when multiple suppliers, retailers, and products are involved in the replenishment process, and the existing solutions are not able to solve large scale problems within a short period of time or not able to obtain solutions with good enough quality for various applications. Additionally, most of the existing solutions are restricted to very specific use cases and cannot address different requirements imposed by the users in various business contexts. In other words, they are not flexible enough in terms of problem modelling and solution design.

[0005] There is thus a need to devise a novel method and apparatus for selecting an optimal set of distribution channels to distribute one or more products from a plurality of suppliers to a plurality of buyers, more particularly, to improve operational efficiency, optimize supply chain cost, and achieve a balance between cost reduction and service improvement for the distribution of the products and replenishment decisions while addressing the pain points of the above existing solutions.

[0006] Furthermore, other desirable features and characteristics will become apparent from the subsequent detailed description and the appended claims, taken in conjunction with the accompanying drawings and this background of the disclosure.

Summary

[0007] In a first aspect, the present disclosure provides a method selecting an optimal set of distribution channels to distribute one or more products from a plurality of suppliers to a plurality of buyers, comprising: calculating, by a processor of an apparatus, a distribution cost of each set of distribution channels of a plurality of sets of distribution channels to distribute the one or more products from the plurality of suppliers to the plurality of buyers, wherein at least one of the plurality of suppliers is set to distribute at least one of the one or more products to each of the plurality of buyers in the each set of distribution channels of the plurality of sets of distribution channels; adjusting, by the processor, the distribution cost of the each set of distribution channels of the plurality of sets of distribution channels based on one or more constraints, each of the one or more constraints limiting a selection of a distribution channel for distributing one of the one or more products from one of the plurality of suppliers to one of the plurality of buyers; detecting, by the processor, a processing time for calculating and adjusting the distribution costs of the plurality of sets of distribution channels has exceeded a

first pre-configured processing time limit, wherein a set of distribution channels having a lowest distribution cost among the plurality of sets of distribution channels is selected as the optimal set of distribution channels to distribute the one or more products from the plurality of suppliers to the plurality of buyers after the detection; determining, by the processor, if the processing time for calculating and adjusting the distribution costs of the plurality of sets of distribution channels has exceeded a second pre-configured processing time limit, in response to a result of the determination: calculating, by the processor, a further distribution cost of the each set of distribution channels of the plurality of sets of distribution channels to distribute the one or more products from the plurality of suppliers to the plurality of buyers; and adjusting, by the processor, the further distribution cost of the each set of distribution channels of the plurality of sets of distribution channels based on one or more constraints, each of the one or more constraints limiting a selection of a distribution channel for distributing one of the one or more products from one of the plurality of suppliers to one of the plurality of buyers, wherein a set of distribution channels having a lowest further distribution cost among the plurality of sets of distribution channels is selected as the optimal set of distribution channels to distribute the one or more products from the plurality of suppliers to the plurality of buyers.

[0008] In a second aspect, the present disclosure provides a system for selecting an optimal set of distribution channels to distribute one or more products from a plurality of suppliers to a plurality of buyers, comprising: at least one processor; and at least one memory including computer program code; the at least one memory and the computer program code configured to, with at least one processor, cause the server at least to, comprising: calculate a distribution cost of each set of distribution channels of a plurality of sets of distribution channels to distribute the one or more products from the plurality of suppliers to the plurality of buyers, wherein at least one of the plurality of suppliers is set to distribute at least one of the one or more products to each of the plurality of buyers in the each set of distribution channels of the plurality of sets of distribution channels; adjust the distribution cost of the each set of distribution channels of the plurality of sets of distribution channels based on one or more constraints, each of the one or more constraints limiting a selection of a distribution channel for distributing one of the one or more products from one of the plurality of suppliers to one of the plurality of buyers; detect, a processing time for calculating and adjusting the distribution costs of the plurality of sets of distribution channels has exceeded a first pre-configured processing time limit, wherein a set of distribution channels having a lowest distribution cost among the plurality of sets of distribution channels is selected as the optimal set of distribution channels to distribute the one or more products from the plurality of suppliers to the plurality of buyers after the detection; determine if the processing time for calculating and adjusting the distribution costs of the plurality of sets of distribution channels has exceeded a second pre-configured processing time limit; calculate a further distribution cost of the each set of distribution channels of the plurality of sets of distribution channels to distribute the one or more products from the plurality of suppliers to the plurality of buyers; and adjust the further distribution cost of the each set of distribution channels of the plurality of sets of distribution channels based on one or more constraints, each of the one or more constraints limiting a selection of a distribution channel for distributing one of the one or more products from one of the plurality of suppliers to one of the plurality of buyers, wherein a set of distribution channels having a lowest further distribution cost among the plurality of sets of distribution channels is selected as the optimal set of distribution channels to distribute the one or more products from the plurality of suppliers to the plurality of buyers.

[0009] Additional benefits and advantages of the disclosed embodiments will become apparent from the specification and drawings. The benefits and/or advantages may be individually obtained by the various embodiments and features of the specification and drawings, which need not all be provided in order to obtain one or more of such benefits and/or advantages.

Brief Description of the Drawings

[0010] Embodiments and implementations are provided by way of example only, and will be better understood and readily apparent to one of ordinary skill in the art from the following written description, read in conjunction with the drawings, in which:

[0011] Figure 1 depicts a schematic diagram illustrating distribution channels between suppliers and buyers in a centralized delivery network and a decentralized distribution network.

[0012] Figure 2 shows a block diagram illustrating a system for selecting an optimal set of distribution channels to distribute one or more products from a plurality of supplier to a plurality of buyers according to various embodiments of the present disclosure.

CLAIMS

1. A method for selecting an optimal set of distribution channels to distribute one or more products from a plurality of suppliers to a plurality of buyers, comprising:

calculating, by a processor of an apparatus, a distribution cost of each set of distribution channels of a plurality of sets of distribution channels to distribute the one or more products from the plurality of suppliers to the plurality of buyers, wherein at least one of the plurality of suppliers is set to distribute at least one of the one or more products to each of the plurality of buyers in the each set of distribution channels of the plurality of sets of distribution channels;

adjusting, by the processor, the distribution cost of the each set of distribution channels of the plurality of sets of distribution channels based on one or more constraints, each of the one or more constraints limiting a selection of a distribution channel for distributing one of the one or more products from one of the plurality of suppliers to one of the plurality of buyers;

detecting, by the processor, a processing time for calculating and adjusting the distribution costs of the plurality of sets of distribution channels has exceeded a first pre-configured processing time limit, wherein a set of distribution channels having a lowest distribution cost among the plurality of sets of distribution channels is selected as the optimal set of distribution channels to distribute the one or more products from the plurality of suppliers to the plurality of buyers after the detection;

determining, by the processor, if the processing time for calculating and adjusting the distribution costs of the plurality of sets of distribution channels has exceeded a second pre-configured processing time limit,

in response to a result of the determination:

calculating, by the processor, a further distribution cost of the each set of distribution channels of the plurality of sets of distribution channels to distribute the one or more products from the plurality of suppliers to the plurality of buyers; and

adjusting, by the processor, the further distribution cost of the each set of distribution channels of the plurality of sets of distribution channels based on one or more constraints, each of the one or more constraints limiting a selection of a distribution channel for distributing one of the one or more products from one of the plurality of suppliers to one of the plurality of buyers, wherein a set of distribution channels having a lowest further distribution cost among the plurality of sets of distribution channels is selected as the optimal

set of distribution channels to distribute the one or more products from the plurality of suppliers to the plurality of buyers.

2. The method of claim 1, further comprising:

forming, by the processor, a set of data relating to the one or more products, the plurality of buyers and/or the plurality of suppliers received from a data input, wherein the calculation of the distribution cost to distribute the one or more products from the plurality of suppliers to the plurality of buyers is based on the set of data.

3. The method of claim 2, wherein the step of adjusting the distribution cost of the each set of distribution channels of the plurality of sets of distribution channels comprises:

modifying, by the processor, the set of data relating to at least one of the one or more products, at least one of the plurality of buyers and/or at least one of the plurality of suppliers based on the one or more constraints; and

calculating, by the processor, the distribution cost of the each of the set of distribution channels of the plurality of sets of distribution channels based on the modified set of data.

4. The method of claim 1, further comprising:

determining, by the processor, if a distribution channel of the each set of distribution channels is a distribution channel which selection is limited by the one or more constraints, and the adjustment is carried in response to a result of the determination.

5. The method of claim 2, wherein the step of calculating the distribution cost of the each set of distribution channels of the plurality of sets of distribution channels comprises:

calculating, by the processor, a second distribution cost of each second set of distribution channels of a plurality of second sets of distribution channels to distribute the one or more products from the plurality of suppliers to the plurality of buyers based on a different set of data formed by the data input relating to the one or more products, the plurality of buyers and/or the plurality of suppliers, wherein a set of distribution channels having a lowest distribution cost among the plurality of set of distribution channels and the

plurality of second sets of distribution channels is selected as the optimal set of distribution channels.

6. The method of claim 5, further comprising:

adjusting, by the processor, the second distribution cost based on the one or more constraints.

7. The method of claim 1, wherein the second pre-configured processing time limit is configured such that two or more iterations of the calculation and the adjustment of the further distribution costs of the plurality of sets of distribution channels can be carried out.

8. The method of any one of claims 2-7, further comprising:

receiving, by the processor, data relating to at least one of a product quantity, a distribution cost of a buyer/supplier, a location, a required delivery time, a distance and a reliability level of a buyer/supplier and a weight parameter to be applied to the data as the data input.

9. The method of claim 8, wherein the step of forming the set of data relating to the one or more products, the plurality of buyers and/or the plurality of suppliers comprises:

detecting, by the processor, data relating to a human input error or a false measurement from the data input; and

filtering out, by the processor, the data relating the human input error or the false measurement from the data input; wherein the set of data is formed from the filtered data input.

10. The method of claim 8, further comprising:

detecting, by the processor, missing data in the data input relating to the at least one of the product quantity, the distribution cost of the buyer/supplier, the location, the required delivery time, the distance, the reliability level of a buyer/supplier and the weight parameter to be applied to the data input; and

inserting, by the processor, new data to replace the missing data in the data input, wherein the new data is a pre-set data or a median of existing data in the data input.

11. The method of any one of claims 1-10, wherein the one or more constraints comprises a constraint relating to a mode to distribute one of the one or more products, a constraint to have the one or more products of one of the plurality of buyers distributed by only one of the plurality of suppliers, a constraint relating to an availability of a one of the plurality of suppliers, a constraint relating to a minimum order requirement of one of the plurality of suppliers, a constraint relating to a delivery capacity of one of the plurality of suppliers.

12. An apparatus for selecting an optimal set of distribution channels to distribute one or more products from a plurality of suppliers to a plurality of buyers, comprising:

at least one processor; and

at least one memory including computer program code;

the at least one memory and the computer program code configured to, with at least one processor, cause the server at least to, comprising:

calculate a distribution cost of each set of distribution channels of a plurality of sets of distribution channels to distribute the one or more products from the plurality of suppliers to the plurality of buyers, wherein at least one of the plurality of suppliers is set to distribute at least one of the one or more products to each of the plurality of buyers in the each set of distribution channels of the plurality of sets of distribution channels;

adjust the distribution cost of the each set of distribution channels of the plurality of sets of distribution channels based on one or more constraints, each of the one or more constraints limiting a selection of a distribution channel for distributing one of the one or more products from one of the plurality of suppliers to one of the plurality of buyers;

detect a processing time for calculating and adjusting the distribution costs of the plurality of sets of distribution channels has exceeded a first pre-configured processing time limit, wherein a set of distribution channels having a lowest distribution cost among the plurality of sets of distribution channels is selected as the

optimal set of distribution channels to distribute the one or more products from the plurality of suppliers to the plurality of buyers after the detection;

determine if the processing time for calculating and adjusting the distribution costs of the plurality of sets of distribution channels has exceeded a second pre-configured processing time limit;

calculate a further distribution cost of the each set of distribution channels of the plurality of sets of distribution channels to distribute the one or more products from the plurality of suppliers to the plurality of buyers; and

adjust the further distribution cost of the each set of distribution channels of the plurality of sets of distribution channels based on one or more constraints, each of the one or more constraints limiting a selection of a distribution channel for distributing one of the one or more products from one of the plurality of suppliers to one of the plurality of buyers, wherein a set of distribution channels having a lowest further distribution cost among the plurality of sets of distribution channels is selected as the optimal set of distribution channels to distribute the one or more products from the plurality of suppliers to the plurality of buyers.

13. The apparatus of claim 12, wherein the at least one memory and the computer program code configured to, with the at least one processor, cause the server at least to, further:

form a set of data relating to the one or more products, the plurality of buyers and/or the plurality of suppliers received from a data input, wherein the calculation of the distribution cost to distribute the one or more products from the plurality of suppliers to the plurality of buyers is based on the set of data.

14. The apparatus of claim 13, wherein the at least one memory and the computer program code configured to, with the at least one processor, cause the server at least to, further:

modify the set of data relating to at least one of the one or more products, at least one of the plurality of buyers and/or at least one of the plurality of suppliers based on the one or more constraints; and

calculate the distribution cost of the each of the set of distribution channels of the plurality of sets of distribution channels based on the modified set of data.

15. The apparatus of claim 12, wherein the at least one memory and the computer program code configured to, with the at least one processor, cause the server at least to, further:

determine if a distribution channel of the each set of distribution channels is a distribution channel which selection is limited by the one or more constraints, and the adjustment is carried in response to a result of the determination.

16. The apparatus of claim 13, wherein the at least one memory and the computer program code configured to, with the at least one processor, cause the server at least to, further:

calculate a second distribution cost of each second set of distribution channels of a plurality of second sets of distribution channels to distribute the one or more products from the plurality of suppliers to the plurality of buyers based on a different set of data formed by the data input relating to the one or more products, the plurality of buyers and/or the plurality of suppliers, wherein a set of distribution channels having a lowest distribution cost among the plurality of set of distribution channels and the plurality of second sets of distribution channels is selected as the optimal set of distribution channels.

17. The apparatus of claim 16, wherein the at least one memory and the computer program code configured to, with the at least one processor, cause the server at least to, further:

adjust the second distribution cost based on the one or more constraints.

18. The apparatus of claims 12-17, wherein the second pre-configured processing time limit is configured such that two or more iterations of the calculation and the adjustment of the second distribution costs of the plurality of sets of distribution channels can be carried out.

19. The apparatus of any one of claims 13-18, wherein the at least one memory and the computer program code configured to, with the at least one processor, cause the server at least to, further:

receive data relating to at least one of a product quantity, a distribution cost of a buyer/supplier, a location, a required delivery time, a distance and a reliability level of a buyer/supplier and a weight parameter to be applied to the data as the data input.

20. The apparatus of claim 19, wherein the at least one memory and the computer program code configured to, with the at least one processor, cause the server at least to:

detect data relating to a human input error or a false measurement from the data input; and

filter out the data relating the human input error or the false measurement from the data input; and

form the set of data relating to the one or more products, the plurality of buyers and/or the plurality of suppliers from the filtered data input.

21. The apparatus of claim 19, wherein the at least one memory and the computer program code configured to, with the at least one processor, cause the server at least to, further:

detect missing data in the data input relating to the at least one of the product quantity, the distribution cost of the buyer/supplier, the location, the required delivery time, the distance, the reliability level of a buyer/supplier and the weight parameter to be applied to the data input; and

insert new data to replace the missing data in the data input, wherein the new data is a pre-set data or a median of existing data in the data input.

22. The apparatus of any one of claims 12-19, wherein the one or more constraints comprises a constraint relating to a mode to distribute one of the one or more products, a constraint to have the one or more products of one of the plurality of buyers distributed by only one of the plurality of suppliers, a constraint relating to an availability of a one of the plurality of suppliers, a constraint relating to a minimum order requirement of one of the

plurality of suppliers, a constraint relating to a delivery capacity of one of the plurality of suppliers.