriate permissions assigned to each participant. Thereafter, participants are allowed to share information such as maps, reports, plans, images, videos, comments, etc. to influence the other participants. In the social network, a participant may assign trust ranks to one or more other participants according to how much confidence the participant has in their decisions in different areas. Trust ranks may be allocated according to issue, so for example, a participant could give a high trust ranking on scientific decisions to a friend who is an engineer. For example, Joe may know Sam personally and feels that Sam’s views are similar to his own. Hence, Joe may assign a high trust ranking for Sam. However, if Joe feels that Sam’s views on only certain issues match his own, then Joe may assign a high trust ranking to Sam for only those issues. Similarly, Sam may in turn assign a trust rank to Fred. In this example, since Joe has assigned a high trust ranking for Sam since they share the same views, Sam’s ranking of options and issues may be recommended to Joe when Joe ranks the options and issues.

[0039] \( \tau(x,y) \) indicates the trust rank of a participant x for a participant y and \( \tau(x,y) \) is the trust rank provided by participant x to participant y over an issue u.

[0040] To recommend ranks for options or issues to a participant, other participants who the participant has not directly assigned a trust rank to may also be considered. In this case, a participant may specify a trust propagation factor. The trust propagation factor \( \Pi(x) \) for a participant x describes the maximum length of the chain of participants between the participant x and a participant y that is to be relied on as a basis of trust. Here, the length of the chain includes both participant x and participant y. For example, \( \Pi(x) = 2 \) means participant x and participant y are directly connected as there are only two participants in the chain \( \Pi(x) = 3 \) means that participant x and participant y are connected via one intermediary participant.

[0041] \( \Pi(x) \) may be used to determine how much the trust rank of a participant for another participant changes if the other participant is not known to the participant but is connected to the participant by one or more degrees of separation through intermediary participants. Referring to the previous example, although Joe did not provide a trust rank for Fred, he provided a trust rank for Sam who in turn provided a trust rank for Fred. A trust rank of Joe for Fred may be determined based on the trust propagation factor and the trust rankings provided by Joe to Sam and provided by Sam to Fred.

[0042] A trust pathway \( P(x,y) \) from participant x to participant y is defined as a series of participants linked by trust ranks \( P(x,y) = [P_x, P_2, \ldots, P_n] \) is a subset of P where \( x = P_1 \) and \( y = P_n \) and \( \tau(P_x, P_{x+1}) \) for all \( 1 \leq x \leq n - 1 \) is received. \( P(x,y) \) is a valid trust pathway between the participant x and the participant y represented by the following equation:

\[
P(x,y) = \{ P(x,y) | \tau(P(x,y)) \}
\]

[0043] In addition to the trust propagation factor, a trust decay factor may also be defined. The trust decay factor is a measure of rate at which the trust between a participant and another participant decays as degree of separation between the two participants increases. The degree of separation between a participant and another participant is the number of participants which connect the participant and the other participant. In an embodiment, the trust decay factor may be an exponential factor. Referring to the previous example, Joe and Sam are directly related therefore the degree of separation between them can be considered as minimum. However, Joe and Fred are connected indirectly with each other through Sam therefore a degree of separation between Joe and Fred is more as compared with the degree of separation between Joe
and Sam. The trust decay factor defines a rate of decay in trust for each degree of separation between participants.

Based on the trust pathway information, a trust ranking can be recommended to participant x for participant y. To begin with, the trust rankings are normalized such that the most trusted participant has a value ‘1’. The normalized trust ranking \( \tau(x,y) \) is given by:

\[
\tau(x, y) = \frac{\tau(x, y)}{\tau(x, y')}
\]

where \( y \in P \) and \( \tau(x,y)=\max \{ \tau(x,y) \text{ for all } y \in P \} \)

The trust ranking recommended to participant x for participant y is determined by:

\[
\tau(x, y, P(x,y)) = \sum_{P' \subseteq P(x,y)} \left( \frac{\tau(x,y) - \tau(x,y')}{\Delta(x)} \right) \prod_{P, P' \neq P} \tau'(P, P')
\]

where \( \Delta(x) \) represents a trust decay factor associated with a participant x.

In the above equation, the first part represents the trust decay factor and the second part represents the trust propagation factor. The trust decay factor and the trust propagation factor are added up over all the valid trust pathways from x to y.

In an embodiment, rankings for an option or issue may be recommended to a participant based on the recommended trust rankings. A recommended rank for the participant x for an option a, \( R'(a,x) \), may be determined by:

\[
R'(a,x) = \frac{\sum_{y \in P} \tau(x, y, P(x,y)) \cdot R(a, y)}{\sum_{y \in P} \tau(x, y, P(x,y))}
\]

where:

\( R(a,y) \) is the rank provided by the participant y to the option a. \( P' \) is a subset of \( P \) where \( P' \) includes \( P'(a) \) and \( P'(u) \) which represents the set of participants that ranked the option a and the issue u respectively.

Similarly, a recommended rank or weight \( W'(u,x) \) for an issue u may be determined by the following equation:

\[
W'(u,x) = \frac{\sum_{y \in P} \tau(x, y, P(x,y)) \cdot W(u,y))}{\sum_{y \in P} \tau(x, y, P(x,y))}
\]

Additionally, the confidence of a recommended ranking for an option a may be determined by evaluating the standard deviation of the recommendations as given below:

\[
C(R'(a,x)) = \sqrt{\frac{\sum_{y \in P} \tau(x, y, P(x,y)) \cdot [R(a, y) - R'(a,x)]^2}{\sum_{y \in P} \tau(x, y, P(x,y))}}
\]

Similarly, the confidence of a recommended weight to an issue u may also be determined.

In an embodiment, trust ranks may be recommended based on historical data. Here, previous voting patterns may be checked to identify other participants who have voted similarly to the participant and based on this information a trust rank for the other participants may be recommended to the participant. A recommended historic trust rank \( \tau'(x,y,a) \) is provided by a participant x to a participant y related to option a. A historic decision series \( D' = \{D(1), D(2), \ldots, D(n)\} \) may be referred to for suggesting the recommended historic trust rank to the participant y. \( A(x,y,a) \) is a set of options that may be considered for suggesting the recommended historic rank to the participant y, wherein \( a=\{a_1, a_2, a_n\} \in D(i) \), where \( D(i) \) contains all voting information for all participants.

In calculating a historic trust recommendation for option a, the calculation can be restricted to looking at options belonging to the same issue as option a. In an embodiment, we can take \( A_x(x,y,a) = \{a \in A_x \text{ such that } R(a,x), R(a,y) > 0\} \) where \( R(a,x) \) is a rank provided by the participant x to an option \( a \). In a decision D(i) in \( D' \); and \( R(a,y) \) is a rank provided by the participant y to an option \( a \) in a decision D(i). Therefore, the recommended historic trust rank for the participant y by the participant x is determined by:

\[
\tau'(x,y,a) = \left\{ 1 + \frac{\sum_{b \in A_x(x,y,a)} |R(b,x) - R(b,y)|}{\|b(x,y,a)\|} \right\}^{-1}
\]

In an embodiment, we can take a measure of semantic proximity between two options \( Prox(a,b) \), for example where

\[
Prox(a, b) = \frac{\|a \cap b \|}{\|b \|}
\]

for all issues u in a set of issue domains. In such a case the recommended historic trust rank would be:

\[
\tau'(x,y,a) = \left\{ 1 + \frac{\sum_{b \in A_x(x,y,a)} Prox(a, b) |R(b,x) - R(b,y)|}{\sum_{b \in A_x(x,y,a)} Prox(a, b)} \right\}^{-1}
\]

Thereafter, based on the recommended historic trust rank suggested to participant x for the other participants, a recommended historic rank \( R'(a,x) \) is determined for participant x for option a as:

\[
R'(a,x) = \frac{\sum_{y \in P} \tau(x, y, P(x,y)) \cdot R(a, y)}{\sum_{y \in P} \tau(x, y, P(x,y))}
\]
where, \(P'(a)\) is the set of participants that voted on the option \(a\).

Additionally, a confidence rating of the recommended historic rank \(R'(a, x)\) for participant \(x\) for option \(a\) may be given as:

\[
C(R'(a, x)) = \sqrt{\frac{\sum_{y \in P(a)} r^2(x, y, a) + R(a, y) - R'(a, x)}{\sum_{y \in P(a)} r^2(x, y, a)}}
\]

In a similar manner, a recommended historical trust rank can be found for an issue, and a confidence rating associated with that historical trust rank.

In addition to directly ranking the plurality of options and the one or more issues associated with each survey to create one or more influent functions for each survey, a participant may create one or more influent functions for a survey by modifying one or more influent functions associated with the survey. The one or more influent functions associated with the survey may correspond to one or more influent functions created by other participants of the plurality of participants for the survey. A participant may choose one or more influent functions and modify the ranks associated with one or more of the options and issues of the chosen influent functions to create one or more influent functions for the participant. It is to be noted here that the original influent functions created by the other participants are left intact to be used by another participant. Modifying the influent functions associated with the other participants by a participant creates a new influent function for the participant. FIG. 4 illustrates an exemplary embodiment of modifying an influent function by varying a rank associated with an option. Similarly, FIG. 5 illustrates an exemplary embodiment of modifying an influent function by varying a rank or weight associated with an issue. In this way, a participant can restrict an influent function to a specific issue by making the rank of that issue ‘1’ and making the ranks of other issues ‘0’. Thus, if there are five issues, a participant could possibly create five influent functions, each corresponding to the original influent function restricted to an issue.

In yet another embodiment, a participant may create an influent function for a survey by merging two or more influent functions associated with the survey. The two or more influent functions may be associated with two or more other participants of the plurality of participants. In this case, the two or more influent functions may be considered as starting influent functions. FIG. 6 illustrates an exemplary embodiment of merging two or more influent functions. Merging the two or more starting influent functions involves assigning a weight to each of the two or more influent functions and combining them to form a single influent function. Given the starting influent functions \(\Phi^* = \{\Phi_1, \ldots, \Phi_m\}\), a participant can integrate them into a single function by assigning a relative weight \(K = [k_1, \ldots, k_m]\) to each starting influent, given by \(I(K, \Phi^*) = I(K, \Phi^*)\) is the sum of the starting influent functions \(\Phi^* = \{\Phi_1, \ldots, \Phi_m\}\) and weights \(K = [k_1, \ldots, k_m]\), given by:

\[
I(K, \Phi^*) = \sum_{i=1}^{m} k_i \cdot \Phi_i
\]

In an embodiment, the component influent functions \(\Phi_i\) in \(\Phi^*\) may be divided by their magnitude

\[
|\Phi| = \sum_{i \in P} \Phi_i
\]

in order to satisfy the condition \(|\Phi| = 1\).

Assuming there are a number of starting influent functions of the form:

\[
\Phi(a) = w(a(s,a)) \ast \ldots \ast w(a(1,a)) \ast R(a)
\]

then the starting influent functions are merged using the above process to find:

\[
\Phi(a) = \sum_{i \in P} k_i \cdot \Phi_i(a)
\]

for all \(a\). Two approaches may be used to represent this in the form:

\[
w(u(j,a)) = \frac{\sum_{i \in P} k_i \cdot w(a(j,a))}{\sum_{i \in P} k_i}
\]

Further, \(R(a)\) is defined as:

\[
R(a) = \frac{\Phi(a)}{\sum_{i \in P} w(a(j,a))}
\]

\(\Phi(a)\) is then calculated as:

\[
\Phi(a) = w(a(s,a)) \ast \ldots \ast w(a(1,a)) \ast R(a)
\]

In a second approach, \(w(u(j,a))\) is defined as the weighted average by:

\[
w'(u(j,a)) = \frac{\sum_{i \in P} k_i \cdot w(a(j,a))}{\sum_{i \in P} k_i}
\]

Similarly, \(R'(a)\) is defined as:

\[
R'(a) = \frac{\sum_{i \in P} k_i \cdot R_i(a)}{\sum_{i \in P} k_i}
\]
Thereafter, V is defined as the space of solutions for \( \{ \Delta w(u(i, a), \Delta R(a) \} \) for \( \forall a \in \Lambda \) that satisfy the following equation:

\[
\begin{align*}
[w'(u(1, a)) + \Delta w(u(1, a))] &\equiv [w'(u(1, a)) + \Delta w(u(1, a))] \\
\vdots &\equiv [w'(u(1, a)) + \Delta w(u(1, a))] \\
[w'(u(S-1, a)) + \Delta w(u(S-1, a))] &\equiv [w'(u(S-1, a)) + \Delta w(u(S-1, a))] \\
\Phi(a) &\equiv \sum_{i=1}^{S} k_i \Phi_i(a)
\end{align*}
\]

with the condition that \( w(u(i, a)) = w(u(i, b)) \) if option a and option b belong to the same issue, and that the sum of the weights of issues in an issue set is 100%.

[0059] Thereafter, computational methods such as linear programming and numerical approximations are used to determine \( v \) in V such that:

\[
\sum_{i=1}^{S} |\Delta R_i(a)|
\]

is minimized. If there is more than one solution, then a random solution may be chosen or further computational methods may be used to choose \( v \) such that:

\[
\sum_{i=1}^{S} |\Delta w_i(u(i, a))|
\]

is minimized. If there is more than one solution, then a random solution may be chosen.

[0060] In an embodiment, a participant may vary a weight associated with the two or more influential functions based on a trust rank associated with each participant associated with the two or more influential functions or a trust rank associated with issues associated with the two or more influential functions. Moreover, the merging of the two or more influential functions may be based on different trust ranks corresponding to different issues, wherein the trust ranks are associated with the expertise of a participant for that issue. A trust rank associated with a participant may be determined as explained earlier.

[0061] In another embodiment, for the case when influential functions are created by ranking one or more of the plurality of options and the one or more issues based on one or more criteria, a participant may merge two or more such influential functions associated with one or more other participants based on a trust rank associated with each of the one or more other participants for the one or more criteria. Here, the trust rank may be based on a level of expertise associated with the one or more other participants for a criterion. For example, if John had previously created an influential function by ranking the one or more options associated with the issue “Gymnasium” based on a criterion “Environment”, Jim may use the influential function created by John along with one or more influential functions created by other participants with respect to the one or more options associated with “Gymnasium” based on the criterion “Environment” to be merged into an influential function for Jim associated with that criterion. Now, if John happens to be an environmental expert, then Jim may assign a higher trust rank to John for the criterion “Environment” such that a higher weightage is given for John’s views regarding environmental impact of the one or more options associated with a gymnasium. Similarly, Jim may assign different trust ranks to different other participants for various criteria with respect to different issues depending on the expertise of the different participants for the various criteria and various issues. In yet another embodiment, trust ranks may be recommended to a participant by considering not only the trust propagation factor and the trust decay factor but also the expertise of other participants related to one or more criteria.

[0062] In a further embodiment, a participant may create an influential function by using the one or more influential functions associated with the participant and one or more potential outcome of a plurality of potential outcomes. In this case, the participant may initially create one or more influential functions for a survey by one or more of ranking the plurality of options and the one or more issues, ranking the plurality of options and the one or more issues based on one or more criteria, modifying one or more existing influential functions, and merging two or more existing functions as explained above. Based on the one or more influential functions associated with the participant, the plurality of potential outcomes are ranked automatically. Here, each potential outcome associated with a survey corresponds to a particular combination of options and issues associated with that survey. The automatically ranked potential outcomes are presented to the participant. The participant may then provide ordinal ranks for one or more potential outcomes of the plurality of potential outcomes. For example, the participant may provide a rank ‘1’ to the top ranked potential outcome that was presented as a result of the automatic ranking of the potential outcomes if the participant agrees that the top ranked potential outcome is indeed his most preferred outcome. If the top ranked potential outcome is not the preferred outcome for the participant then the participant may choose a preferred outcome from the list of potential outcomes and assign that potential outcome a rank ‘1’. Similarly, the participant may assign a rank ‘2’, a rank ‘3’, etc, to potential outcomes in the automatically ranked potential outcomes to indicate his second preferred outcome, his third preferred outcome and so on. In other words, the participant may provide an ordinally ranked list for one or more of the potential outcomes.

[0063] If \( O_1, O_2, \ldots, O_n \) is the list of potential outcomes ranked by the participant, then for outcome \( O_j \) an equation can be generated as:

\[
l = \sum_{i \in O_1 \cap O_j} r_i
\]

where each \( r_i \) is some unknown variable in IR corresponding to the option \( a_i \) in \( O_j \).

[0064] For potential outcome \( O_2 \), an equation can be generated as:

\[
l - \Delta \sum_{i \in O_2} r_i
\]

where \( \Delta, > 0 \)

using some of the \( r_i \) from the equation for \( O_1 \) and some new ones from \( O_2 \).
If the participant provides a third preferred potential outcome \( O_3 \), then an equation for \( O_3 \) is given by:

\[
1 - \Delta_3 = \sum_{i = 0, i \neq 3}^{m} \eta_i
\]

where \( \Delta > \Delta_3 \).

This process of generating equations may be continued for how many ever potential outcomes the participant ranks. If the participant ranks \( n \) outcomes, then \( n \) simultaneous equations are generated.

\( O' \) is defined as the set of \( a \in \{O_1, O_2, \ldots, O_n\} \) if \( a \notin O \).

Since there are \( n-1 \) variables \( \Delta_0 \), there are \( n \) equations with \( n-1 \) variables. Further, there are \( n-1 \) inequalities of the form \( \Delta_{i+1} > 0 \) and \( \Delta_3 > \Delta_0 \). This gives a subset \( V \) of \( \mathbb{R}^{n-1} \) comprised of vectors \( \{r_0, r_1, \ldots, r_{n-1}, \Delta_1, \ldots, \Delta_{n-1}\} \) where \( r_0 = 0 \) if \( a \notin O' \). This represents the space of possible solutions to the \( n \) simultaneous equations.

If \( V \) is empty, then the list of ranks provided by the participant for the potential outcomes does not support creation of an influential function. In this case, the participant may be provided the option of eliminating the last ranked potential outcome on the list and trying again. This may be repeated until a non-empty \( V \) is obtained. If \( V \) is not empty, an influential function may be chosen from the influential functions in \( V \) by taking mid(\( r_2 \)) and mid(\( \Delta_0 \)) as the median value from the range of solutions for each variable and finding the vector \( V' = \{r'_0, r'_1, \ldots, r'_{n-2}, \Delta'_1, \ldots, \Delta'_{n-1}\} \) in \( V \) such that:

\[
\sum_{j \in V} \sum_{l \in V} |r'_l - r'_j| = \min_{V'} \sum_i \mid \text{mid}(\Delta_i) - \text{mid}(\Delta'_i) \mid
\]

is minimized and then a vector may be chosen randomly. Thereafter, an influential function is defined as \( \Phi' \), where \( \Phi'(a_i) = r'_i \).

In yet another embodiment, influential functions for a participant may be created using rules. Rules are ways of building influential functions using defined functions. These functions take characteristics and characteristic functions associated with the options and outcomes, as well as other influential functions, to create another influential function. For example, a rule-based influential function may represent a total cost of a date. The choices might be (a) which restaurant (b) which theatre and (c) what transportation in between. The cost of the date may depend on not just the restaurant or movie theatre, but also how much it will cost to travel in between if both a restaurant and a movie theatre are chosen. The cost to travel might in turn depend on the choice of transportation, which depends on which restaurant and theatre is chosen. Rules are ways of expressing more complicated relations which can be entered as formulas.

Rules can express inequalities or Boolean statements which can lead to different functions if satisfied or not satisfied. Rules can be defined by participants as well as administrators. Rules can be used to create influential functions from scratch, or modify an existing influential. For example, a participant may take a certain influential function as their starting point, but create a rule which zeros the support for any outcome in which the budget exceeds a certain spending threshold. It might also be used as a multiplier or power function which affects the total support for an outcome, based on certain characteristics.

In an embodiment, one or more influential functions associated with one or more participants of the plurality of participants may be included in a library of influential functions. Here, the one or more influential functions associated with a participant may include influential functions created by ranking options, by ranking options and issues, by ranking options and issues based on one or more criteria, by modifying one or more influential functions, by merging two or more influential functions, by using one or more starting influential functions associated with the participant and one or more potential outcomes of a plurality of potential outcomes, and by using rules. The library of influential functions may be accessed by a participant to select one or more starting influential functions and further perform operations such as modifying one or more starting influential functions, merging two or more starting influential functions, and using one or more starting influential functions and one or more potential outcomes to create an influential function, and creating an influential function by using rules. Thus, the library serves as a repository of influential functions and may continuously be populated over time with influential functions created by participants. These influential functions may then be presented to other participants as starting influential functions. Each survey of the one or more surveys may be associated with a library containing influential functions associated with that survey.

One or more influential functions associated with a participant are based on a participant profile associated with the participant. The participant profile for a participant is populated over time over the one or more surveys. Each participant of the plurality of participants may have a corresponding participant profile. A participant profile for a participant may include one or more of a final influential function associated with the participant for each survey, a satisfaction score associated with the participant for each survey, a dissonance score associated with the participant for each survey, an influential level of the participant for each survey, and a weight assigned by the participant to each survey. To begin with, at time \( t \), the participant profile for a participant may include an influential level associated with the participant for a decision \( D(t) \) and a weight or “impulse” assigned by the participant to the decision \( D(t) \).

The influential level associated with each survey is a weighing factor assigned to one or more influential functions that constitute a vote associated with the participant for that survey. In a democratic process, all participants may be considered equal and a weighing factor of 100% assigned to each participant. This indicates that all participants have an equal say or equal influence in deciding a collective outcome or collective decision. However, a democratic process that assigns all participants an equal influence towards a decision may not always be desirable or feasible. For example, in the case of a Parliament, there could be five political parties with 40%, 31%, 19%, 6% and 4% of popular support respectively. In this case, the political parties could be assigned influential levels of 40, 31, 19, 6 and 4 respectively. This means the political parties’ vote towards a collective decision is weighed by a factor 40%, 31%, 19%, 6% and 4% respectively. The influential level associated with a partici-
pant towards a decision may be assigned by one or more administrators or participants associated with the survey. The influent level of a participant \( x \) is referred to as \( 0(x) \). The influent level of a participant can also vary depending upon the time or decision, in which case we write \( 0(D(t), x) \) is the influent level for the decision at time \( t \). The influent level of a participant may vary depending on the outcome, for example the influent level for outcome \( O \) may be the percentage of options belonging to \( O \) for which participant \( x \) provided a rank. We refer to the influent level of participant \( x \) for outcome \( O \) as \( 0(O, x) \).

[0075] In addition to the influent level associated with a participant for a survey, the participant profile may also include a weight assigned by a participant for a survey. The weight assigned by a participant to a survey indicates a level of importance given by that participant for the survey. A participant can give a rank \( J(D(t), x) \) to a decision as a way of indicating its importance relative to other decisions in the series of decisions. The rank \( J(D(t), x) \) is called the impulse of \( x \) for \( D(t) \). In an embodiment the rank \( J(D(t), x) \) may lie between 0 and 1, both ends inclusive.

[0076] The impulse assigned by the participant to each survey of the one or more surveys may be used to determine a satisfaction or dissonance associated with the participant for one or more surveys as will be explained later.

[0077] At step 106, one or more of the one or more influent functions associated with each participant for each survey is aggregated across the plurality of participants to create a collective influent function for each survey. A participant may select the one or more of the one or more influent functions associated with the participant to form a final influent function. The final influent function developed by a participant corresponds to a “vote” of the participant. Here, a vote associated with a participant includes one or more influent functions created by the participant. The participant may create a number of influent functions but may select a subset to form a vote. A vote associated with a participant corresponds to an aggregation of the one or more influent functions selected by the participant. Aggregating the one or more influent functions selected by the participant creates a new influent function for the participant which corresponds to a vote of the participant towards a collective decision. The new influent function corresponding to the participant’s vote as well as the one or more influent functions created by the participant may be published by the participant for use by other participants.

[0078] All participants similarly create votes by aggregating one or more influent functions associated with them. The vote associated with each participant is aggregated across the plurality of participants to create a collective influent function. In other words, a final influent function associated with each participant of the plurality of participants is aggregated across the plurality of participants to create the collective influent function for each survey. Thus, every participant’s vote contributes towards the collective influent function for each survey.

[0079] The collective influent function for a survey takes into consideration one or more of a satisfaction score and a dissonance score associated with a plurality of potential outcomes for the survey. The satisfaction score represents a degree of satisfaction associated with each participant of the plurality of participants for each potential outcome of a plurality of potential outcomes associated the survey. Thus, for each potential outcome, a satisfaction score is calculated which indicates how satisfied each participant would be with that potential outcome. The collection of satisfaction scores for each outcome constitutes a participant’s vote. In other words, the satisfaction score is simply the final influent developed by the participant. The satisfaction score corresponds to the amount of intentional energy that a participant would put towards realizing that outcome. The satisfaction score \( Sat \) is expressed as a percentage of potential energy available.

[0080] In another embodiment, in order to determine a satisfaction score for each potential outcome for a participant, the plurality of potential outcomes may be automatically ranked in accordance with the final influent function developed by the participant. The participant may then manually rank one or more of the potential outcomes by providing a most preferred potential outcome, a second most preferred outcome and so on. In other words, the participant may provide a rank list for the one or more potential outcomes which indicates the participant’s preferred choices of potential outcomes relative to the other potential outcomes. In an embodiment, ranks for the potential outcomes may be recommended using the recommended rank for an option and the recommended rank for an issue as determined earlier. Further, the satisfaction score associated with a participant for a survey is saved in the participant profile of the participant to determine an influent level associated with the participant for a subsequent survey as explained later. Thus, as and when each survey of the one or more surveys is conducted, the participant profile of a participant is updated to include the satisfaction score for that survey.

[0081] If \( R(O, x) \) is the rank given by a participant \( x \) to a potential outcome \( O \) and corresponds to an influent function \( \varphi(O) \) in the unit form, that is, \( R(O, x) = \varphi(O) \) and \( ||\varphi|| = 1 \), then, \( Sat'(O, x) \) represents the satisfaction of participant \( x \) for outcome \( O \) and is expressed as:

\[
Sat'(O, x) = \frac{(R(O, x) - \text{Max}R(x)) \times (1 - 2\Delta)}{\text{Max}R(x) - \text{Min}R(x)} + \Delta
\]

where,

- \( \text{Max}R(x) = R(O, x) s.t. O \in O^s \) and \( R(O, x) \equiv R(O, y) \forall y \in P, x \neq y \), where \( \text{Max}R(x) \) corresponds to the greatest rank provided by participant \( x \) for any of the outcomes;
- \( \text{Min}R(x) = R(O, x) s.t. O \in O^s \) and \( R(O, x) \equiv R(O, y) \forall y \in P, x \neq y \), where \( \text{Min}R(x) \) corresponds to the smallest rank provided by participant \( x \) for any of the outcomes; and
- \( \Delta \) is some very small number eg. 0.0001. If \( \text{Max}R(x) = \text{Min}R(x) \) then \( Sat'(O, x) = 0.5 \) is taken.

[0082] If the satisfaction function is considered over the space of all possible outcomes, a way of applying equality and preventing strategic ranking is to require that the volume displaced by the satisfaction function be the same for all participants. A way of thinking about this is to imagine an automated bidding system, which helps each participant to place a price and bid on each potential outcome, where the amount of each bid is based on how much the participant values that outcome relative to the other outcomes. Normalizing the final influent function associated with each participant ensures the total amount bid by each participant over all the outcomes is the same, while preserving the relative rankings of the outcomes and ensuring that \( 0 < Sat(O, x) < 1 \) for all outcomes and all participants. \( Sat(O, x) \) defines the normalized satisfaction for a participant \( x \) and is given by: \( Sat(O, x) = Sat(O, x)^{0.5} \).
where \( P_X \) is the exponential modifier for each function that normalizes it to a constant volume while respecting the relative rankings of the outcomes and keeping the result between 0 and 1. \( P_X \) is determined by taking \( n = |O| \) and finding \( P_X \) for each \( x \) in \( P \) such that:

\[
\sum_{x \in O} S_A(t, x) = \frac{n}{2}
\]

Thus,

\[
\sum_{x \in O} S_A(O, x) = \sum_{x \in O} S_A(O, y) = \frac{n}{2} \quad \text{for all} \ x, y \in P
\]

which basically asserts that all participants start with the same amount to spend in the bidding process.

If we are considering the survey as a decision following a set of preceding decisions \( D' = \{ D(i) : D(j) \} \subseteq D \), we can define \( D(O) \) as \( D' \) ending with a decision to adopt outcome \( O \), for some potential outcome \( O \). If we are not considering previous decisions then we simply take \( D(O) = O \).

The preceding decisions \( D' \) might include all previous decisions, or a subset of previous decisions such as the most recent decisions. The preceding decisions \( D' \) may include some “blank” decisions \( D' \) where \( S_A(D', y) = S_A(D', x) \) and \( J(D', y) = J(D', x) \) for all participants \( x, y \) for decisions with few or no prior decisions. Then we can define a measure of how satisfied a participant \( x \) would be with the decision series \( D' \) that ends in decision to adopt outcome \( O \) as:

\[
S_A(D'(O), x) = \frac{\sum_{i \in D'} J(i, x) \times S_A(i, x)}{\sum_{i \in D'} J(i, x)}
\]

where \( J(D(i), x) \) is the impulse of the participant \( x \) on the decision \( D(i) \) and \( S_A(D(i), x) \) is the satisfaction of the participant \( x \) towards a decision \( D(i) \). Further, we can define the average satisfaction of the participants for the decisions as:

\[
\text{AvgSat}(D'(O)) = \frac{\sum_{x \in P} S_A(D'(O), x)}{p}
\]

where \( p \) is the number of participants.

For each potential outcome \( O \), we can take \( I(D'(O)) \) as the “collective satisfaction score” to represent the amount of influence behind a decision to adopt \( O \) by:

\[
I(D'(O)) = \frac{\sum_{x \in O} \theta(O, x) \times S_A(D'(O), x)}{\sum_{x \in O} \theta(O, x)}
\]

On determining the satisfaction score and influence level for each potential outcome for each participant, the dissonance score associated with a potential outcome may be determined based on one or more of a satisfaction score of the one or more participants, an average satisfaction score for each outcome, the greatest rank provided by a participant to an outcome, the impulse of the one or more participants on an outcome, an advantage quotient associated with each outcome, a disadvantage quotient associated with each outcome and the influent level of one or more participants.

In an embodiment, the dissonance score may be defined as a standard deviation of influents invested in a decision series to come up with an outcome \( O \). Therefore, the dissonance score of the outcome may be determined based on a satisfaction score of each participant for the decision series, an average satisfaction of the plurality of participants for a decision, and an average satisfaction of plurality of participants over the decision series. Based on the values calculated above, the dissonance score \( DS_x(D'(O)) \) of the outcome \( O \) is calculated by the following equation:

\[
DS_x(D'(O)) = \sqrt{\frac{\sum_{x \in O} \theta(O, x) \times S_A(D'(O), x) - \text{AvgSat}(D'(O))}{\sum_{x \in O} \theta(O, x)}}
\]

A collective influent function is defined for each outcome based on a relative weighting of the collective satisfaction scores and the dissonance scores. This relative weighting or “equality factor” may be determined by one or more of the administrators or participants, or it may be calculated based on assumptions about agreements between the parties. In an embodiment, the collective influent function is determined by making an assumption that none of the participants will support the most unfair outcome, even if they were to benefit. This can be thought of as a social contract. To determine the collective influent function based on this assumption, a satisfaction quotient and an inequality quotient may be defined. The satisfaction quotient \( \alpha \) is a linear factor that sets the value of the outcome which generates the most satisfaction at 1. \( \alpha \) is determined by taking \( O^* \) in \( O^* \) such that \( I(D'(O^*)) \) is maximum. Then, \( \alpha \) is taken such that \( \alpha \times I(D'(O^*)) = 1 \). \( \beta \) represents the inequality quotient. The inequality quotient is a linear factor that embodies the assumption that none of the parties will support the most unfair outcome. That is, no individual or collective effort shall be made for the outcome that is the most unequal. \( \beta \) is determined by taking \( O^* \) in \( O^* \) such that \( DS_x(D'(O^*)) \) is maximum. Then, \( \beta \) is taken such that:

\[
\alpha I(D'(O^*)) + \beta DS_x(D'(O^*))
\]

The collective influent function is the ratio of collective satisfaction to dissonance with the relative importance of the two factors determined by the satisfaction and inequality quotients. The collective influent function represents the optimized will of the plurality of participants and is given by:

\[
\varepsilon(D'(O)) = \alpha I(D'(O^*)) + \beta DS_x(D'(O^*))
\]

When one or more of the final influent functions include rankings based on a characteristic function \( c^* \) mapping an option or an outcome characteristic to a range within \( IR \), then \( c^* \) is a function mapping \( \{ \text{in}^n(i) \} \) to \( \{ \text{out}^n(i) \} \) where \( n \) is the number of such final influent functions. Extending this, if one or more of the final influent functions include rankings based on a set of characteristic functions \( [c^*, c^{*^2}, \ldots c^{*^m}] \) then \( c^* \) is a function mapping \( \{ c^*[\text{in}^n(i)] \cup \ldots \cup c^*[\text{out}^n(i)] \} \) to \( \{ c^*[\text{out}^n(i)] \} \) where \( m(i) \) is the number
of final influent functions that include rankings based on characteristic function $c^*_r$. Taking $c^*_r(O)$ is based on a set of characteristic functions $\{c^*_r\}$ for each outcome, the set of values in $\{c^*_r\}$ that maximize $c^*_r(O)$ is used to determine the final $c^*_r(O)$, and the specific values of the characteristics of that outcome. This may be done using computational methods such as linear programming and numerical approximations. This approach to determining $c^*_r(O)$ can also be used in the processes for calculating the collective influent functions below.

**[0090]** In another embodiment, the dissonance score may be determined as a resistance to inequality by a participant based on the resistance of the participant to satisfaction associated with one or more other participants. The one or more other participants may include one or more participants having a higher satisfaction score than the participant for an outcome and one or more participants having a lower satisfaction score than the participant for an outcome. The resistance of a participant for a decision may be determined based on the impulse of the participant for the decision and difference of satisfaction between the participant and one or more other participants.

**[0091]** In an embodiment, resistance of the participant to an outcome may also be determined based on difference in the satisfaction of the participant and one or more other participants, an advantage quotient and a disadvantage quotient. The resistance of the participant for an outcome may indicate resistance towards satisfaction of one or more other participants having higher satisfaction than the participant. The resistance of the participant for an outcome may also indicate the resistance towards satisfaction of one or more other participants having lower satisfaction than the participant.

**[0092]** Further, dissonance of the participant to an outcome in a decision series may be determined based on the influent functions of a participant towards a decision of the decision series, an impulse of the participant towards the decisions in the decision series, the influent level of the participant, and resistance of the participant to the decision series.

**[0093]** The resistance to a decision $O$ by a participant $x$ is determined by:

$$DS_x(D'(O), x) = \delta(x)Hi(D'(O), x) + \phi(x)Lo(D'(O), x)$$

where $\delta(x)$ is the advantage quotient, $\phi(x)$ is the disadvantage quotient, $Hi(D'(O), x)$ is a normalized difference between the satisfaction of the participant $x$ with one or more other participants having better satisfaction scores as compared to the participant $x$ for a decision $O$ and $Lo(D'(O), x)$ is a normalized difference between the participant $x$ and one or more other participants having lower satisfaction score than the participant $x$ for a decision $O$. $Hi(D'(O), x)$ is determined using the following equation:

$$Hi(D'(O), x) = \sum_{y \in Hi} Sat(D'(O), y) - Sat(D'(O), x)$$

where $Hi$ is the set of participants whose satisfaction score $Sat(D'(O), y)$ is higher than satisfaction score $Sat(D'(O), x)$ of the participant $x$.

Similarly $Lo(D'(O), x)$ is determined using the following equation:

$$Lo(D'(O), x) = \sum_{y \in Lo} Sat(D'(O), x) - Sat(D'(O), y)$$

where $Lo$ is the set of participants whose satisfaction score $Sat(D'(O), y)$ is lower than satisfaction score $Sat(D'(O), x)$ of the participant $x$.

**[0094]** The advantage quotient $\delta(x)$ and the disadvantage quotient $\phi(x)$ for a participant $x$ may be provided by one or more of one or more participants and one or more administrators. In an embodiment, $\delta(x)$ and $\phi(x)$ may be determined to be the same for all participants such that $\delta(x) = \delta(y)$ and $\phi(x) = \phi(y)$ for all $x$ and $y$. In another embodiment, $\delta$ and $\phi$ may be based on empirical studies. In a further embodiment, $\delta$ and $\phi$ may be determined by making one or more assumptions about agreements between the parties. Such assumed agreements might include:

Assumed Agreement I: No Participant Will Support the Most Unpopular Outcome.

**[0095]** Taking $O^*$ such that some calculation of collective satisfaction such as $I(D'(O^*))$ is at a minimum, then

$$Sat(D'(O^*), x) - \delta(x)Hi(D'(O^*), x) + \phi(x)Lo(D'(O^*), x)$$

for all $x$.

Assumed Agreement II: No Participant Will Support the Most Unfair Outcome.

**[0096]** Taking $O^*$ such that some calculation of dissonance such as $DS_x(D'(O^*))$ is at a maximum, then

$$Sat(D'(O^*), x) - \delta(x)Hi(D'(O^*), x) + \phi(x)Lo(D'(O^*), x)$$

for all $x$.

From equation (1) and equation (2), $\delta(x)$ and $\phi(x)$ may be calculated for each participant. In an embodiment, one or more of one or more participants and one or more administrators may provide a ratio for $\delta$ and $\phi$, and one of the assumed agreements may be used to calculate the value of $\delta$ and $\phi$.

**[0097]** Now, the resistance of the participant $x$ for a decision series $D'$ is determined as:

$$DS_x(D'(O)) = \frac{\sum_{x \in P} \theta(O, x) \cdot DS_x(D'(O), x)}{\sum_{x \in P} \theta(O, x)}$$

The dissonance score of an outcome $O$ is determined as:

$$DS_x(D'(O)) = \frac{\sum_{x \in P} \theta(O, x) \cdot DS_x(D'(O), x) - Avg[DS_x(D'(O))]}{\sum_{x \in P} \theta(O, x)}$$

where $\theta(O, x)$ is the influent level of the participant $x$ for an outcome $O$. In an embodiment, we can take $DS_x(D'(O))$ is the standard deviation of the $DS_x(D'(O), x)$ as per the first embodiment, that is:

$$DS_x(D'(O)) = \sqrt{\frac{\sum_{x \in P} \theta(O, x) \cdot DS_x(D'(O), x) - Avg[DS_x(D'(O))]}{\sum_{x \in P} \theta(O, x)}}$$
which is a measure of fairness in the distribution of unhappiness.

[0098] As in the preceding embodiment, a collective influence function may be defined for each outcome based on a relative weighting of the collective satisfaction and dissonance scores. We may also take \( \alpha \) as calculated in the preceding embodiment, and calculate a linear factor \( \beta_2 \) that embodies the assumed agreement that no collective effort shall be made for the outcome that is the most unequal. \( \beta_2 \) is determined by taking \( \varnothing \) in \( D'(O) \) s.t. \( DS_2(D'(O)) \) is maximum. Then \( \beta_2 \) is taken such that \( \alpha(D'(O)) = \beta_2 DS_2(D'(O)) \).

[0099] The collective influence function \( \varepsilon_2(O) \) is then calculated as:

\[
\varepsilon_2(O) = \alpha(D'(O)) - \beta_2 DS_2(D'(O))
\]

[0100] In another embodiment, the dissonance score may be determined as a deviation of satisfaction of a participant for an outcome, from the satisfaction of the participant for their ideal outcome. The ideal outcome is the outcome to which the participant has provided maximum rank. Therefore the dissonance score for an outcome may be determined based on the influence of one or more participants on the decision series, a rank \( R(O,x) \) of one or more participants, and a maximum rank \( MaxR(x) \) of one or more participants. The dissonance score \( DS_3(D'(O),x) \) for participant \( x \) may be determined by the following equation:

\[
DS_3(D'(O),x) = \sum_{i \in D'(O)} MaxR(i,x) - R(i,x)
\]

\[
DS_3(D'(O)) = \frac{\sum_{x \in D} \theta(O,x) * DS_3(D'(O),x)}{\sum_{x \in D} \theta(O,x)}
\]

where \( R(D(t),x) \) is as defined above for \( R(O,x) \) as the rank by the participant \( x \) for the final outcome \( O \) of the decision \( D(t) \) in the decision series \( D' \). Similarly, \( MaxR(D(t)) \) is defined as above for \( MaxR(x) \) as the maximum rank by a participant \( x \) for an outcome of the decision \( D(t) \) in the decision series \( D' \).

[0101] The relative weighting of \( 1(D'(O)) \) and \( DS_3(D'(O)) \) to define a collective influence function may be determined as above. Similarly, an inequality quotient \( \beta_3 \) may be determined by taking \( O \) in \( D \) such that \( DS_3(D'(O)) \) is maximum and then taking \( \beta_3 \) such that \( \alpha(D'(O)) = \beta_3 DS_3(D'(O)) \). These values may be used to calculate the collective influence function as:

\[
\varepsilon_3(O) = \alpha(D'(O)) - \beta_3 DS_3(D'(O))
\]

[0102] In yet another embodiment, the dissonance score of an outcome may be determined as the difference in satisfaction between one or more participants related to the outcome. The dissonance score may be determined based on one or more of the influent level of a participant, an influent level of one or more participants, the satisfaction score of the participant and the satisfaction score of the one or more other participants. For example, a dissonance score for an outcome \( O \) is determined by:

\[
DS_4(D'(O)) = \sum_{x \in D} \theta(O,x) * (S(O,x) - S(D'(O),x))
\]

[0103] The collective influence function may then be given by:

\[
\varepsilon_4(D'(O)) = \alpha(D'(O)) - \beta_4 DS_4(D'(O))
\]

[0104] On determining the collective influence function for each survey, the plurality of potential outcomes associated with each survey is evaluated based on the collective influential function at step 108. In an embodiment, the ranked outcomes may be processed further to determine shortlisted outcomes. The shortlisted outcomes are determined based on one or more of a threshold satisfaction score, a threshold dissonance score, a threshold equality factor and a threshold rank. One or more of the threshold satisfaction score, the threshold inequality score, the threshold equality factor and the threshold rank may be defined by the one or more participants. In an embodiment, the shortlisted outcomes may be determined by comparing one or more of the threshold values with the corresponding values associated with each outcome. The shortlisted outcomes may represent a set of possible outcomes. The shortlisted outcomes may then be ranked based on one or more criteria, for example the collective influence function. On ranking the potential outcomes or the shortlisted potential outcomes based on the collective influential function, the top ranked outcome may be selected as a final outcome, or a shortlist of the top ranked outcomes can be submitted for another decision-making process such as a direct vote.

[0105] In an embodiment, a confidence rating may be provided to one or more issues or one or more options based on the shortlisted outcomes. The shortlisted outcomes are further processed to identify a frequency of occurrence of one or more issues associated with the shortlisted outcomes. For example, in a survey assume that there are 10 shortlisted outcomes. Each shortlisted outcome is associated with one or more options and one or more issues. If 4 shortlisted outcomes are associated with an option \( a_1 \), and 3 shortlisted outcomes are associated with option \( a_2 \), the frequency of occurrence of \( a_1 \) is 4 and frequency of occurrence of \( a_2 \) is 3. Based on the frequency of occurrence of an issue or an option a confidence rating is provided for the issue or the option. The confidence rating represents higher confidence of the plurality of participants in the issue or the option for solving the problem.

[0106] Based on the final collective outcome associated with a survey, the influent level of each participant and the satisfaction score of each participant associated with the selected outcome, a revised influential level for each participant may be determined. In an embodiment, a function \( \theta(D(t),x) \) determining the influential level for \( x \) of different times may also be considered for determination of the revised influential level. The revised influential level represents the influence of the participant in the selection of the outcome. The revised influential level may be used in future surveys of the one or more surveys. The revised influential level for a participant is updated in the participant profile of the participant to be referred to when future surveys are conducted.

[0107] In an embodiment, the revised influential level for a participant is allocated in a future survey to compensate for satisfaction level achieved by the participant in a current survey due to selection of the final collective outcome. For
example, in a decision series for making a plurality of decisions, one or more participants may have achieved lower satisfaction as compared to one or more other participants. In such a scenario, the one or more participants who had a lower satisfaction are provided with revised increased influent levels to select a more satisfactory option in a subsequent decision. The revised influent level for a participant may be determined using the satisfaction of each participant associated with the chosen outcome, the maximum satisfaction of any participant for the chosen outcome, and the influent level of each participant.

[0108] In an exemplary embodiment, after choosing an outcome O for a decision D, based on a satisfaction score for each participant, the influent level of each participant is reduced from the starting influent level. For the participant x having a satisfaction score of Sat(D(O), x) for a chosen outcome O, the reduced influent level for the participant x is determined by:

\[ T_1(\theta(x)) = \frac{\theta(x) + \text{Sat}(D(O), x)}{\text{max}[\text{Sat}(D(O), y) \forall y]} \]

where, \( \theta(x) \) is the starting influent level of the participant x, \( \theta(O,x) \) is the influent level of the participant x for the outcome O, and \( \text{max}[\text{Sat}(D(O), y) \forall y] \) is the maximum satisfaction of one or more participants for the outcome O. \( T_1(\theta(x)) \) may be used as the starting influent levels for the participant x for a subsequent decision.

[0109] Recycled influent levels for the participant x may be determined as a function over time t. Therefore, the recycled influent levels for the participant x for O is determined by the following equation:

\[ T_2(T_1(\theta(x))) = T_1(\theta(x)) + \sum_{y \in O} \sum_{x \in O} \theta(y) \sum_{x \in O} T_1(\theta - y) \]

Thus starting influent levels for the participant x for the subsequent decision D(t+1) may be determined by:

\[ \theta(O,x) = T_2(T_1(\theta(O,x))) \]

[0110] FIG. 7 illustrates a block diagram of a system 700 for conducting one or more surveys in accordance with various embodiments of the invention. Each survey of the one or more surveys may be conducted at different instances of time to arrive at a collective outcome or collective decision for each survey. System 700 includes a presenting module 702, a receiving module 704, an aggregation module 706, and a ranking module 708. For conducting the one or more surveys, these modules work in conjunction with each other. Presenting module 702 is configured to present one or more of a plurality of options and one or more issues associated with each survey to the plurality of participants. Here, each issue of the one or more issues includes two or more options. Presenting module 702 may include a user interface through which the plurality of options and the one or more issues are displayed to the plurality of participants. An exemplary embodiment of a plurality of options and one or more issues presented to the plurality of participants is illustrated in FIG. 2. Further, presenting module 702 may be configured to present one or more potential outcomes associated with the one or more of the plurality of options and the one or more issues to the plurality of participants.

[0111] For a survey, different combinations of one or more options result in a plurality of potential outcomes. A potential outcome is a particular combination of the plurality of options. However, not all possible combinations of options may result in a useful potential outcome. Many combinations might result in impossible or impractical potential outcomes. In other words, many combinations may lead to non-actionable outcomes. In this regard, system 700 may include a shortlisting module 710 for eliminating one or more non-actionable outcomes from the plurality of potential outcomes associated with the survey. To eliminate the non-actionable outcomes, one or more of one or more participants and one or more administrators may specify one or more constraints or one or more rules. Constraints can be framed as Boolean logical relations between options and groups of options. Rules can be framed as mathematical or logical functions based on influence functions and characteristics associated with options or outcomes. Shortlisting module 710 analyses the plurality of potential outcomes associated with a survey based on the constraints or rules specified for that survey and eliminates any potential outcomes that are not actionable. The shortlisted potential outcomes may be presented to the plurality of participants by presenting module 702.

[0112] Once one or more of the plurality of options and the one or more issues associated with a survey are presented to the plurality of participants, each participant of the plurality of participants ranks one or more of the plurality of options and the one or more issues. Optionally, the plurality of participants may rank one or more of the plurality of options and the one or more issues based on one or more criteria. The plurality of options, the one or more issues and the one or more criteria may be defined by one or more of one or more participants and one or more administrators associated with the survey. Ranking the one or more of the plurality of options and the one or more issues is further explained in conjunction with FIG. 1.

[0113] Receiving module 704 receives the ranks provided by the plurality of participants for each survey to create one or more influential functions for each participant as explained in conjunction with FIG. 1. Further, in an embodiment, rankings for one or more options and one or more issues may be recommended to a participant from one or more other participants based on a trust rank assigned by the participant to the one or more other participants. A participant can give another participant more than one trust rank, depending on their expertise in different areas under consideration. For those participants to whom the participant has not assigned a trust rank, a trust rank may be established by considering a trust propagation factor and a trust decay factor as explained in conjunction with FIG. 1. In this case, system 700 may include a trust establishing module 712 to determine a trust rank for those participants for whom the participant has not directly assigned a trust rank. A trust rank may also be established by considering historical voting information.

[0114] In another embodiment, system 700 includes a modification module 714 to enable a participant to create one or more influential functions. Modification module 714 may be configured to present a plurality of influential functions created by one or more other participants associated with the survey to a participant. In other words, modification module 714 may present a plurality of existing influential functions created by one or more other participants to a participant. The participant may then select one or more existing influential functions and modify the one or more existing influential functions to create an
influent function as explained in conjunction with FIG. 1. In an embodiment, modification module may include a user interface to allow a participant to modify one or more influent functions. In an embodiment, modification module 714 may be configured to create one or more influent functions by modifying one or more influent functions using one or more rules. Here, rules can express inequalities or boolean statements which can lead to different functions if satisfied or not satisfied.

[0115] In another embodiment, system 700 may further include a merging module 716 configured to allow merging of two or more influent functions associated with a survey. Merging module 716 may include a user interface to allow a participant to select two or more existing influent functions for merging. The two or more influent functions may be associated with two or more other participants of the plurality of participants. In this case, the two or more influent functions may be considered as starting influent functions. Merging the two or more starting influent functions involves assigning a weight to each of the two or more influent functions and combining them to form a single influent function. Merging two or more influent functions to create a single influent is further explained in conjunction with FIG. 1. In an embodiment, merging module 716 is configured to create one or more influent functions by merging two or more influent functions using one or more rules.

[0116] In a further embodiment, system 700 may include an influent function generation module 718 for generating an influent function by using the one or more influent functions associated with the participant and one or more potential outcomes of a plurality of potential outcomes. In this case, the participant may initially create one or more influent functions for a survey by one or more of ranking the plurality of options and the one or more issues, ranking the plurality of options and the one or more issues based on one or more criteria, modifying one or more existing influent functions, and merging two or more existing functions as explained above. Based on the one or more influent functions associated with the participant, the plurality of potential outcomes are ordered automatically by an ordering module 720. Here, each potential outcome associated with a survey corresponds to a particular combination of options and issues associated with that survey. Ordering module 720 works in conjunction with presenting module 702 to present the ordered potential outcomes to the participant. The participant may then rank the one or more potential outcomes of the plurality of potential outcomes based on one or more preferences of the participant. In an embodiment, the participant may provide a rank list for one or more of the one or more potential outcomes by indicating a most preferred outcome, a second most preferred outcome and so on as explained in conjunction with FIG. 1. Receiving module 704 receives the one or more ranks provided for the one or more potential outcomes and works in conjunction with influent function generation module 718 to generate an influent function for the participant based on one or more of the initially created influent functions and the ranked outcomes.

[0117] One or more influent functions associated with a participant may be based on a participant profile associated with the participant. The participant profile for a participant is populated over time over the one or more surveys. Each participant of the plurality of participants may have a corresponding participant profile. A participant profile for a participant may include one or more of a final influent function associated with the participant for each survey, a satisfaction score associated with the participant for each survey, a dissonance score associated with the participant for each survey, an influent level of the participant for each survey, and a weight assigned by the participant to each survey. The participant profile associated with a participant is elaborated in detail in conjunction with FIG. 1.

[0118] On creating one or more influent functions associated with a participant, one or more of the one or more influent functions associated with each participant for each survey is aggregated by aggregation module 706 across the plurality of participants to create a collective influent function for each survey. A participant may select the one or more of the one or more influent functions associated with the participant to form a final influent function associated with the participant. The final influent function developed by a participant corresponds to a “vote” of the participant.

[0119] The collective influent function for a survey takes into consideration one or more of a satisfaction score and a dissonance score associated with a plurality of potential outcomes for the survey. To this end, aggregation module 706 includes one or more of a satisfaction determination module 722 for calculating a degree of satisfaction associated with each participant of the plurality of participants for each potential outcome of a plurality of potential outcomes associated with each survey of the plurality of surveys and a dissonance determination module 724 for calculating a measure of difference in satisfaction between the plurality of participants for each potential outcome of the plurality of potential outcomes associated with each survey. Satisfaction determination module 722 determines a satisfaction score for each participant that indicates how satisfied each participant would be with that potential outcome. In an embodiment, the satisfaction score and dissonance score associated with an outcome can be determined by considering the results of previous surveys and information associated with those surveys stored in the participant profile, including the weight given by the participant to those surveys.

[0120] In another embodiment, in order to determine a satisfaction score for each potential outcome for a participant, the plurality of potential outcomes may be automatically ordered by ordering module 720 in accordance with the final influent function developed by the participant. Presenting module 702 may then present the ordered potential outcomes to the participant. Thereafter, the participant may manually rank one or more of the potential outcomes by providing a most preferred potential outcome, a second most preferred outcome and so on. In other words, the participant may provide a rank list for the one or more potential outcomes which indicates the participant’s preferred choices of potential outcomes relative to the other potential outcomes. In an embodiment, ranks for the potential outcomes may be recommended using the recommended rank for an option and the recommended rank for an issue as determined earlier.

[0121] On determining the satisfaction score for each potential outcome for each participant, dissonance determination module 724 determines the dissonance score associated with a potential outcome based on one or more of a satisfaction score of the one or more participants, an average satisfaction score for each outcome, a maximum rank given by a participant to an outcome, the weight given by the one or more participants to an outcome, an advantage quotient asso-
associated with each outcome, a disadvantage quotient associated with each option and the influent level of one or more participants.

[0122] The dissonance score may also be based on one or more of a standard deviation of satisfaction for each potential outcome of the plurality of potential outcomes associated with each survey, a number of participants having a higher satisfaction score than a participant and a number of participants having a lower satisfaction score than the participant for each survey; difference in satisfaction between a preferred outcome of a participant for a survey and a final outcome for the survey, and sum of differences in satisfaction for a potential outcome associated with each survey across the plurality of participants. Calculating dissonance score is explained in detail in conjunction with FIG. 1.

[0123] On determining the collective influent function based on the satisfaction score and the dissonance score associated with each participant of the plurality of participants, ranking module 708 ranks the plurality of potential outcomes associated with each survey based on the collective influent function associated with each survey. In an embodiment, ranking module 708 may further process the ranked outcomes to determine shortlisted outcomes. The shortlisted outcomes are determined based on one or more of a threshold satisfaction score, a threshold dissonance score, a threshold equality factor and a threshold rank. One or more of the threshold satisfaction score, the threshold inequality score, the threshold equality factor and the threshold rank may be defined by the one or more participants. In an embodiment, the shortlisted outcomes may be determined by comparing one or more of the threshold values with the corresponding values associated with each outcome. The shortlisted outcomes may represent a set of possible outcomes. The shortlisted outcomes may then be ranked based on one or more criteria, for example the collective influent function. On ranking the potential outcomes or the shortlisted potential outcomes based on the collective influent function, the top ranked outcome may be selected as a final outcome or a shortlist of the top ranked outcomes can be submitted for another decision-making process such as a direct vote.

[0124] Based on the final collective outcome associated with a survey, the influent level of each participant and the satisfaction score of each participant associated with the selected outcome, a revised influent level for each participant may be determined. The revised influent level for a participant is allocated in a future survey to compensate for satisfaction level achieved by the participant in a current survey due to selection of the final collective outcome as explained in conjunction with FIG. 1.

[0125] Thus, the disclosed method and system enables one or more surveys to be conducted to identify a collective outcome for each survey by maximizing the satisfaction of a plurality of participants and minimizing dissonance of the plurality of participants. The satisfaction and dissonance of the participants are carried through from one survey to another to compensate a participant who had a relatively low satisfaction in one or more previous surveys.

[0126] Those skilled in the art will realize that the above recognized advantages and other advantages described herein are merely exemplary and are not meant to be a complete rendering of all of the advantages of the various embodiments of the invention.

1. A method of conducting at least one survey, each survey of the at least one survey comprising a plurality of options and at least one issue, wherein each option is associated with a characteristic, the method comprising:

- presenting the plurality of options and the at least one issue associated with each survey to a plurality of participants, wherein an issue of the at least one issue comprises two or more options;
- ranking at least one of the plurality of options and the at least one issue by the plurality of participants for each survey to create a plurality of influential functions for each survey, wherein the ranking is optionally based on at least one criterion, the plurality of influential functions comprises at least one influential function associated with each participant of the plurality of participants, wherein an influential function associated with a survey determines a score for each outcome of a plurality of potential outcomes associated with the survey, wherein an influential function associated with a participant is based on a participant profile of the participant of the plurality of participants;
- aggregating at least one of at least one influential function associated with each participant across the plurality of participants to create a collective influential function for each survey, wherein the collective influential function for each survey is based on at least one of a satisfaction score and a dissonance score, wherein the satisfaction score represents a degree of satisfaction associated with each participant of the plurality of participants for each potential outcome of a plurality of potential outcomes associated with each survey of the plurality of surveys, wherein the dissonance score represents a measure of difference in satisfaction between the plurality of participants for each potential outcome of the plurality of potential outcomes associated with each survey; and
- ranking the plurality of potential outcomes associated with each survey based on the collective influential function associated with each survey.

2. The method of claim 1 wherein the participant profile associated with each participant comprises at least one of a satisfaction score associated with each survey, a dissonance score associated with each survey, an influential level for each survey, and a weight assigned to each survey, wherein the influential level for each survey is a weighing factor assigned to the at least one influential function associated with a participant, wherein the weight assigned to each survey represents a relative importance of the survey to the participant.

3. The method of claim 1, wherein creating an influential function for a participant for a survey comprises modifying at least one influential function of the plurality of influential functions associated with the survey.

4. The method of claim 3, wherein modifying the at least one influential function comprises at least one of varying a rank of at least one option of the plurality of options associated with the at least one influential function, varying a rank of at least one issue of the at least one issue associated with the at least one influential function, and applying a rule to the at least one influential function.

5. The method of claim 1, wherein creating an influential function for a participant comprises generating an influential function using the at least one influential function associated with the participant and at least one potential outcome of the plurality of potential outcomes, wherein the at least one potential outcome of the plurality of potential outcomes is based on the at least one influential function associated with the
6. The method of claim 1, wherein creating an influent function for a participant for a survey comprises merging at least two influent functions of the plurality of influent functions associated with the survey by the participant by varying a weight associated with each of the at least two influent functions.

7. The method of claim 6, wherein varying a weight associated with each of the at least two influent functions is based on a trust rank associated with each participant of at least one participant associated with the at least two influent functions.

8. The method of claim 1, wherein at least one of the at least one survey, the plurality of options, the at least one issue, and the at least one criterion is defined by at least one of at least one of the plurality of participants and at least one administrator.

9. The method of claim 1, wherein ranking at least one of the plurality of options and the at least one issue associated with a survey comprises providing at least one of a numerical score, a percentage weight, and a function over a numeric range associated with a characteristic associated with an option or an outcome.

10. The method of claim 1, wherein each survey of the at least one survey is conducted at a different instance of time.

11. The method of claim 1 further comprising eliminating at least one non-actionable outcome from the plurality of potential outcomes for each survey based on at least one rule defined by at least one of at least one of the plurality of participants and at least one administrator.

12. The method of claim 1 further comprising ordering the plurality of potential outcomes associated with each survey for each participant of the plurality of participants based on the at least one of the at least one influent function associated with each participant for each survey.

13. The method of claim 1, wherein the dissonance score is based on at least one of:

   a standard deviation of satisfaction for each potential outcome of the plurality of potential outcomes associated with each survey;

   a number of participants having a higher satisfaction score than a participant and a number of participants having a lower satisfaction score than the participant for each survey;

   a difference in satisfaction between a preferred outcome of a participant for a survey and a final outcome for the survey; and

   a sum of differences in satisfaction for a potential outcome associated with each survey across the plurality of participants.

14. A system for conducting at least one survey, each survey of the at least one survey comprising a plurality of options and at least one issue, wherein each option is associated with a characteristic, comprising:

   a presenting module for presenting the plurality of options and the at least one issue associated with each survey to a plurality of participants, wherein an issue of the at least one issue comprises two or more options;

   a receiving module for receiving ranks for at least one of the plurality of options and the at least one issue by the plurality of participants for each survey to create a plurality of influent functions for each survey, wherein the ranking is optionally based on at least one criterion, the plurality of influent functions comprises at least one influent function associated with each participant of the plurality of participants, wherein an influent function associated with a survey determines a score for each outcome of a plurality of potential outcomes associated with the survey, wherein an influent function associated with a participant is based on a participant profile of the participant of the plurality of participants;

   an aggregation module for aggregating at least one of the at least one influent function associated with each participant across the plurality of participants to create a collective influent function for each survey, wherein the collective influent function for each survey is based on at least one of a satisfaction score and a dissonance score, the aggregation module comprising at least one of:

   a satisfaction determination module for calculating a degree of satisfaction associated with each participant of the plurality of participants for each potential outcome of a plurality of potential outcomes associated with each survey of the plurality of surveys; and

   a dissonance determination module for calculating a measure of difference in satisfaction between the plurality of participants for each potential outcome of the plurality of potential outcomes associated with each survey;

   a ranking module for ranking the plurality of potential outcomes associated with each survey based on the collective influent function associated with each survey to create a collective ranking of potential outcomes for each survey.

15. The system of claim 14, wherein the participant profile associated with each participant comprises at least one of a satisfaction score associated with each survey, a dissonance score associated with each survey, an influent level for each survey, and a weight assigned to each survey, wherein the influent level for each survey is a weighing factor assigned to the at least one influent function associated with a participant, wherein the weight assigned to each survey represents a relative importance of the survey to the participant.

16. The system of claim 14 further comprising a modification module configured to allow modifying at least one influent function of the plurality of influent functions associated with each survey, wherein modifying the at least one influent function associated with each survey by a participant creates at least one influent function for the participant for each survey.

17. The system of claim 16, wherein modifying the at least one influent function comprises at least one of varying a rank of at least one option of the plurality of options associated with the at least one influent function, varying a rank of at least one issue of the at least one issue associated with the at least one influent function, and applying a rule to the at least one influent function.

18. The system of claim 14 further comprising an influent function generation module for generating an influent function using the at least one influent function associated with the participant and at least one potential outcome of the plurality of potential outcomes, wherein the at least one potential outcome of the plurality of potential outcomes is based on the at least one influent function associated with the participant, wherein each outcome of the plurality of outcomes is associated with a characteristic.

19. The system of claim 14 further comprising a trust establishing module for establishing trust ranks among the plurality of participants.
20. The system of claim 19 further comprising a merging module configured to allow merging at least two influent functions of the plurality of influent functions associated with a survey, wherein merging the at least two influent functions by a participant creates an influent function for the participant for the survey, wherein merging the at least two influent functions comprises varying a weight associated with each of the at least two influent functions, wherein varying a weight associated with each of the at least two influent functions is based on a trust rank associated with each participant of at least one participant associated with the at least two influent functions.

21. The system of claim 14 further comprising a shortlisting module for eliminating at least one non-actionable outcome from the plurality of potential outcomes for each survey based on at least one rule defined by at least one of at least one of the plurality of participants and at least one administrator.

22. The system of claim 14 further comprising an ordering module for ordering the plurality of potential outcomes associated with each survey for each participant of the plurality of participants based on the at least one of the at least one influent function associated with each participant for each survey.

23. The system of claim 14, wherein the a dissonance score calculation module calculates a dissonance score based on at least one of:

- a standard deviation of satisfaction for each potential outcome of the plurality of potential outcomes associated with each survey;
- a number of participants having a higher satisfaction score than a participant and a number of participants having a lower satisfaction score than the participant for each survey;
- difference in satisfaction between a preferred outcome of a participant for a survey and a final outcome for the survey; and
- sum of differences in satisfaction for a potential outcome associated with each survey across the plurality of participants.