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Information management system and information management method

Abstract

When information on a chemical substance is disclosed by a node of an upstream company (S**11**), a controller updates product composition data (S**12**) and determines whether or not the disclosed information on the chemical substance is to be kept secret (S**13**). When the controller determines that the disclosed information on the chemical substance does not have to be kept secret (NO in S**13**), it adds the information on the chemical substance (a restricted substance) received in S**11** to update public data (S**17**) and generates transaction data including the public data and transmits the transaction data to a node of a target downstream company (S**18**).

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS
(1) This nonprovisional application is based on Japanese Patent Application No. 2022-122487 filed with the Japan Patent Office on Aug. 1, 2022, the entire contents of which are hereby incorporated by reference.
BACKGROUND
Field
(2) The present disclosure relates to an information management system that manages information based on distributed ledger technology and an information management method of managing information based on distributed ledger technology.
Description of the Background Art
(3) Japanese Patent Laying-Open No. 2009-70257 discloses an information management system that manages information on a chemical substance contained in a component traded in a supply chain including an end product manufacturer and a supplier that supplies a component to the end product manufacturer. This information management system is connected to a supplier terminal used by the supplier and another supplier terminal used by another supplier over a network.

Another supplier supplies the supplier with a sub component included in a component delivered by the supplier to the end product manufacturer. The supplier requests another supplier to disclose information on a chemical substance contained in the sub component for reporting information on the chemical substance contained in the component to the end product manufacturer.

SUMMARY

(4) In a supply chain, information on a chemical substance contained in a distributed product, in particular, a chemical substance to be restricted by laws and regulations etc., may be disclosed from an upstream company to a midstream company and from the midstream company to a downstream company. For each company, however, information on a chemical substance contained in its product is important, and there is a demand for avoidance of disclosure as much as possible. Therefore, each company may keep information on the chemical substance contained in its product secret from a downstream company, instead of voluntarily disclosing the information.

(5) For disclosure of secret information, a plurality of types of processing are performed in each company. For example, in a midstream company, processing for requesting an upstream company to disclose secret information, processing for approving therein, disclosure of the information disclosed by the upstream company to a downstream company, or the like may be performed. Such processing is normally humanly performed by a person in charge of the processing or the like and hence much cost and many man-hours are required. Then, construction of a scheme that facilitates distribution of information in a supply chain has been desired.

(6) The present disclosure was made to solve the problem above, and an object of the present disclosure is to provide a scheme that facilitates distribution of information in a supply chain. (1) An information management system according to one aspect of the present disclosure manages information on a chemical substance contained in a product distributed in a supply chain based on distributed ledger technology. The information management system includes a first apparatus that belongs to a first company that manufactures a first product, the first apparatus including a first distributed ledger, a second apparatus that belongs to a second company that supplies a second product to be included in the first product to the first company, the second apparatus including a second distributed ledger, a third apparatus that belongs to a third company that supplies a third product to be included in the second product to the second company, the third apparatus including a third distributed ledger, and a management apparatus that manages the information management system, the management apparatus including a fourth distributed ledger. Each of the first distributed ledger, the second distributed ledger, the third distributed ledger, and the fourth distributed ledger includes a list showing the chemical substance managed in the information management system. Composition data of the second product including composition data of the third product disclosed by the third apparatus is stored in the second apparatus. The management apparatus adds, when the management apparatus designates a new chemical substance to be managed in the information management system, the new chemical substance to the list in the fourth distributed ledger to update the list in the fourth distributed ledger, and transmits first transaction data that proposes addition of the new chemical substance to the corresponding list to update the corresponding list to the first apparatus, the second apparatus, and the third apparatus. The first apparatus, the second apparatus, and the third apparatus update the list in the first distributed ledger, the list in the second distributed ledger, and the list in the third distributed ledger based on the first transaction data from the management apparatus, respectively. When the new chemical substance is contained in composition of the third product, the third apparatus transmits second transaction data including the composition data of the third product including information on the new chemical substance to the second apparatus. The second apparatus updates the composition data of the third product included in the composition data of the second product based on the second transaction data from the third apparatus to update the composition data of the second product, and transmits, when the second apparatus has determined to publish the composition data of the third product included in the composition data of the second product, third

transaction data including the updated composition data of the second product to the first apparatus.

(7) According to the configuration, when the second apparatus receives from the third apparatus, the second transaction data including the composition data of the third product including the information on the new chemical substance, the second apparatus updates the composition data of the third product included in the composition data of the second product based on the second transaction data from the third apparatus to update the composition data of the second product. When the second apparatus has determined to publish the composition data of the third product included in the composition data of the second product, the second apparatus transmits to the first apparatus, the third transaction data including the updated composition data of the second product. In other words, when the second apparatus has determined to publish the composition data of the third product included in the composition data of the second product at the time of disclosure of the composition data of the third product including the information on the new chemical substance to the second apparatus by the third apparatus, the second apparatus discloses the updated composition data of the second product to the first apparatus. Therefore, when decision to publish the composition data of the third product included in the composition data of the second product has been made, the updated composition data of the second product can be disclosed to the first apparatus without the need for additional processing or the like. Therefore, information can readily be distributed in the supply chain. (2) In one embodiment, when the second apparatus has not determined to publish the composition data of the third product included in the composition data of the second product, the second apparatus performs first processing for publication of the information on the new chemical substance and transmits the third transaction data including the information on the new chemical substance to the first apparatus based on approval obtained in the first processing.

(8) According to the configuration, when decision to publish the composition data of the third product included in the composition data of the second product has not been made, the information on the new chemical substance is disclosed based on approval obtained in the first processing. Therefore, disclosure of unnecessary information due to a system error or the like can be suppressed. (3) In one embodiment, the second distributed ledger includes a first secret area where transaction data not shared with the first distributed ledger, the third distributed ledger, and the fourth distributed ledger is stored and a first public area where transaction data shared with at least one of the first distributed ledger, the third distributed ledger, and the fourth distributed ledger is stored. In the second apparatus, the composition data of the second product is stored in the first secret area and first public data is stored in the first public area, the first public data being data to be disclosed to the first company, of the composition data of the second product. The second apparatus adds information on the new chemical substance to the composition data of the third product included in the composition data of the second product stored in the first secret area based on the second transaction data from the third apparatus, the second transaction data including the composition data of the third product including the information on the new chemical substance, to update the composition data of the second product, and adds, when the first public data includes the composition data of the third product yet to be updated, the updated composition data of the second product to the first public data to update the first public data and transmits the third transaction data including this updated first public data to the first apparatus.

(9) According to the configuration, when the first public data includes the composition data of the third product yet to be updated, the second apparatus adds the updated composition data of the second product to the first public data and transmits the third transaction data including the updated first public data to the first apparatus. In other words, when the first public data includes the composition data of the third product yet to be updated (the composition data of the third product yet to be updated is stored in the first public area), the second apparatus discloses the updated first public data (the updated composition data of the second product) to the first apparatus. The second apparatus can determine whether or not to disclose the updated first public data to the first

company, depending on whether the composition data of the third product yet to be updated is stored in the first public area. (4) In one embodiment, when the first public data does not include the composition data of the third product yet to be updated, the second apparatus performs the first processing, and adds the updated composition data of the second product to the first public data based on the approval obtained in the first processing to update the first public data and transmits the third transaction data including this updated first public data to the first apparatus.

(10) According to the configuration, when the first public data does not include the composition data of the third product yet to be updated, the information on the new chemical substance is disclosed based on approval obtained in the first processing. Therefore, disclosure of unnecessary information due to a system error or the like can be suppressed. (5) In one embodiment, the third distributed ledger includes a second secret area where transaction data not shared with the first distributed ledger, the second distributed ledger, and the fourth distributed ledger is stored and a second public area where transaction data shared with at least one of the first distributed ledger, the second distributed ledger, and the fourth distributed ledger is stored. In the third apparatus, the second transaction data including the composition data of the third product is stored in the second secret area and second public data is stored in the second public area, the second public data being data to be disclosed to the second company, of the composition data of the third product. The third apparatus performs, when the new chemical substance is added to the list in the third distributed ledger, second processing for incorporating information on the new chemical substance into the second public data, and transmits the second transaction data including the second public data including the information on the new chemical substance to the second apparatus based on approval obtained in the second processing.

(11) According to the configuration, as a new chemical substance is added to the list in the third distributed ledger, the third apparatus discloses information on the new chemical substance based on approval obtained in the second processing. As the information on the new chemical substance is disclosed based on approval obtained in the second processing, disclosure of unnecessary information due to a system error or the like can be suppressed. (6) In one embodiment, the chemical substance included in the list is a chemical substance designated under laws and regulations.

(12) According to the configuration, the information management system can appropriately manage a chemical substance designated under the laws and regulations. (7) An information management method according to another aspect of the present disclosure is an information management method for an information management system that manages information on a chemical substance contained in a product distributed in a supply chain based on distributed ledger technology. The information management system includes a first apparatus that belongs to a first company that manufactures a first product, the first apparatus including a first distributed ledger, a second apparatus that belongs to a second company that supplies a second product to be included in the first product to the first company, the second apparatus including a second distributed ledger, a third apparatus that belongs to a third company that supplies a third product to be included in the second product to the second company, the third apparatus including a third distributed ledger, and a management apparatus that manages the information management system, the management apparatus including a fourth distributed ledger. Each of the first distributed ledger, the second distributed ledger, the third distributed ledger, and the fourth distributed ledger includes a list showing the chemical substance managed in the information management system. Composition data of the second product including composition data of the third product disclosed by the third apparatus is stored in the second apparatus. The information management method includes adding, by the management apparatus, when the management apparatus designates a new chemical substance to be managed in the information management system, the new chemical substance to the list in the fourth distributed ledger to update the list in the fourth distributed ledger, and transmitting, by the management apparatus, first transaction data that proposes addition of the new

chemical substance to the corresponding list to update the corresponding list to the first apparatus, the second apparatus, and the third apparatus, updating, by the first apparatus, the second apparatus, and the third apparatus, the list in the first distributed ledger, the list in the second distributed ledger, and the list in the third distributed ledger based on the first transaction data from the management apparatus, respectively, transmitting, by the third apparatus, when the new chemical substance is contained in composition of the third product, second transaction data including the composition data of the third product including information on the new chemical substance to the second apparatus, updating, by the second apparatus, the composition data of the third product included in the composition data of the second product based on the second transaction data from the third apparatus to update the composition data of the second product, and transmitting, by the second apparatus, when the second apparatus has determined to publish the composition data of the third product included in the composition data of the second product, third transaction data including the updated composition data of the second product to the first apparatus.

(13) The foregoing and other objects, features, aspects and advantages of the present disclosure will become more apparent from the following detailed description of the present disclosure when taken in conjunction with the accompanying drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIG. **1** is a diagram showing a schematic configuration of an information management system according to an embodiment.

(2) FIG. **2** is a diagram for illustrating business relation among companies in a supply chain.

(3) FIG. **3** is a conceptual diagram for illustrating a distributed ledger.

(4) FIG. **4** is a diagram schematically showing a hardware configuration of a platform provider.

(5) FIG. **5** is a diagram schematically showing a hardware configuration of an information management apparatus.

(6) FIG. **6** is a diagram schematically showing exemplary product composition data on a C product of a C company.

(7) FIG. **7** is a diagram for illustrating a workflow function.

(8) FIG. **8** is a diagram (No. 1) schematically showing exemplary product composition data on a B product of a B company.

(9) FIG. **9** is a diagram (No. 2) schematically showing exemplary product composition data on the B product of the B company.

(10) FIG. **10** is a flowchart showing a procedure in processing performed by a controller of the information management apparatus at the time of update of a restriction list.

(11) FIG. **11** is a flowchart showing a procedure in processing performed by the controller of the information management apparatus at the time of reception of information on a chemical substance from an upstream company.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

(12) An embodiment of the present disclosure will be described in detail below with reference to the drawings. The same or corresponding elements in the drawings have the same reference characters allotted and description thereof will not be repeated.

(13) <Overall Configuration of Information Management System>

(14) FIG. **1** is a diagram showing a schematic configuration of an information management system **1** according to the present embodiment. Information management system **1** according to the present embodiment is a system for managing, based on distributed ledger technology, information on a specific chemical substance (which is also referred to as a "subject substance" below) contained in a product (including a component and a raw material) distributed in a supply chain including a

plurality of companies. In the present embodiment, a supply chain including four companies (an A company, a B company, a C company, and a D company) is assumed by way of example. In information management system **1**, the subject substance is a chemical substance to be reported to a downstream company in the supply chain. The subject substance includes, for example, a chemical substance designated as a substance of very high concern (SVHC) as a highly harmful substance under the Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH) regulation and/or a chemical substance designated in the global automotive declarable substance list (GADSL) which is a chemical substance list managed worldwide. The chemical substance designated as the SVHC and/or the chemical substance designated in the GADSL are/is also referred to as a "restricted substance(s)" below. The restricted substance may include a chemical substance designated under other laws and regulations. Furthermore, a company that participates in information management system **1** can also have an optional chemical substance included as the subject substance. In other words, the subject substance managed by information management system **1** may include the restricted substance and the chemical substance optionally designated by a participating company. Each company is obliged to convey (report) information on the restricted substance to a downstream company. On the other hand, each company is not obliged to convey to a downstream company, information on the chemical substance optionally designated by the participating company. Information management system **1** manages the restricted substance based on a restriction list which will be described later. In other words, when a downstream company issues a disclosure request to request an upstream company to disclose the subject substance and when the subject substance, disclosure of which has been requested, falls under a chemical substance other than the restricted substance (that is, a chemical substance not registered in the restriction list), the upstream company can reject the disclosure request.

(15) Information management system **1** includes an information management apparatus **10-1** belonging to the A company, an information management apparatus **10-2** belonging to the B company, an information management apparatus **10-3** belonging to the C company, an information management apparatus **10-4** belonging to the D company, and a platform provider **30**. In the present embodiment, the A company is an end product manufacturer and falls under what is called a "downstream company" in the supply chain. In the present embodiment, the B company is a component manufacturer and falls under what is called a "midstream company" in the supply chain. In the present embodiment, the C company and the D company are material manufacturers and fall under what is called "upstream companies" in the supply chain.

(16) FIG. **2** is a diagram for illustrating business relation among companies in the supply chain. The C company supplies a C product which is its product to the B company. The D company supplies a D product which is its product to the B company. The B company manufactures a B product which is its product from the C product purchased (supplied) from the C company and the D product purchased from the D company, and supplies the B product to the A company. The A company manufactures an A product which is its product from the product purchased from the B company and sells the A product to an end user. The A company may be, for example, an automaker.

(17) The midstream company may include a trading company. A trading company may be interposed, for example, between the A company and the B company, between the B company and the C company, and/or between the B company and the D company.

(18) Each company is required to manage information on a subject substance contained in a product sold by that company. Each company in the supply chain obtains disclosure from an upstream company thereof, of information on the subject substance contained in a product that it purchases therefrom, and manages the information on the subject substance contained in a product it sells. For example, the A company receives from the B company, information on the subject substance contained in the B product, and based on that information, the A company manages the information on the subject substance contained in the A product.

(19) In information management system **1** according to the present embodiment, information is conveyed only between companies in direct business relation with each other. For example, a downstream company (the A company) and a midstream company (the B company) in supply-demand relation of products with each other are in direct business relation with each other. A midstream company (the B company) and an upstream company (the C company, the D company) in supply-demand relation of products with each other are in direct business relation with each other. On the other hand, a downstream company (the A company) and an upstream company (the C company, the D company) are not in direct business relation. In other words, information is conveyed between the downstream company (the A company) and the midstream company (the B company) and between the midstream company (the B company) and the upstream company (the C company, the D company), whereas information is not conveyed between the downstream company (the A company) and the upstream company (the C company, the D company). For example, when an E company which is a trading company is interposed between the A company and the B company, information is conveyed between the A company and the E company and between the E company and the B company, whereas information is not conveyed between the A company and the B company.

(20) For example, when trade of the C product is started between the B company and the C company, information at least on restricted substances of subject substances contained in the C product is provided from the C company to the B company. Specifically, the C company voluntarily provides information on restricted substances among subject substances contained in the C product to the B company, or the C company provides that information to the B company in response to a request from the B company. On the other hand, information on a chemical substance other than the restricted substance among the subject substances contained in the C product is provided from the C company to the B company voluntarily or in response to a request from the B company. In other words, the C company may not provide to the B company, information on the chemical substance other than the restricted substance among the subject substances contained in the C product. This is also applicable to information provided between the A company and the B company and between the B company and the D company. When trade of the D product is started between the B company and the D company, the D company provides information at least on a restricted substance among subject substances contained in the D product to the B company. When trade of the B product is started between the A company and the B company, the B company provides information at least on the restricted substance among the subject substances contained in the B product to the A company. As each company thus receives information at least on the restricted substance among the subject substances contained in a product it purchased from an upstream company in direct business relation, each company manages information on the subject substance contained in its product including the purchased product. Information is conveyed between companies over a distributed ledger network **2** (FIG. **1**) including information management apparatuses **10-1** to **10-4** and platform provider **30**.

(21) Referring again to FIG. **1**, distributed ledger platform software has been introduced in each of information management apparatuses **10-1** to **10-4**. The distributed ledger platform includes smart contract that allows limitation of a range where transaction data is shared to a range between concerned parties. Therefore, distributed ledgers **161-1** to **161-4** of information management apparatuses **10-1** to **10-4** hold transaction data that are different from one another. For example, CORDA® may be adopted as the distributed ledger platform. Distributed ledgers **161-1** to **161-4** may be denoted as a "distributed ledger **161**-N" when they are not particularly distinguished from one another.

(22) As the introduced distributed ledger platform software functions, controllers **110-1** to **110-4** (FIG. **5** which will be described later) included in information management apparatuses **10-1** to **10-4** function as nodes **111-1** to **111-4**, respectively. Communication among nodes **111-1** to **111-4** over a network NW allows formation of distributed ledger network **2**. Information management

apparatuses **10-1** to **10-4** are basically similar in configuration to one another. Therefore, when information management apparatuses **10-1** to **10-4** are not particularly distinguished from one another, they may be denoted as an "information management apparatus **10**-N." Nodes **111-1** to **111-4** may be denoted as a "node **111**-N" when they are not particularly distinguished from one another.

(23) FIG. **3** is a conceptual diagram for illustrating distributed ledger **161**-N. FIG. **3** schematically shows relation among distributed ledgers **161-1** to **161-4** stored in respective information management apparatuses **10-1** to **10-4**.

(24) Distributed ledger **161-1** and distributed ledger **161-2** share transaction data transmitted and received between information management apparatus **10-1** (node **111-1**) of the A company and information management apparatus **10-2** (node **111-2**) of the B company (a region D**1**). Region D**1** includes, for example, transaction data including information on the subject substance contained in the B product, that is transmitted and received between nodes **111-1** and **111-2**. Region D**1** also includes, for example, transaction data for an inquiry about the subject substance contained in the B product and transaction data on an answer to the inquiry that are transmitted and received between nodes **111-1** and **111-2**.

(25) Distributed ledger **161-2** and distributed ledger **161-3** share transaction data transmitted and received between information management apparatus **10-2** (node **111-2**) of the B company and information management apparatus **10-3** (node **111-3**) of the C company (a region D**2**). Region D**2** includes, for example, transaction data including information on the subject substance contained in the C product, that is transmitted and received between nodes **111-2** and **111-3**. Region D**2** also includes, for example, transaction data for an inquiry about the subject substance contained in the C product and transaction data on an answer to the inquiry that are transmitted and received between nodes **111-2** and **111-3**.

(26) Distributed ledger **161-2** and distributed ledger **161-4** share transaction data transmitted and received between information management apparatus **10-2** (node **111-2**) of the B company and information management apparatus **10-4** (node **111-4**) of the D company (a region D**3**). Region D**3** includes, for example, transaction data including information on the subject substance contained in the D product, that is transmitted and received between nodes **111-2** and **111-4**. Region D**3** also includes, for example, transaction data for an inquiry about the subject substance contained in the D product and transaction data on an answer to the inquiry that are transmitted and received between nodes **111-2** and **111-4**.

(27) For example, the B company, which is the midstream company in the supply chain, may not want the A company to know information about from which company it purchases the C product and the D product included in the B product. Transaction data includes information on a sender node and a destination node. Therefore, for example, if transaction data is broadcast to all nodes that form distributed ledger network **2**, the A company may know a source of the C product and the D product. In information management system **1** according to the present embodiment, as the range within which transaction data is shared is limited to the range between concerned parties, disclosure of information (a company name or the like) on a business partner to a company other than a company in direct business relation can be suppressed.

(28) Referring again to FIG. **1**, distributed ledger network **2** in information management system **1** is a consortium/private network. Platform provider **30** functions as a manager of information management system **1**. Platform provider **30** performs, as its function, an operation function **40** and a platform function **50**. Operation function **40** includes a node **41**, a list manager **42** (FIG. **5**), and a distributed ledger **43**, and performs a node function to register and update a restriction list which will be described later in distributed ledger network **2**. Details of operation function will be described later. Platform provider **30** corresponds to an exemplary "management apparatus" according to the present disclosure.

(29) Platform function **50** includes a doorman node **51**, a network map node **53**, and a notary node

55 and functions as a platformer that manages distributed ledger network **2**.

(30) Doorman node **51** approves an application for participation from node **111**-N and node **41** that desire participation into distributed ledger network **2**. Doorman node **51** issues a certificate to node **111**-N and node **41**. Node **111**-N and node **41** that participate in distributed ledger network **2** each create a pair of a secret key and a public key at the time of participation (for example, at the time of initial start-up) and transmits a request for grant of the certificate to doorman node **51**. Doorman node **51** verifies a predetermined condition and issues the certificate to node **111**-N and node **41** that issued the request for grant of the certificate.

(31) Information (for example, an IP address) of node **111**-N and node **41**, to which the certificate was issued by doorman node **51** (that is, participation of which into distributed ledger network **2** was permitted), is stored in network map node **53**. Network map node **53** functions as a domain name system (DNS) in distributed ledger network **2**. Nodes **111**-1 to **111**-4 and node **41** that form distributed ledger network **2** recognize a destination of transaction data, for example, based on information provided from network map node **53**.

(32) Notary node **55** gives finality to transaction data. When node **111**-N and node **41** generate transaction data, they send transaction data including a hash value (a transaction ID) of the transaction data and an index of output of the transaction data to notary node **55**. This transaction data includes a signature of a transaction data sender node (for example, node **111**-2 of the B company) and a signature of a transaction data destination node (for example, node **111**-1 of the A company). Notary node **55** verifies the transaction data based on the transaction ID and the index of output, and thereafter puts the signature to the transaction data and sends back the transaction data. Notary node **55** guarantees the order of the transaction data by sequentially holding the signed transaction data. For example, notary node **55** may hold a map, the map including the transaction ID and the index of output as keys and including the transaction ID, an index of input, and peer (node) information as values. For example, notary node **55** may be configured to add the transaction data to the map and puts the signature to the transaction data when there is no matching key in the map. Notary node **55** may be configured to send back an error when there is a matching key in the map.

(33) Node **111**-N and node **41** generate transaction data. As the distributed ledger platform software functions as described above, controller **110**-N (FIG. **5**) included in information management apparatus **10**-N functions as node **111**-N. As distributed ledger platform software functions, a controller **31** (FIG. **4**) included in platform provider **30** functions as node **41**.

(34) In information management system **1**, platform provider **30** (operation function monitors revision of the laws and regulations etc. (that is, update of the restricted substance(s)). Specifically, platform provider **30** monitors, for example, update of the SVHC and/or update of the GADSL. When platform provider **30** senses such update, that is, when a new chemical substance is designated as an SVHC and/or when a new chemical substance is designated in the GADSL, platform provider **30** senses addition of the restricted substance. When node **41** of platform provider **30** senses addition of the restricted substance, it transmits transaction data that proposes addition of the restricted substance (update of the restriction list) to all nodes **111**-1 to **111**-4.

(35) Product composition data (**151**-N and **164**-N in FIG. **5**) on a company's product is stored in information management apparatus **10**-N. For each company, its product composition data is important information. In the present embodiment, in each company, the product composition data is classified into product composition data to be published to a downstream company thereof and product composition data not to be published thereto. Though details will be described later, when information on a restricted substance (subject substance) added to the restriction list as a result of update has been designated as being public, at the time of update of the restriction list, information management apparatus **10**-N automatically discloses information on the subject substance to a downstream company thereof. When information on the subject substance has been designated as being non-public, at the time of update of the restriction list, information management apparatus

10-N discloses information on the subject substance to a downstream company thereof after approval processing with the use of a workflow function which will be described later.

(36) <Hardware Configuration>

(37) FIG. **4** is a diagram schematically showing a hardware configuration of platform provider **30**. Platform provider **30** includes controller **31**, a read only memory (ROM) **32**, a random access memory (RAM) **33**, a communication apparatus **34**, a storage **35**, an input apparatus **36**, and a display apparatus **37**. Controller **31**, ROM **32**, RAM **33**, communication apparatus **34**, storage **35**, input apparatus **36**, and display apparatus **37** are each connected to a bus **39**.

(38) Controller **31** is implemented, for example, by an integrated circuit including a central processing unit (CPU). Controller **31** develops various programs stored in ROM **32** on RAM **33** and executes the programs. The various programs include, for example, distributed ledger platform software. RAM **33** functions as a working memory, and various types of data necessary for execution of the various programs are temporarily stored in RAM **33**. Controller **31** performs various types of processing by executing a program stored in ROM **32**.

(39) Communication apparatus **34** is configured to communicate with external equipment. The external equipment includes, for example, information management apparatus **10**-N included in distributed ledger network **2**. Communication apparatus **34** and the external equipment communicate with each other over the Internet. Examples of the external equipment include a server apparatus in an external group and the like that publishes a restricted substance on the Internet.

(40) Input apparatus **36** includes an input device. The input device refers, for example, to a mouse, a keyboard, a touch panel, and/or another apparatus that can receive an operation by a user.

(41) Display apparatus **37** includes a display. Display apparatus **37** shows on the display, various images in accordance with a control signal from controller **31**. The display is, for example, a liquid crystal display, an organic electroluminescence (EL) display, or another display device.

(42) Storage **35** includes a storage medium such as a hard disk or a flash memory. Distributed ledger **43** is stored in storage **35**. Distributed ledger **43** and distributed ledger **161**-N of information management apparatus **10**-N are each, for example, a distributed ledger in a directed acyclic graph (DAG) structure. Transaction data included in distributed ledger **43** and distributed ledger **161**-N forms a partially ordered data model. In the present embodiment, for example, one piece of transaction data forms one block.

(43) Distributed ledger **43** includes a restriction list **350**. Restriction list **350** is information indicating a restricted substance (for example, a chemical substance designated as the SVHC and/or a chemical substance designated in the GADSL). Restriction list **350** includes information on at least one restricted substance. Information on the restricted substance includes, for example, a Chemical Abstracts Service (CAS) number, a name of a substance, a date of update of restriction, and a report threshold value. The CAS number is an identification number specific to a chemical substance provided in a chemical substance registration system in CAS of the American Chemical Society. The name of the substance refers to a name of a chemical substance. The date of update of restriction refers to a date on which the chemical substance is added to restriction list **350** (date on which the chemical substance is subjected to reporting to a downstream company) or the date when restriction is imposed on the chemical substance under the laws and regulations etc. (for example, the date of designation as the SVHC). The report threshold value is a threshold value of a ratio (content ratio) of a chemical substance contained per unit amount of a product. When a content ratio is equal to or more than the report threshold value, information on the chemical substance of that product should be given to a downstream company. When the content ratio is lower than the report threshold value, information on the chemical substance does not have to be given.

(44) A secret key generated by node **41** of controller **31** may be stored in storage **35**.

(45) Controller **31** functions as node **41** and list manager **42** by executing a program relating to operation function **40**.

(46) At the time of initial start-up, node **41** generates a secret key and a public key in conformity with a prescribed standard. The public key is sent, for example, to network map node **53** of platform function **50**. Node **41** performs a function to generate transaction data. Node **41** generates an electronic signature based on the secret key and puts the electronic signature to the transaction data. The secret key is stored, for example, in storage **35** or another storage which is not shown. Node **41** performs a function to approve transaction data proposed by another node. Node **41** verifies the transaction data proposed by another node, and when it sees no problem in a result of verification, it puts the electronic signature to the transaction data and sends the transaction data back to another node.

(47) List manager **42** manages restriction list **350**. List manager **42** communicates with the outside in prescribed cycles through communication apparatus **34** and monitors revision of the laws and regulations etc. (addition of the restricted substance). Specifically, list manager **42** communicates with a server apparatus of an external group in prescribed cycles through communication apparatus **34** to monitor whether or not a new restricted substance has been designated as the SVHC or whether or not a new chemical substance has been designated in the GADSL. When list manager **42** senses addition of the new chemical substance (addition of the restricted substance) to the SVHC, for example, as a result of revision of the laws and regulations etc., it requests node **41** to add the restricted substance to restriction list **350**.

(48) When node **41** receives a request for update of restriction list **350** from list manager **42**, it generates transaction data to add the newly designated restricted substance to restriction list **350** and puts a signature to the transaction data. The newly designated restricted substance is thus added to restriction list **350** and restriction list **350** is updated. Specifically, node **41** transmits the transaction data to notary node and by receiving the signed transaction data from notary node **55**, node **41** commits the transaction data (finalizes the transaction). Node **41** transmits the signed transaction data to all nodes **111**-**1** to **111**-**4** that participate in distributed ledger network **2**. In other words, node **41** transmits to all nodes **111**-**1** to **111**-**4** that participate in distributed ledger network **2**, transaction data that proposes incorporation of the newly designated restricted substance in a restriction list **165**-N (FIG. 5) of information management apparatus **10**-N. As node **111**-N that receives this transaction data approves the transaction data, the transaction data is added to distributed ledger **161**-N of node **111**-N so that restriction list **165**-N of information management apparatus **10**-N is updated. Specifically, node **41** transmits the transaction data sent back from node **111**-N to notary node **55**, and by receiving the signed transaction data from notary node **55**, node **41** and node **111**-N commit the transaction data. The transaction data signed by notary node **55** is transmitted, for example, from node **41** to node **111**-N. Description of a process in which notary node puts the signature to transaction data in transmission and reception of transaction data between node **41** and node **111**-N and between nodes **111**-N may not be provided below.

(49) Controller **31** functions as doorman node **51**, network map node **53**, and notary node **55** by executing a program relating to platform function **50**. Since these functions are as described above, description thereof will not be repeated.

(50) FIG. **5** is a diagram schematically showing a hardware configuration of information management apparatus **10**-N. Information management apparatus **10**-N includes a controller **110**-N, a ROM **120**-N, a RAM **130**-N, a communication apparatus **140**-N, a storage **150**-N, a storage **160**-N, an input apparatus **170**-N, and a display apparatus **180**-N. Controller **110**-N, ROM **120**-N, RAM **130**-N, communication apparatus **140**-N, storage **150**-N, storage **160**-N, input apparatus **170**-N, and display apparatus **180**-N are connected to a bus **190**-N.

(51) Controller **110**-N is implemented, for example, by an integrated circuit including a CPU. Controller **110**-N develops various programs stored in ROM **120**-N on RAM **130**-N and executes the programs. The various programs include, for example, distributed ledger platform software. RAM **130**-N functions as a working memory, and various types of data necessary for execution of the various programs are temporarily stored in RAM **130**-N. Controller **110**-N performs various

types of processing by executing a program stored in ROM **120**-N.

(52) Communication apparatus **140**-N is configured to communicate with external equipment. The external equipment includes, for example, another information management apparatus included in distributed ledger network **2** and platform provider Communication apparatus **140**-N and the external equipment communicate with each other, for example, over the Internet.

(53) Input apparatus **170**-N includes an input device. The input device refers, for example, to a mouse, a keyboard, a touch panel, and/or another apparatus that can receive an operation by a user.

(54) Display apparatus **180**-N includes a display. Display apparatus **180**-N shows on the display, various images in accordance with a control signal from controller **110**-N. The display is, for example, a liquid crystal display, an organic EL display, or another display device.

(55) Storage **150**-N includes a storage medium such as a hard disk or a flash memory. Information stored in storage **150**-N is managed off-chain (on the outside of distributed ledger network **2**). Product composition data **151**-N of a company's product to which it belongs, a client list **152**-N, and a secret key **153**-N are stored in storage **150**-N. For example, in the case of information management apparatus **10**-1 of the A company, product composition data **151**-1 includes composition data of the A product. For example, in the case of information management apparatus **10**-2 of the B company, product composition data **151**-2 includes composition data of the B product. For example, in the case of information management apparatus **10**-3 of the C company, product composition data **151**-3 includes composition data of the C product. For example, in the case of information management apparatus **10**-4 of the D company, product composition data **151**-4 includes composition data of the D product. Details of product composition data **151**-N will be described later, together with details of product composition data **164**-N which will be described later.

(56) Client list **152**-N includes information on a company to which disclosure of information is permitted. Specifically, downstream companies that do direct business transactions in the supply chain are registered in client list **152**-N. For example, in the case of information management apparatus **10**-1 of the A company, no company has been registered in client list **152**-1. For example, in the case of information management apparatus **10**-2 of the B company, the A company has been registered in client list **152**-2. For example, in the case of information management apparatus **10**-3 of the C company, the B company has been registered in client list **152**-3. For example, in the case of information management apparatus **10**-4 of the D company, the B company has been registered in client list **152**-4. No answer is given to an inquiry from a company not registered in client list **152**-N. Client list **152**-1 does not have to be stored in storage **150**-1 of information management apparatus **10**-1.

(57) Secret key **153**-N and a public key (not shown) generated by controller **110**-N are stored in storage **150**-N. A certificate (not shown) issued by doorman node **51** of platform provider **30** is stored in storage **150**-N.

(58) Storage **160**-N includes a storage medium such as a hard disk or a flash memory. Information stored in storage **160**-N is managed on-chain (in the inside of distributed ledger network **2**). Distributed ledger **161**-N is stored in storage **160**-N.

(59) Distributed ledger **161**-N includes a secret area **162**-N and a public area **163**-N. Secret area **162**-N is an area where transaction data shared with none of other nodes is stored, that is, an area where transaction data held only by distributed ledger **161**-N itself on-chain is stored. Public area **163**-N is an area where transaction data shared with at least one other node is stored on-chain.

(60) Product composition data **164**-N is stored in secret area **162**-N. Product composition data **164**-N is the same as product composition data **151**-N stored in storage **150**-N. Controller **110**-N has product composition data **164**-N identical in content to product composition data **151**-N stored also in on-chain secret area **162**-N (secret area **162**-N in distributed ledger **161**-N). When controller **110**-N updates one of product composition data **151**-N and product composition data **164**-N, it also updates the other in the same way. The reason why product composition data **164**-N similar in

contents to product composition data **151**-N is stored also in secret area **162**-N on-chain is because information on a chemical substance (restricted substance) newly added to restriction list **165**-N can automatically be extracted from product composition data **164**-N as a result of processing by node **111**-N (specifically, node **111**-N and a management function unit **112**-N in the present embodiment) on-chain. For example, node **111**-N is unable to extract information on the newly designated restricted substance from product composition data **151**-N stored off-chain. In order to extract the information on the newly designated restricted substance from product composition data **151**-N stored off-chain, for example, a feature for extraction should separately be added or intervention by human processing is required. As product composition data **164**-N is stored on-chain, node **111**-N is able to extract the information on the newly designated restricted substance from product composition data **164**-N. A series of processing including update of restriction list **350** by platform provider **30**, update of restriction list **165**-N in response to update of restriction list **350**, and extraction of information on the newly designated restricted substance from product composition data **164**-N based on restriction list **165**-N can thus be automated in information management apparatus **1**.

(61) Restriction list **165**-N and public data **166**-N are stored in public area **163**-N. Restriction list **165**-N is updated as platform provider **30** updates restriction list **350**. When node **41** of platform provider **30** adds a restricted substance newly designated as a result of revision of the laws and regulations etc. to restriction list **350** to update restriction list **350**, it transmits to node **111**-N of information management apparatus **10**-N, transaction data that proposes addition of the newly designated restricted substance to restriction list **165**-N to update restriction list **165**-N. As node **111**-N approves the transaction data, the transaction data is added to distributed ledger **161**-N and restriction list **165**-N is updated. Specifically, the transaction data is committed through a process in which notary node **55** puts the signature to the transaction data. Public data **166**-N is created by extraction of information on the restricted substance included in restriction list **165**-N from product composition data **164**-N. In other words, public data **166**-N is information on the chemical substance included in product composition data **164**-N and included in restriction list **165**. Product composition data is information important for each company. The product composition data that does not have to be disclosed may be disclosed to another company, for example, due to a system error or the like. In the present embodiment, necessity for keeping secret can be determined for each prescribed unit of data included in product composition data. Data desired to be kept secret can be designated to be kept secret and data that may be disclosed can be designated not to be kept secret. When a chemical substance that has been designated to be kept secret is designated as a restricted substance, information on the chemical substance is disclosed after approval is obtained in a company with the use of the workflow function which will be described later. Therefore, more specifically, public data **166**-N is information on a chemical substance (1) included in product composition data **164**-N, (2) included in restriction list **165**-N, and (3) designated not to be kept secret or publication of which has been approved.

(62) FIG. **6** is a diagram schematically showing exemplary product composition data **151**-3 and **164**-3 on the C product of the C company. Since product composition data **151**-3 is the same as product composition data **164**-3 as described above, product composition data **164**-3 will be described below by way of example.

(63) Product composition data **164**-3 includes item information such as a product name, a product number, a constituent product number, a content ratio, and necessity for keeping secret. The product name is the C product and the product number thereof is C**001**. The C product contains products (chemical substances) labeled with constituent product numbers CA**001** to CA**004** as its composition. In the example shown in FIG. **6**, the content ratio of constituent product number CA**001** occupied in the C product is X**1**%, the content ratio of constituent product number CA**002** occupied in the C product is X**2**%, the content ratio of constituent product number CA**003** occupied in the C product is X**3**%, and the content ratio of constituent product number CA**004** occupied in

the C product is X**4**%. The total of the content ratios X**1**% to X**4**% is 100%. For example, when the product labeled with constituent product number CA**001** further contains products labeled with constituent product numbers CB**001** and CB**002**, the item information associated with the constituent product number may include a first tier including constituent product numbers CA**001** to CA**004** and a second tier including constituent product numbers included in the product labeled with the constituent product number in the first tier for each constituent product number in the first tier. In product composition data **164-3** according to the present embodiment, the item information associated with the constituent product number includes only the first tier.

(64) The item information expressing necessity for keeping secret indicates "public" or "non-public", which is determined for each constituent product number (each constituent product number in the first tier). In other words, the constituent product number in the first tier is defined for the prescribed unit of data described above in product composition data **164-3**. "Public" means that composition data (including at least the constituent product number and the content ratio) of a chemical substance is extracted from product composition data **164-3**, included in public data **166-N**, and stored in public area **163-N**. "Non-public" means that composition data of a chemical substance is not included in public data **166-N** but remains in secret area **162-N**. In the example shown in FIG. **6**, constituent product numbers CA**001** and CA**002** are designated as being public and constituent product numbers CA**003** and CA**004** are designated as being non-public. Chemical substances identified by constituent product numbers CA**001** and CA**002** are assumed as restricted substances and chemical substances identified by constituent product numbers CA**003** and CA**004** are not assumed as restricted substances.

(65) Product composition data (public data **166-3**) of the C product disclosed to information management apparatus **10-2** (node **111-2**) of the B company by information management apparatus **10-3** (node **111-3**) of the C company includes composition data of constituent product numbers CA**001** and CA**002** but does not include composition data of constituent product numbers CA**003** and CA**004**.

(66) It is assumed that restriction list **165-3** is updated and the chemical substance identified by constituent product number CA**003** is added as the restricted substance to restriction list **165-3**. For disclosure to the outside, of information on the restricted substance newly added to restriction list **165-3**, approval should be obtained in the C company. Information management apparatus **10-3** (information management apparatus **10-N**) performs a workflow function to automate a process for obtaining approval for disclosure of information on the restricted substance. The workflow function can be applied also to disclosure of information on a chemical substance other than the restricted substance. In the present embodiment, all information management apparatuses **10-N** included in information management system **1** perform the workflow function.

(67) FIG. **7** is a diagram for illustrating the workflow function. Referring to FIG. **7**, a plurality of client apparatuses **12-N** are connected to information management apparatus **10-N** to establish wireless or wired communication. Information management apparatus **10-N** and client apparatus **12-N** capable of establishing wired communication are each connected to a bus **11-N**.

(68) Each of the plurality of client apparatuses **12-N** is a terminal apparatus belonging to a company the same as the company that manages information management apparatus **10-N** or a company associated therewith. The plurality of client apparatuses **12-N** belong, for example, to departments different from one another. Specifically, in an example of information management apparatus **10-3** of the C company, the plurality of client apparatuses **12-3** belong, for example, to departments different from one another in the C company.

(69) When a new restricted substance is designated as a result of revision of laws and regulations etc., approval for disclosure of information on the new restricted substance to the outside (the downstream company) should be obtained in the company. A department having approval authority for disclosure of information on the chemical substance may be different for each chemical substance.

(70) Information management apparatus **10**-N incorporates web application software (which is also simply referred to as a "web app" below). Each of the plurality of client apparatuses **12**-N uses the web app through a web browser. The workflow function in the present embodiment is performed with the use of the web app. When information management apparatus **10**-N starts the workflow function, it notifies a client apparatus group (the plurality of client apparatuses **12**-N) of start of the workflow.

(71) Client apparatus **12**-N of the department having the approval authority (approval department) is set in advance for each chemical substance contained in composition of a product. Each of the plurality of client apparatuses **12**-N refers to the web app every prescribed cycle after it receives a notification about start of the workflow until it receives a notification about end of the workflow. Information management apparatus **10**-N discloses information on the newly designated restricted substance to the plurality of client apparatuses **12**-N with the use of the web app. Each of the plurality of client apparatuses **12**-N determines whether or not a department to which it belongs is the approval department that approves disclosure of information on the newly designated restricted substance. Client apparatus **12**-N belonging to the approval department performs approval processing when the restricted substance, disclosure of information on which is approved by the client apparatus itself, is newly designated. Thereafter, client apparatus **12**-N approves disclosure to the downstream company, of information on the restricted substance contained in the product of the company to which it belongs. The approval processing may include processing for checking whether or not a content of the restricted substance in the company's product is equal to or more than a report threshold value. The report threshold value refers to a threshold value of a ratio (a content ratio) of the subject substance contained per unit amount of the product. The prescribed value is determined, for example, under the laws and regulations etc. The upstream company is obliged to disclose information on the restricted substance in its product to the downstream company when the content of the restricted substance is equal to or more than the prescribed value. The report threshold value can be the prescribed value. The approval processing may be performed automatically by a program incorporated in client apparatus **12**-N or manually by a manager (employee) of a management department of client apparatus **12**-N.

(72) When information management apparatus **10**-N senses approval by client apparatus **12**-N in the approval department, it determines to set the item information expressing necessity for keeping secret in connection with the restricted substance, for which approval for information disclosure has been obtained, from non-public to public, and has the composition data of that restricted substance incorporated in public data **166**-N. When information management apparatus **10**-N senses approval by client apparatus **12**-N in the approval department, it notifies the client apparatus group (the plurality of client apparatuses **12**-N) of end of the workflow. The workflow function thus ends.

(73) Node **111**-N of information management apparatus **10**-N generates transaction data that reports product composition data (public data **166**-N) including information on the restricted substance, for which approval for information disclosure has been obtained, and transmits the transaction data to the node of the downstream company. Information on the restricted substance is thus reported to the downstream company. When a restricted substance is newly designated, only information on the restricted substance may be reported from the upstream company to the downstream company, or product composition data (public data **166**-N) to which information on the restricted substance has been added may be reported from the upstream company to the downstream company.

(74) In the example in FIG. **6**, when information management apparatus **10-3** senses approval by client apparatus **12-3** in the approval department, it determines to set the item information expressing necessity for keeping secret in connection with the chemical substance identified by constituent product number CA**003** from non-public to public. Node **111-3** of information management apparatus **10-3** extracts the composition data of the chemical substance (restricted substance) identified by constituent product number CA**003** from product composition data **164-3**

and has the composition data of the chemical substance identified by constituent product number CA**003** incorporated in public data **166-3**. Node **111-3** of information management apparatus **10-3** generates transaction data that reports public data **166-3** (product composition data including information on the restricted substance, for which approval for information disclosure has been obtained), and transmits the transaction data to the node of the downstream company (node **111-2** of the B company). Information on the chemical substance identified by constituent product number CA**003**, which is the newly added restricted substance, is thus reported to the downstream company.

(75) FIGS. **8** and **9** are diagrams schematically showing exemplary product composition data **151-2** and **164-2** on the B product of the B company. FIG. **8** shows exemplary product composition data **151-2** and **164-2** before addition of a new restricted substance (constituent product number CA**003**) to restriction list **165-2**. FIG. **9** shows exemplary product composition data **151-2** and **164-2** after addition of the new restricted substance (constituent product number CA**003**) to restriction list **165-2**. Since product composition data **151-2** is the same as product composition data **164-2** as described above, product composition data **164-2** will be described below by way of example.

(76) Initially, referring to FIG. **8**, product composition data **164-2** includes item information such as a product name, a product number, a constituent product number, a content ratio, and necessity for keeping secret. The product name is the B product and the product number thereof is B**001**. The B product includes the C product and the D product. The first tier of the constituent product number includes the C product and the product number C**001** thereof and the D product and the product number D**001** thereof. The content ratio of the C product in the B product is Z**1**% and the content ratio of the D product in the B product is Z**2**%. The sum of the content ratio Z**1**% and the content ratio Z**2**% is 100%.

(77) The second tier of the constituent product number includes the composition data of the C product disclosed by the C company and the composition data of the D product disclosed by the D company. Specifically, the second tier of the constituent product number includes constituent product numbers CA**001** and CA**002** incorporated in public data **166-3** by the C company and constituent product numbers DA**001**, DA**002**, and DA**003** incorporated in public data **166-4** by the D company. The content ratio of constituent product number CA**001** in the C product is X**1**% and the content ratio of constituent product number CA**002** in the C product is X**2**%. The content ratio of constituent product number DA**001** in the D product is Y**1**%, the content ratio of constituent product number DA**002** in the D product is Y**2**%, and the content ratio of constituent product number DA**003** in the D product is Y**3**%. For example, when the C company does not fully disclose composition of the C product, the sum of the content ratio X**1**% and the content ratio X**2**% is not 100%. Since the C company does not disclose information on the chemical substances identified by constituent product numbers CA**003** and CA**004** in the present embodiment, the sum of the content ratio X**1**% and the content ratio X**2**% is not 100%.

(78) The item information expressing necessity for keeping secret is determined for each constituent product number in the first tier. In the example in FIG. **8**, for the C product, necessity for keeping secret has been designated as being public, and for the D product, necessity for keeping secret has been designated as being non-public. Specifically, though product composition data (public data **166-2**) disclosed to information management apparatus **10-1** (node **111-1**) of the A company by information management apparatus **10-2** (node **111-2**) of the B company includes the composition data of the C product, it does not include the composition data of the D product. In other words, though public data **166-2** includes the composition data of the C product, it does not include the composition data of the D product. Namely, the constituent product number in the first tier is defined for the prescribed unit of data described above in product composition data **164-2**. For the item information expressing necessity for keeping secret, designation for each constituent product number in the second tier can also be adopted. In other words, the constituent product number in the second tier can also be defined for the prescribed unit of data.

(79) As the restricted substance (constituent product number CA**003**) is added to restriction list **165-3**, the composition data of constituent product number CA**003** is added to public data **166-3** in information management apparatus **10-3** (node **111-3**) of the C company. Transaction data that discloses public data **166-3** to which the composition data of constituent product number CA**003** has been added is thus transmitted from node **111-3** to node **111-2**. As node **111-2** approves the transaction data, the transaction data is added to distributed ledger **161-2** and the composition data of constituent product number CA**003** is disclosed to node **111-2**. Node **111-2** adds the composition data of constituent product number CA**003** to update product composition data **164-2**. Controller **110-2** further updates product composition data **151-2** as product composition data **164-2** is updated.

(80) Therefore, as shown in FIG. **9**, the composition data of constituent product number CA**003** in connection with the C product is added to product composition data **151-2** and **164-2**. Specifically, constituent product number CA**003** and the content ratio X**3**% thereof in connection with the C product are added to product composition data **164-2**. As shown also in FIG. **8**, the item information expressing necessity for keeping secret in connection with the C product has been designated as being public. In other words, the composition data of the C product is included in public data **166-2**. Therefore, node **111-2** extracts the composition data of constituent product number CA**003** from product composition data **164-2** and has the composition data incorporated in public data **166-2**. Node **111-2** transmits transaction data that discloses public data **166-2**, to which the composition data of constituent product number CA**003** has been added, to node **111-1** of the A company. As node **111-1** approves the transaction data, the transaction data is added to distributed ledger **161-1** and the composition data of constituent product number CA**003** is disclosed to node **111-1**. Node **111-1** adds the composition data of constituent product number CA**003** to update product composition data **164-1**. Furthermore, controller **110-1** updates product composition data **151-1** as product composition data **164-1** is updated. Thus, when the C company, which is the upstream company, discloses the composition data of the chemical substance identified by constituent product number CA**003** in connection with the C product and when the item information expressing necessity for keeping secret in connection with the C product has been designated as being public in advance, node **111-2** automatically discloses the composition data of constituent product number CA**003** to node **111-1** of the A company, which is the downstream company. In other words, when the item information expressing necessity for keeping secret in connection with the C product has been designated as being public before reception from node **111-3** of the C company, of transaction data that discloses public data **166-3**, to which composition data of constituent product number CA**003** has been added, node **111-2** automatically discloses the composition data of constituent product number CA**003** to node **111-1** of the A company. "Automatic" means that node **111-2** transmits transaction data that discloses public data **166-2**, to which the composition data of constituent product number CA**003** has been added, to node **111-1** of the A company upon reception of the transaction data from node **111-3** of the C company. In other words, node **111-2** transmits the transaction data that discloses public data **166-2**, to which the composition data of constituent product number CA**003** has been added, to node **111-1** of the A company without performing approval processing.

(81) On the assumption that the item information expressing necessity for keeping secret in connection with the C product has been designated as being non-public, when the C company, which is the upstream company, discloses the composition data on the chemical substance identified by constituent product number CA**003** in connection with the C product, node **111-2** does not automatically disclose the composition data of constituent product number CA**003** to node **111-1** of the A company, which is the downstream company. In this case, node **111-2** waits for approval (that is, approval processing) for publication of the composition data of the C product with the workflow function. When approval for publication of the composition data of the C product is obtained as a result of approval processing, node **111-2** discloses the composition data of the C

product to node **111**-1 of the A company.

(82) Referring again to FIG. **5**, controller **110**-N functions as node **111**-N, management function unit **112**-N, and a workflow function unit **113**-N by executing a program stored in ROM **120**-N.

(83) At the time of initial start-up, node **111**-N generates secret key **153**-N and a public key in conformity with a prescribed standard. Secret key **153**-N is stored in storage **150**-N. The public key is sent, for example, to network map node **53** of platform provider **30**. Node **111**-N performs a function to generate transaction data. Node **111**-N generates an electronic signature with the use of secret key **153**-N and puts the electronic signature to the transaction data. Node **111**-N performs a function to approve transaction data proposed by another node. Node **111**-N verifies the transaction data proposed by another node, and when it sees no problem in a result of verification, it puts the electronic signature to the transaction data and sends the transaction data back to another node.

(84) When node **111**-N receives from node **41** of platform provider **30**, the transaction data that proposes incorporation of the restricted substance newly designated as a result of revision of the laws and regulations etc. into restriction list **165**-N, it verifies the transaction data and thereafter approves the transaction data. Then, node **111**-N has the transaction data stored in distributed ledger **161**-N. The newly designated restricted substance is thus added to restriction list **165**-N and restriction list **165**-N is updated.

(85) When restriction list **165**-N is updated, node **111**-N performs processing for checking (checking processing) whether or not information on the restricted substance added to restriction list **165**-N as a result of update has to be disclosed to the downstream company. Specifically, node **111**-N checks the restricted substance added to restriction list **165**-N against product composition data **164**-N and checks whether or not the content ratio of the added restricted substance in a product of a company to which it belongs is equal to or more than the report threshold value. When the content ratio of the restricted substance in product composition data **164**-N is equal to or more than the report threshold value, node **111**-N determines that the information on the restricted substance has to be disclosed to the downstream company. In other words, node **111**-N confirms that update of restriction list **165**-N affects itself. When the content ratio of the restricted substance in product composition data **164**-N is less than the report threshold value, node **111**-N determines that the information on the restricted substance does not have to be disclosed to the downstream company. In other words, node **111**-N confirms that update of restriction list **165**-N does not affect itself. When node **111**-N confirms that update of restriction list **165**-N affects itself, node **111**-N notifies management function unit **112**-N of that fact. Management function unit **112**-N can also perform the function to perform checking processing. In this case, for example, when management function unit **112**-N senses update of restriction list **165**-N by node **111**-N, it performs checking processing with the use of product composition data **151**-N.

(86) When management function unit **112**-N is notified of the fact that update of restriction list **165**-N affects itself, it performs processing (reading processing) for reading information (client information) on the downstream company from storage **150**-N. Specifically, management function unit **112**-N reads the client information by referring to client list **152**-N stored in storage **150**-N. Management function unit **112**-N gives to workflow function unit **113**-N, information on the restricted substance to be reported to the downstream company. The function to perform reading processing by management function unit **112**-N can also be performed by node **111**-N. In this case, for example, information similar to client list **152**-N is stored also in secret area **162**-N in distributed ledger **161**-N stored in storage **160**-N. In other words, information similar to client list **152**-N is also stored on-chain. Node **111**-N can thus read client information from distributed ledger **161**-N.

(87) Workflow function unit **113**-N notifies the client apparatus group (FIG. **7**) of start and end of the workflow. When workflow function unit **113**-N obtains with its workflow function, approval for disclosure of information on the restricted substance added to restriction list **165**-N from client apparatus **12**-N in the approval department, it notifies management function unit **112**-N of that fact.

(88) When management function unit **112**-N receives an approval notification from workflow function unit **113**-N, it requests node **111**-N to update public data **166**-N.

(89) When node **111**-N receives the request for update of public data **166**-N, it adds information on the restricted substance, for which approval for information disclosure has been obtained, to update public data **166**-N. Then, node **111**-N generates transaction data including public data **166**-N and transmits the transaction data to the node of a target downstream company. When the node of the downstream company approves the transaction data, public data **166**-N is disclosed to the downstream company. In other words, information on the added restricted substance is reported to the downstream company. Information on the chemical substance (the restricted substance in the present embodiment) is disclosed to the downstream company by the upstream company. Node **111**-N may generate transaction data including information on the restricted substance for which approval for information disclosure has been obtained, and transmit the transaction data to the node of the target downstream company.

(90) Each element of controller **110**-N functions, for example, as below when the information on the chemical substance is disclosed by the node of an upstream company thereof.

(91) When node **111**-N receives transaction data including public data from the node of the upstream company, it verifies and approves the transaction data. Information on the chemical substance newly disclosed by the node of the upstream company is thus added to product composition data **164**-N and product composition data **164**-N is updated. Management function unit **112**-N senses update of product composition data **164**-N. Management function unit **112**-N updates product composition data **151**-N as product composition data **164**-N is updated.

(92) Node **111**-N performs processing for determining (determination processing) whether or not the disclosed information on the chemical substance is to be kept secret. When the composition data of the product containing the disclosed chemical substance is included in public data **166**-N (in other words, the item information expressing necessity for keeping secret in connection with the product containing the disclosed chemical substance has been designated as being public in advance in product composition data **164**-N), node **111**-N determines that the disclosed chemical substance does not have to be kept secret. When the composition data of the product containing the disclosed chemical substance is not included in public data **166**-N (in other words, the item information expressing necessity for keeping secret in connection with the product containing the disclosed chemical substance has been designated as being non-public in advance in product composition data **164**-N), node **111**-N determines that the disclosed chemical substance is to be kept secret.

(93) Description will be given with reference to the example shown in FIG. **9**. When node **111**-3 of the C company, which is the upstream company, discloses information on the chemical substance identified by constituent product number CA**003**, node **111**-2 of the B company determines that the disclosed chemical substance does not have to be kept secret because the item information expressing necessity for keeping secret in connection with the C product containing the chemical substance identified by constituent product number CA**003** has been designated as being public in advance (the composition data of the C product is included in public data **166**-2).

(94) When node **111**-N determines that the disclosed chemical substance does not have to be kept secret, it has information on the chemical substance incorporated in public data **166**-N. Node **111**-N then transmits transaction data including public data **166**-N to the node of a downstream company thereof. In these ways, node **111**-N determines whether or not the chemical substance is to be kept secret when information on the chemical substance is disclosed by an upstream company thereof, and when the chemical substance does not have to be kept secret, it discloses the information on the chemical substance to the downstream company. A series of processing from disclosure of the information on the chemical substance by the upstream company until disclosure of the information on the chemical substance to the downstream company can be automated.

(95) When node **111**-N determines that the disclosed chemical substance is to be kept secret, it

checks whether or not the disclosed chemical substance falls under the restricted substance based on restriction list **165**-N. Unless the disclosed chemical substance falls under the restricted substance, the node is not obliged to disclose the chemical substance to the downstream company, whereas when the disclosed chemical substance falls under the restricted substance, the node has to disclose the chemical substance to the downstream company. When node **111**-N determines that the disclosed chemical substance falls under the restricted substance, it notifies management function unit **112**-N of that fact (the upstream company has disclosed the restricted substance).

(96) When management function unit **112**-N is notified of disclosure of the restricted substance by the upstream company, it performs the reading processing described above, that is, processing for reading information (client information) on the downstream company from storage **150**-N. Management function unit **112**-N gives workflow function unit **113**-N information (the chemical substance disclosed by the upstream company) on the restricted substance to be reported to the downstream company.

(97) Workflow function unit **113**-N notifies the client apparatus group (FIG. **7**) of start and end of the workflow. When workflow function unit **113**-N obtains approval for disclosure of information on the restricted substance added to restriction list **165**-N from client apparatus **12**-N in the approval department with the workflow function, it notifies management function unit **112**-N of that fact.

(98) When management function unit **112**-N receives approval notification from workflow function unit **113**-N, it requests node **111**-N to update public data **166**-N.

(99) When node **111**-N receives the request for update of public data **166**-N, it adds the information on the restricted substance, for which approval for information disclosure has been obtained, to update public data **166**-N. Node **111**-N then generates transaction data including updated public data **166**-N and transmits the transaction data to the node of the target downstream company. As the node of the downstream company approves the transaction data, public data **166**-N is disclosed to the downstream company. In other words, information on the chemical substance (restricted substance) disclosed by the upstream company is reported to the downstream company. Node **111**-N may generate transaction data including information on the restricted substance, for which approval for information disclosure has been obtained, and transmit the transaction data to the node of the target downstream company.

(100) Management function unit **112**-N can also perform the function to perform the determination processing (processing for determining whether or not information on the chemical substance disclosed by the upstream company is to be kept secret) described above. In this case, for example, information the same as restriction list **165**-N is stored also in storage **150**-N. In other words, information the same as restriction list **165**-N is also stored off-chain. Management function unit **112**-N can thus perform determination processing with the use of the restriction list stored in storage **150**-N.

(101) <Flowchart>

(102) FIG. **10** is a flowchart showing a procedure in processing performed by controller **110**-N of information management apparatus **10**-N at the time of update of the restriction list. Processing in the flowchart shown in FIG. **10** is invoked from a main routine after information management apparatus **10**-N is started up, and repeatedly performed every prescribed cycle. Though an example where each step (the step being abbreviated as "S" below) in the flowchart shown in FIG. **10** and FIG. **11** which will be described later is performed by software processing by controller **110**-N of information management apparatus **10**-N is described, a part or the entirety thereof may be performed by hardware (electronic circuitry) made in controller **110**-N.

(103) In S**1**, controller **110**-N (node **111**-N) determines whether or not it has received transaction data that proposes incorporation of a new restricted substance in restriction list **165**-N from node **41** of platform provider **30**. When controller **110**-N (node **111**-N) determines that it has received the transaction data (YES in S**1**), the process proceeds to S**2**. When controller **110**-N (node **111**-N)

determines that it has not received the transaction data (NO in S**1**), the process returns.

(104) In S**2**, after controller **110**-N (node **111**-N) verifies the transaction data received in S**1**, it approves the transaction data. Controller **110**-N (node **111**-N) has the transaction data stored in distributed ledger **161**-N. Thus, the newly designated restricted substance is added to restriction list **165**-N and restriction list **165**-N is updated.

(105) In S**3**, controller **110**-N (node **111**-N) performs checking processing and determines whether or not information on the added restricted substance should be reported to the downstream company. Specifically, controller **110**-N (node **111**-N) checks the restricted substance added to restriction list **165**-N against product composition data **164**-N and checks whether or not the added restricted substance is contained in the product (company's product) supplied by the company to the downstream company. When the company's product contains the added restricted substance, controller **110**-N (node **111**-N) also checks whether or not the content ratio thereof is equal to or more than the report threshold value. When product composition data **164**-N includes the restricted substance and the content ratio of the restricted substance is equal to or more than the report threshold value, controller **110**-N (node **111**-N) determines that the information on the restricted substance should be disclosed to the downstream company (YES in S**3**) and the process proceeds to S**4**. When product composition data **164**-N does not include the restricted substance or when product composition data **164**-N includes the restricted substance but the content ratio of the restricted substance is less than the report threshold value, controller **110**-N (node **111**-N) determines that the information on the restricted substance does not have to be disclosed to the downstream company (NO in S**3**), and the process returns.

(106) In S**4**, controller **110**-N (node **111**-N) determines whether or not information on the added restricted substance is to be kept secret in the company. Specifically, controller **110**-N (node **111**-N) determines whether or not the information on the added restricted substance is to be kept secret based on whether or not the added restricted substance has already been included in public data **166**-N. When controller **110**-N (node **111**-N) determines that the added restricted substance has not yet been included in public data **166**-N (YES in S**4**), it determines that the information on the added restricted substance is to be kept secret and the process proceeds to S**5**. When controller **110**-N (node **111**-N) determines that the added restricted substance has already been included in public data **166**-N (NO in S**4**), it determines that the information on the added restricted substance does not have to be kept secret, and the process proceeds to S**7** with processing in S**5** and S**6** being skipped.

(107) In S**5**, controller **110**-N (management function unit **112**-N) reads information (client information) on the downstream company from storage **150**-N. Controller **110**-N (workflow function unit **113**-N) notifies the client apparatus group of start of the workflow in order to obtain approval for disclosure of information on the restricted substance to be reported to the downstream company.

(108) In S**6**, controller **110**-N (workflow function unit **113**-N) obtains approval for disclosure of information on the restricted substance added to restriction list **165**-N from client apparatus **12**-N in the approval department. Controller **110**-N (workflow function unit **113**-N) notifies the client apparatus group of end of the workflow.

(109) In S**7**, controller **110**-N (node **111**-N) adds the information on the restricted substance added to restriction list **165**-N to update public data **166**-N.

(110) In S**8**, controller **110**-N (node **111**-N) generates transaction data including public data **166**-N and transmits the transaction data to the node of the target downstream company. As the node of the downstream company approves the transaction data, public data **166**-N is disclosed to the downstream company. In other words, information on the added restricted substance is reported to the downstream company.

(111) FIG. **11** is a flowchart showing a procedure in processing performed by controller **110**-N of information management apparatus **10**-N at the time of reception of information on the chemical

substance from the upstream company. Processing in the flowchart shown in FIG. **11** is invoked from the main routine after information management apparatus **10**-N is started up, and repeatedly performed every prescribed cycle.

(112) In S**11**, controller **110**-N (node **111**-N) determines whether or not information on the chemical substance has been disclosed by the node of the upstream company. In other words, controller **110**-N (node **111**-N) determines whether or not it has received transaction data including the public data from the node of the upstream company. When the information on the chemical substance has been disclosed to controller **110**-N (node **111**-N) by the node of the upstream company (YES in S**11**), the process proceeds to S**12**. When the information on the chemical substance has not been disclosed to controller **110**-N (node **111**-N) by the node of the upstream company (NO in S**11**), the process returns.

(113) In S**12**, controller **110**-N (node **111**-N) approves the transaction data received from the node of the upstream company and has the transaction data stored in distributed ledger **161**-N. Product composition data **164**-N is thus updated. Controller **110**-N (management function unit **112**-N) updates product composition data **151**-N as product composition data **164**-N is updated.

(114) In S**13**, controller **110**-N (node **111**-N) determines whether or not the received (disclosed) information on the chemical substance is to be kept secret in a company to which it belongs. As shown in FIGS. **8** and **9**, it is assumed that the constituent product number in the first tier is defined for the prescribed unit of data. Specifically, controller **110**-N (node **111**-N) determines whether or not composition data of the product containing the disclosed chemical substance is included in public data **166**-N (the item information expressing necessity for keeping secret in connection with the product containing the disclosed chemical substance is designated as being public in advance in product composition data **164**-N). When controller **110**-N (node **111**-N) determines that the composition data of the product containing the disclosed chemical substance is not included in public data **166**-N (YES in S**13**), it determines that the information on the disclosed chemical substance is to be kept secret and the process proceeds to S**14**. When controller **110**-N (node **111**-N) determines that the composition data of the product containing the disclosed chemical substance is included in public data **166**-N (NO in S**13**), it determines that the information on the disclosed chemical substance does not have to be kept secret and the process proceeds to S**17** with processing (approval processing) in S**14** to S**16** being skipped.

(115) In S**14**, controller **110**-N (node **111**-N) determines whether or not the chemical substance in the received information falls under the restricted substance based on restriction list **165**-N. When controller **110**-N (node **111**-N) determines that the chemical substance in the received information falls under the restricted substance (YES in S**14**), the process proceeds to S**15** in order to disclose the information on the chemical substance to the node of the downstream company. When controller **110**-N (node **111**-N) determines that the chemical substance does not fall under the restricted substance (NO in S**14**), the process returns without the information on the chemical substance being disclosed to the node of the downstream company.

(116) In S**15**, controller **110**-N (management function unit **112**-N) reads information (client information) on the downstream company from storage **150**-N. Controller **110**-N (workflow function unit **113**-N) notifies the client apparatus group of start of the workflow in order to obtain approval for disclosure of the information on the restricted substance (the received information on the chemical substance) to the downstream company.

(117) In S**16**, controller **110**-N (workflow function unit **113**-N) obtains approval for disclosure of the received information on the chemical substance from client apparatus **12**-N in the approval department. Controller **110**-N (workflow function unit **113**-N) notifies the client apparatus group of end of the workflow.

(118) In S**17**, controller **110**-N (node **111**-N) adds the information on the chemical substance (restricted substance) received in S**11** to update public data **166**-N.

(119) In S**18**, controller **110**-N (node **111**-N) generates transaction data including public data **166**-N

and transmits the transaction data to the node of the target downstream company. As the node of the downstream company approves the transaction data, public data **166**-N is disclosed to the downstream company. In other words, the received information on the restricted substance is reported to the downstream company.

(120) As set forth above, in information management system **1** according to the present embodiment, as platform provider **30** updates restriction list **350**, in each node **111**-N, restriction list **165**-N is updated as restriction list **350** is updated. Then, as restriction list **165**-N is updated, information on the restricted substance is disclosed to a downstream company by an upstream company.

(121) When the information on the chemical substance is disclosed by the upstream company and when the chemical substance does not to have to be kept secret and falls under the restricted substance, node **111**-N discloses the composition data of a product of a company to which it belongs, the composition data including information on the chemical substance disclosed by the upstream company, to the downstream company. In other words, a series of processing including update of restriction list **350** by platform provider **30**, update of restriction list **165**-N in accordance with restriction list **350**, and extraction of information on the newly designated restricted substance from product composition data **164**-N based on restriction list **165**-N can be automated. Therefore, information can readily be distributed in the supply chain.

(122) When the chemical substance disclosed by the upstream company is to be kept secret, node **111**-N discloses the composition data of the company's product including information on the chemical substance disclosed by the upstream company to the downstream company after it performs approval processing. For example, when the chemical substance disclosed by the upstream company falls under the restricted substance, the composition data of the company's product including information on the chemical substance may automatically be disclosed to the downstream company. Product composition data that does not have to be disclosed, however, may be disclosed to another company due to a system error or the like. When the chemical substance disclosed by the upstream company is to be kept secret as above, composition data of the company's product including information on the chemical substance is disclosed to the downstream company after the approval processing, so that unnecessary disclosure of the composition data of the company's product can be suppressed.

(123) Furthermore, in information management system **1** according to the present embodiment, since the restriction list (restriction lists **350** and **165**-N) and public data **166**-N are managed based on the distributed ledger technology, tamper resistance thereof can be enhanced.

(124) [Modification]

(125) In the embodiment, whether or not to disclose information on a disclosed chemical substance to a downstream company is determined based on whether or not composition data of a product containing the chemical substance disclosed by an upstream company is included in public data **166**-N. Whether or not to disclose the information on the disclosed chemical substance to the downstream company, however, may be determined, for example, by setting a flag indicating necessity for keeping secret for each prescribed unit of data in product composition data **151**-N and **164**-N and making determination based on the flag.

(126) Though an embodiment of the present disclosure has been described, it should be understood that the embodiment disclosed herein is illustrative and non-restrictive in every respect. The scope of the present disclosure is defined by the terms of the claims and is intended to include any modifications within the scope and meaning equivalent to the terms of the claims.

Claims

1. An information management system that manages information on a chemical substance contained in a product distributed in a supply chain based on distributed ledger technology, the

information management system comprising: a first apparatus that belongs to a first company that manufactures a first product, the first apparatus including a first distributed ledger; a second apparatus that belongs to a second company that supplies a second product to be included in the first product to the first company, the second apparatus including a second distributed ledger; a third apparatus that belongs to a third company that supplies a third product to be included in the second product to the second company, the third apparatus including a third distributed ledger; and a management apparatus that manages the information management system, the management apparatus including a fourth distributed ledger, wherein each of the first distributed ledger, the second distributed ledger, the third distributed ledger, and the fourth distributed ledger includes a list showing the chemical substance managed in the information management system, composition data of the second product including composition data of the third product disclosed by the third apparatus is stored in the second apparatus, the management apparatus adds, when the management apparatus designates a new chemical substance to be managed in the information management system, the new chemical substance to the list in the fourth distributed ledger to update the list in the fourth distributed ledger, and transmits first transaction data that proposes addition of the new chemical substance to the corresponding list to update the corresponding list to the first apparatus, the second apparatus, and the third apparatus, the first apparatus, the second apparatus, and the third apparatus update the list in the first distributed ledger, the list in the second distributed ledger, and the list in the third distributed ledger based on the first transaction data from the management apparatus, respectively, when the new chemical substance is contained in composition of the third product, the third apparatus transmits second transaction data including the composition data of the third product including information on the new chemical substance to the second apparatus, and the second apparatus updates the composition data of the third product included in the composition data of the second product based on the second transaction data from the third apparatus to update the composition data of the second product, and transmits, when the second apparatus has determined to publish the composition data of the third product included in the composition data of the second product, third transaction data including the updated composition data of the second product to the first apparatus.

2. The information management system according to claim 1, wherein when the second apparatus has not determined to publish the composition data of the third product included in the composition data of the second product, the second apparatus performs first processing for publication of the information on the new chemical substance, and transmits the third transaction data including the information on the new chemical substance to the first apparatus based on approval obtained in the first processing.

3. The information management system according to claim 2, wherein the second distributed ledger includes a first secret area where transaction data not shared with the first distributed ledger, the third distributed ledger, and the fourth distributed ledger is stored, and a first public area where transaction data shared with at least one of the first distributed ledger, the third distributed ledger, and the fourth distributed ledger is stored, in the second apparatus, the composition data of the second product is stored in the first secret area and first public data is stored in the first public area, the first public data being data to be disclosed to the first company, of the composition data of the second product, and the second apparatus adds information on the new chemical substance to the composition data of the third product included in the composition data of the second product stored in the first secret area based on the second transaction data from the third apparatus, the second transaction data including the composition data of the third product including the information on the new chemical substance, to update the composition data of the second product, and adds, when the first public data includes the composition data of the third product yet to be updated, the updated composition data of the second product to the first public data to update the first public data and transmits the third transaction data including this updated first public data to the first apparatus.

4. The information management system according to claim 3, wherein when the first public data does not include the composition data of the third product yet to be updated, the second apparatus performs the first processing, and adds the updated composition data of the second product to the first public data based on the approval obtained in the first processing to update the first public data and transmits the third transaction data including this updated first public data to the first apparatus.

5. The information management system according to claim 4, wherein the third distributed ledger includes a second secret area where transaction data not shared with the first distributed ledger, the second distributed ledger, and the fourth distributed ledger is stored and a second public area where transaction data shared with at least one of the first distributed ledger, the second distributed ledger, and the fourth distributed ledger is stored, in the third apparatus, the second transaction data including the composition data of the third product is stored in the second secret area and second public data is stored in the second public area, the second public data being data to be disclosed to the second company, of the composition data of the third product, and the third apparatus performs, when the new chemical substance is added to the list in the third distributed ledger, second processing for incorporating information on the new chemical substance into the second public data, and transmits the second transaction data including the second public data including the information on the new chemical substance to the second apparatus based on approval obtained in the second processing.

6. The information management system according to claim 1, wherein the chemical substance included in the list is a chemical substance designated under laws and regulations.

7. An information management method for an information management system that manages information on a chemical substance contained in a product distributed in a supply chain based on distributed ledger technology, the information management system including a first apparatus that belongs to a first company that manufactures a first product, the first apparatus including a first distributed ledger, a second apparatus that belongs to a second company that supplies a second product to be included in the first product to the first company, the second apparatus including a second distributed ledger, a third apparatus that belongs to a third company that supplies a third product to be included in the second product to the second company, the third apparatus including a third distributed ledger, and a management apparatus that manages the information management system, the management apparatus including a fourth distributed ledger, each of the first distributed ledger, the second distributed ledger, the third distributed ledger, and the fourth distributed ledger including a list showing the chemical substance managed in the information management system, composition data of the second product including composition data of the third product disclosed by the third apparatus being stored in the second apparatus, the information management method comprising: adding, by the management apparatus, when the management apparatus designates a new chemical substance to be managed in the information management system, the new chemical substance to the list in the fourth distributed ledger to update the list in the fourth distributed ledger, and transmitting, by the management apparatus, first transaction data that proposes addition of the new chemical substance to the corresponding list to update the corresponding list to the first apparatus, the second apparatus, and the third apparatus; updating, by the first apparatus, the second apparatus, and the third apparatus, the list in the first distributed ledger, the list in the second distributed ledger, and the list in the third distributed ledger based on the first transaction data from the management apparatus, respectively; transmitting, by the third apparatus, when the new chemical substance is contained in composition of the third product, second transaction data including the composition data of the third product including information on the new chemical substance to the second apparatus; updating, by the second apparatus, the composition data of the third product included in the composition data of the second product based on the second transaction data from the third apparatus to update the composition data of the second product; and transmitting, by the second apparatus, when the second apparatus has determined to publish the

composition data of the third product included in the composition data of the second product, third transaction data including the updated composition data of the second product to the first apparatus.