

FINANCIAL INSTRUMENT MANAGEMENT SYSTEM AND FINANCIAL INSTRUMENT MANAGEMENT METHOD

CLAIM OF PRIORITY

5 The present application claims priority from Japanese patent application JP 2022-162139 filed on October 7, 2022, the content of which is hereby incorporated by reference into this application.

BACKGROUND OF THE INVENTION

10 The present invention is related to a financial instrument management system and a financial instrument management method.

 In order to achieve a sustainable society, the manufacturing industry and the distribution industry of a supply chain, for example, are also seeking measures for a reduction in environmental load in response to the social decarbonization trend. For
15 example, such measures as replacement by and operation of a facility having low energy consumption, procurement of electric power generation which uses fuel which has a low CO₂ emission amount and regenerative energy, delivery using electric vehicles, and the like are taken.

 In response to such a trend, financial institutions announce loans (for example,
20 environment social governance (ESG) bonds and sustainability-linked loans) having interest rates linked to target values (CO₂ emission amount and the like) relating to the environmental load in order to support operation of business operators which actively promote introduction of facilities and execution of tasks required for those measures.

 Moreover, some companies are running business for economic efficiency, but
25 companies are increasingly required, for the future, to have social importance of existence, for example, to continuously deal with financial problems or to make a continuous relationship of trust between the company and a business partner, rather than to make a temporary profit. Accordingly, some companies set social contribution as a policy, and such a company sometimes prioritizes investment in growth of future

business, stable operation of business, and achievement of a set target value of environmental load after certain sales obtained by a production activity are achieved.

As the background art of this invention, there exists JP 2022-14050 A. In JP 2022-14050 A, it is described that "A demand response control system includes a control device which executes demand adjustment by instructing, via a communication network, a consumer to adjust consumed electric energy set in advance at the consumer in response to a demand control request notified from an upper device via the communication network. The control device includes an information presentation unit configured to calculate, based on an environmental value obtained through the demand adjustment at the consumer, an evaluated value of the environmental value for each consumer, and to present the evaluated value to the consumer via the communication network" (see Abstract).

In the technology as described in JP 2022-14050 A, when the consumer also considers that an economic value different from the environmental value is important, the consumer is required to determine by itself a reduction amount based on economic rationality. In particular, in the technology as described in JP 2022-14050 A, the loan to which the interest rate linked to the target value relating to the environmental load is set is not considered. When the consumer has such a loan, the interest rate may change in accordance with an achievement state of the target value, and the consumer may suffer a disadvantage.

Moreover, in the supply chain, a product or a service may be provided from an order placement user to a customer via tasks such as procurement, production, and processing by a plurality of order reception users, but a reduction amount in a case in which such order placement and reception exist is not considered in the technology as described in JP 2022-14050 A.

SUMMARY OF THE INVENTION

Thus, at least one aspect of this invention is to execute control of a facility to simultaneously achieve a reduction in environmental load and an economic value

when a user of a supply chain holds a contract of a financial instrument to which an interest rate linked to the environmental load is applied.

In order to solve the above-described problems, the at least one aspect of this invention adopts to the following structures. A financial instrument management system comprises: a processor; and a memory, the memory holds: supply chain information indicating content of a task conducted by a user included in a supply chain, a facility used for the task, and an environmental load caused by the task; financial instrument information indicating a financial instrument having the user included in the supply chain as a debtor, an interest rate at a time when a target value of the environmental load is achieved by the user, and an interest rate at a time when the target value is underachieved by the user; and economic rationality information indicating an arithmetic expression for calculating an economic value generated by conducting the task, and the processor is configured to: determine a facility that possibly serves as a control target based on a result of comparison between a cost incurred when the interest rate at the time of underachievement of the target value based on the environmental load indicated by the supply chain information and the financial instrument information is applied and the economic value based on the arithmetic expression and the supply chain information; and generate a control message directed to the determined facility.

The at least one aspect of this invention can execute control of a facility to simultaneously achieve a reduction in environmental load and an economic value when a user of a supply chain holds a contract of a financial instrument to which an interest rate linked to the environmental load is applied.

Problems, structures, and effects except for those described above become apparent by the descriptions of embodiments below.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention can be appreciated by the description which follows in conjunction with the following figures, wherein:

Fig. 1 is a block diagram for illustrating a configuration example of a supply chain information-linked financial instrument management system;

Fig. 2A is a table for showing a data configuration example of a financial instrument information;

5 Fig. 2B is a table for showing a data configuration example of the financial instrument information;

Fig. 3A is a table for showing a data configuration example of a supply chain information;

10 Fig. 3B is a table for showing a data configuration example of the supply chain information;

Fig. 3C is a table for showing a data configuration example of the supply chain information;

Fig. 4A is a table for showing a data configuration example of an economic rationality information;

15 Fig. 4B is a table for showing a data configuration example of the economic rationality information;

Fig. 5 is a table for showing a data configuration example of a facility control information;

Fig. 6A is a sequence diagram for illustrating entire processing;

20 Fig. 6B is a sequence diagram for illustrating the entire processing;

Fig. 7 is a flowchart for illustrating an example of value evaluation and economic rationality estimation processing;

Fig. 8 is a flowchart for illustrating an example of interchange processing;

Fig. 9 is a flowchart for illustrating an example of facility control processing;

25 and

Fig. 10 is a view for illustrating a screen configuration example of an interchange processing screen;

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, embodiments of the present invention are described in detail with reference to the drawings. In the present embodiment, in principle, the same components are designated by the same reference numerals, and the repeated description is omitted. It should be noted that the present embodiment is merely an example for realizing the present invention and does not limit the technical scope of the present invention.

In the at least one embodiment, a scene in which, as a company of a supply chain, a business operator in the manufacturing industry is in charge of a component processing task, the business operator sets a target value of an environmental load, and a financial instrument to which an interest rate linked to this target value is set is used as a loan is taken as an example for description.

For example, the task is conducted in a sequence of financial contract, production/collection, packaging, and delivery. The at least one embodiment can be applied to not only the example of the manufacturing task, but also to capital investment in business administration, use of buildings and factory facilities, delivery tasks, energy procurement, and devices for operating those tasks.

FIG. 1 is a block diagram for illustrating a configuration example of a supply chain information-linked financial instrument management system 1. The supply chain information-linked financial instrument management system 1 includes, for example, a computer including a central processing unit (CPU) 11, an input device 12, an output device 13, a memory 14, an auxiliary storage device 15, and a communication device 16 which are coupled to one another via internal wires or in conformity to a bus standard. As the supply chain information-linked financial instrument management system 1, for example, a business computer, a personal computer (PC), or a general-purpose computer can be applied.

The CPU 11 includes a processor, and executes a program stored in the memory 14. The memory 14 includes a read only memory (ROM), which is a nonvolatile memory device, and a random access memory (RAM), which is a volatile memory device. The ROM stores, for example, an invariant program (for example,

basic input/output system (BIOS)). The RAM is a dynamic random access memory (DRAM) or other such high-speed and volatile memory device, and temporarily stores a program to be executed by the CPU 11 and data to be used at a time of execution of the program.

5 The auxiliary storage device 15 is, for example, a large-capacity and non-volatile storage device, such as a magnetic storage device (hard disk drive (HDD)) and a flash memory (solid state drive (SSD)). Programs to be executed by the CPU 11 and data to be used when the programs are executed are stored in the auxiliary storage device 15. Specifically, the programs are read out from the auxiliary storage device
10 15, loaded onto the memory 14, and executed by the CPU 11.

 The input device 12 is a device, such as a keyboard or a mouse, through which input from an operator is received. The output device 13 is a device, such as a display device or a printer, which outputs an execution result of a program in a form which the operator can visually recognize.

15 The communication device 16 is a network interface device which controls communication to and from another device in accordance with a predetermined protocol. The communication device 16 may include, for example, a serial interface such as USB (universal serial bus).

 A part or all of programs executed by the CPU 11 may be supplied, to the
20 supply chain information-linked financial instrument management system 1, from a removable medium (such as a CD-ROM or a flash memory) being a non-transitory storage medium or from an external computer provided with a non-transitory storage medium via a network, and may be stored in the nonvolatile auxiliary storage device 15 being a non-transitory storage medium. Thus, it is preferred that the supply chain
25 information-linked financial instrument management system 1 include an interface for reading data from the removable medium. Moreover, a part or all of the programs executed by the CPU 11 may have a configuration independent of the supply chain information-linked financial instrument management system 1, for example, may be stored on a cloud.

The supply chain information-linked financial instrument management system 1 is a computer system formed on physically one computer or formed on a plurality of computers that are configured logically or physically, and may be operated on separate threads on the same computer, or may operate on a virtual machine built on a plurality of physical computer resources.

The memory 14 includes, for example, a registration management module 21, an environmental load calculation module 22, a facility control module 23, a supply chain cooperation management module 24, an economic rationality estimation module 25, and a credit management module 26, each of which is a program.

The registration management module 21 executes registration of information on a user, information on the financial instrument, and the like. The environmental load calculation module 22 executes environmental load calculation processing described later. The facility control module 23 executes processing for controlling a production facility 4. The supply chain cooperation management module 24 executes processing such as generation of information on the supply chain. The economic rationality estimation module 25 executes value evaluation and economic rationality estimation processing described later. The credit management module 26 executes control right sale and purchase processing described later.

For example, the CPU 11 operates in accordance with the registration management module 21 being the program loaded onto the memory 14, to thereby implement a registration management function and operates in accordance with the environmental load calculation module 22 being the program loaded onto the memory 14, to thereby implement an environmental load calculation function. Regarding each of other programs included in the memory 14, the relationship between the program and the function implemented by the CPU 11 is the same.

A part or all of the functions implemented by the programs included in the memory 14 may be implemented by hardware, for example, an application specific integrated circuit (ASIC), a field-programmable gate array (FPGA), or the like.

The auxiliary storage device 15 holds, for example, financial instrument

information 31, supply chain information 32, facility control information 33, and economic rationality information 34. The financial instrument information 31 includes information on the financial instruments. The supply chain information 32 includes information on the supply chain. The facility control information 33 includes
5 information on the production facility 4. The economic rationality information 34 includes information on economic rationality of the users in the supply chain.

A part or all of the information stored in the auxiliary storage device 15 may be stored in the memory 14 or may be stored in an external database coupled to the supply chain information-linked financial instrument management system 1.

10 In the at least one embodiment, information used by the supply chain information-linked financial instrument management system 1 does not depend on its data structure, and may be expressed in any data structure. For example, a data structure appropriately selected from the table, the list, the database, and the queue can store the information.

15 Moreover, the supply chain information-linked financial instrument management system 1, a production management system 3, and the production facility 4 are coupled to one another via a network 2 such as the Internet. The production management system 3 includes, for example, a production plan/record management module 41 and an interchange processing module 42. The production plan/record
20 management module 41 manages a record of procurement, production, shipping, and the like of the manufacturing task of the user in the supply chain. The interchange processing module 42 executes interchange processing described later.

The supply chain information-linked financial instrument management system 1 may be coupled, via the network 2, to a terminal such as a smartphone or a PC which
25 is owned by each user in the supply chain and can be used to input and/or to view data. Moreover, a person in charge in a business partner of the user in the supply chain can use the terminal to input conditions and information on a production plan. Moreover, the terminal may also be coupled, via the network 2, to a terminal owned by a financial institution which registers the financial instruments.

The user in the supply chain conducts a task related to the manufacturing task, such as contract, manufacturing, shipping, and delivery, based on an instruction of the production plan/record management module 41 of the production management system 3. The user in the supply chain not only conducts the task in the own company, but
5 may also place an order for the task to a business partner of the user. The order placement and reception information on the task may be shared via the production management system 3.

The production facility 4 is a facility owned by the user of the supply chain which conducts the task, and is a facility for conducting, for example, metal press, heat
10 treatment, painting, or the like. To the production facility 4, a production situation measurement sensor 5 for measuring and collecting situations of production work such as an operation time and an energy consumption amount of the production facility 4 is added, and executes the measurement at any time.

Moreover, the production facility 4 has a communication function to cause a
15 state of completion of work and the like to be displayed on a web page or the like and transmit a measurement value obtained by the production situation measurement sensor 5 to the production management system 3, for example. Those pieces of information can be transmitted also to the supply chain information-linked financial instrument management system 1 via the network 2.

20 The production facility 4 may be a computer provided with a large-sized display. Moreover, a sensor such as a global positioning system (GPS) sensor which measures position information or the like may be built into the production facility 4. The production facility 4 is hereinafter also simply referred to as "facility."

FIG. 2A and FIG. 2B are tables for showing a data configuration example of
25 the financial instrument information 31. The financial instrument information 31 is, for example, information obtained by connecting the table shown in FIG. 2A and the table shown in FIG. 2B to each other in a direction of rows (that is, the financial instrument information 31 includes all fields of the table shown in FIG. 2A and all fields of the table shown in FIG. 2B).

The financial instrument information 31 is provided from the financial institution, and manages, through use of each record, the financial instrument contracted by a manufacturer. For example, each time the manufacturer being a debtor makes a contract for a financial instrument, a record of the financial instrument information 31 is added.

The financial instrument information 31 includes, for example, a financial instrument ID field 121, a financial instrument name field 122, a user ID field 123, a period field 124, an interest rate field 125, a target value field 126, a loan amount field 127, a status field 128, and a control right sale and purchase record field 129.

The financial instrument ID field 121 holds a financial instrument ID for identifying a financial instrument. The financial instrument name field 122 holds information indicating a name of the financial instrument. The user ID field 123 holds a user ID for identifying the user (manufacturer) being the debtor (contractor) of the financial instrument. The period field 124 holds information indicating a debt period of the financial instrument.

The interest rate field 125 holds information on an interest rate at a time of achievement of a target and an interest rate at a time of underachievement of the target. The target value field 126 holds information indicating an item to which a target linked to the interest rate is set and a target value. The target is defined as, for example, an index indicating an environmental load. The loan amount field 127 holds information indicating an amount of the loan of the user. The status field 128 holds information indicating a status indicating a current state of the item to which the target is set and a described item. The control right sale and purchase record field 129 holds information indicating sale and purchase record of a control right such as a date of trade of the control right, a price of the trade, the amount of the trade, destinations of purchase and sale of the trade, and the like.

FIG. 3A, FIG. 3B, and FIG. 3C are tables for showing a data configuration example of the supply chain information 32. The supply chain information 32 is, for example, information obtained by connecting the table shown in FIG. 3A, the table

shown in FIG. 3B, and the table shown in FIG. 3C to each other in a direction of rows (that is, the supply chain information 32 includes all fields of the table shown in FIG. 3A, all fields of the table shown in FIG. 3B, and all fields of the table shown in FIG. 3C).

The supply chain information 32 indicates information on an order placement and reception situation in the supply chain, a task load, and an environmental load caused to occur by the supply chain task. Supply chain tasks generated in a supply chain can be divided into one or more tasks, and orders for those tasks can be placed and received in the supply chain. Each record in the supply chain information 32 corresponds to one order placed and received in the supply chain (one task for which the order is placed and received).

The supply chain information 32 includes, for example, a supply chain task ID field 131, an order reception user ID field 132, a task classification field 133, a delivery date field 134, a number-of-products-in-received-order field 135, a finished-products-in-stock field 136, an estimated environmental load field 137, an estimated profit unit price field 138, an order placement user ID field 139, a work period field 140, a work facility field 141, a facility operation time field 142, a component/material type field 143, a component/material-in-stock field 144, and a progress rate field 145.

The supply chain task ID field 131 holds a supply chain task ID for identifying a task in the supply chain. The order reception user ID field 132 holds a user ID for identifying an order reception user (company) of the placed and received order for the task. The task classification field 133 holds information indicating a classification of the task.

The delivery date field 134 holds information indicating the delivery date of the placed and received order for the task. The number-of-products-in-received-order field 135 holds information indicating the number of products in the placed and received order for the task. The finished-products-in-stock field 136 indicates the number of products held by the order reception user in the placed and received order for the task. The number of finished products in stock can be considered as a surplus number of finished products which are not required to be produced by the order reception user in

the task of the received order.

The estimated environmental load field 137 holds information indicating an environmental load (for example, a CO₂ emission amount) (caused by the supply chain) estimated when the task of the placed and received order is to be conducted.

5 The estimated profit unit price field 138 holds information indicating a unit price (for example, a unit price per product to be delivered) of a profit of the order reception user which is estimated when the task of the placed and received order is to be conducted, and is gained through the completion of the task. The order placement user ID field 139 holds a user ID for identifying a user (company) which has placed the order of the
10 task.

The work period field 140 holds information indicating a period required for the task. The work facility field 141 holds information indicating a facility required to conduct the task. The facility operation time field 142 holds information indicating an operation time (operation time required to produce one product) of the work facility
15 when the task is to be conducted. The component/material type field 143 holds information indicating types of components and materials (for example, components and materials of the product to be manufactured) required to conduct the task. The component/material-in-stock field 144 holds information indicating the components and materials which are required to conduct the task, and are in the stock held by the
20 order reception user. The progress rate field 145 holds information indicating a progress rate (number of finished products occupied in the number of products in the received order) of the task.

The supply chain companies (users) have a hierarchical structure (tree structure) relating to the order placement and reception of the supply chain task. In
25 other words, for one supply chain task, an order placement user at the highest level may place an order to one or more order reception users at lower levels in the hierarchy, and each of the one or more order reception users may place an order to one or more users at further lower levels in the hierarchy. Thus, the supply chain information 32 may include a plurality of records including the same supply chain task ID, and an order

placing user in a certain record in the supply chain information 32 may be an order receiving user in another record including the same supply chain task ID as that in the certain record.

Thus, the hierarchical structure relating to the order placement and reception can be identified by, for example, repeating processing of searching, by an order reception user ID of a certain record in the supply chain information 32 as a key, for an order placement user ID of a record including the same supply chain task ID as that in the record or repeating processing of searching, by an order placement user ID of a certain record in the supply chain information 32 as a key, for an order reception user ID of a record including the same supply chain task ID as that in the record.

FIG. 4A and FIG. 4B are tables for showing a data configuration example of the economic rationality information 34. The economic rationality information 34 is, for example, information obtained by connecting the table shown in FIG. 4A and the table shown in FIG. 4B to each other in a direction of rows (that is, the economic rationality information 34 includes all fields of the table shown in FIG. 4A and all fields of the table shown in FIG. 4B).

Each record of the economic rationality information 34 indicates a calculation method for economic rationality in the supply chain task. The economic rationality information 34 includes, for example, an economic rationality ID field 151, a supply chain task ID field 152, a task classification field 153, an economic rationality arithmetic expression field 154, a description field 155, a stock/time shift field 156, a facility shift field 157, a material change field 158, a processing method change field 159, an urgency field 160, a control target field 161, and an economic rationality field 162.

The economic rationality ID field 151 holds an economic rationality ID for identifying a record of the economic rationality information 34. The supply chain task ID field 152 holds the supply chain task ID. The task classification field 153 holds information indicating the classification of the task.

The economic rationality arithmetic expression field 154 holds information indicating an arithmetic expression ("y" being a dependent variable indicates the

economic rationality) for calculating economic rationality of the task (economic value at the time when the task is to be conducted). The description field 155 holds information indicating a description of this arithmetic expression. Specifically, for example, the description field 155 indicates definition of an independent variable "x" of the arithmetic expression, a condition for calculation using the arithmetic expression, and the like.

Each of the stock/time shift field 156, the facility shift field 157, the material change field 158, the processing method change field 159, and the urgency field 160 indicates a parameter used for the arithmetic expression.

As four viewpoints affecting the task of a manufacturing industry, 4M (Man, Machine, Material, and Method) is known. The stock/time shift field 156 holds information relating to allocation of personnel and allocation of the finished products in stock in accordance with labor being one example of means relating to "Man" of 4M. The facility shift field 157 holds information relating to allocation relating to a facility being one example of means relating to "Machine" of 4M. The material change field 158 holds information relating to allocation of materials being one example of means relating to "Material" of 4M. The processing method change field 159 holds information relating to a change in processing method being one example of means relating to "Method" of 4M.

The urgency field 160 holds information indicating urgency of the task. The urgency is, for example, an index which takes a higher value as a work amount in the task becomes larger and takes a higher value as remaining days to the delivery date become smaller. The control target field 161 holds a flag indicating whether the task is a target of control. The economic rationality field 162 holds information indicating a value of estimated economic rationality.

FIG. 5 is a table for showing a data configuration example of the facility control information 33. The facility control information 33 includes, for example, a facility ID field 171, an address field 172, an economic rationality ID field 173, a control command field 174, a control amount field 175, and a condition field 176.

The facility ID field 171 holds a facility ID for identifying the production facility 4 held by the manufacturer. The address field 172 holds information indicating an address for accessing the production facility 4. The economic rationality ID field 173 holds the economic rationality ID. The control command field 174 holds information
5 indicating a control command for controlling the production facility 4. The control amount field 175 holds information indicating a control amount for the production facility 4. The condition field 176 holds information indicating a condition for controlling the production facility 4.

FIG. 6A and FIG. 6B are sequence diagrams for illustrating entire processing
10 executed in the at least one embodiment. First, description is given of persons (or organizations), systems, terminals, and the like relating to the processing. A financial institution 101 registers information on the financial instrument in the supply chain information-linked financial instrument management system 1, and acquires information on the environmental load from the supply chain information-linked
15 financial instrument management system 1 via an operation system 102. The financial institution 101 conducts a task relating to credit and sale of the financial instrument for a debtor (manufacturer 105 described later) of the supply chain companies.

A person in charge of the credit and a person in charge of the sale of the
20 financial institution 101 input information on the financial instrument and check display of information on the debtor and information on the environmental load via the operation system 102. The operation system 102 is, for example, a computer such as a PC. The debtor and the financial institution 101 can communicate to and from each other via the operation system 102.

25 The supply chain information-linked financial instrument management system 1 intermediates between the financial institution 101 and the production management system 3 of the supply chain company, to thereby execute acquisition of measurement information indicating the environmental load relating to the manufacturing task, management of various types of information, the interchange processing described

later, transmission of a control command directed to the production facility 4, and the like.

5 The manufacturer 105 undertakes the manufacturing task of the supply chain company and receives, as a debt, a financial instrument linked to the environmental load from the financial institution. In the at least one embodiment, the manufacturer 105 is a manufacturer which conducts a manufacturing task as business, but may be a department of headquarters or a holding company which consigns and combines the manufacturing (in this case, for example, supply chain companies at lower levels of the manufacturer 105 conducts the manufacturing task).

10 A manufacturer 106 is, for example, a contract company which conducts a task (for example, a manufacturing task such as processing of a component) an order for which is received from the manufacturer 105. A manufacturer 107 is, for example, a further contract company (for example, a subcontract company) which undertakes a task from the manufacturer 106. That is, the manufacturer 105, the manufacturer 106, 15 and the manufacturer 107 are included in one supply chain. When a further trading relationship exists in the supply chain, the supply chain includes a further contract company.

Moreover, each of the manufacturer 105, the manufacturer 106, and the manufacturer 107 holds an enterprise resource planning (ERP), an electronic data 20 interchange (EDI) system 108, and the like for managing tasks of placed and received orders by the manufacturer itself and managing stock held by the manufacturer itself. Cooperation with the production management system 3 is achieved by inputting, via the EDI system 108 and the like, information indicating the progress of a task and a trading situation.

25 Next, description is given of processing to be executed. The operation system 102 transmits information on a financial instrument to the supply chain information-linked financial instrument management system 1 to request registration of the information on the financial instrument or to request provision of the financial instrument to the manufacturer 105 being the debtor in accordance with input from the

financial institution 101 (S200).

The supply chain information-linked financial instrument management system 1 executes processing steps of Step S201 to Step S208 described below. The registration management module 21 receives information input via a device held by each user, and generates (or updates) the user information 30 in accordance with this received information to execute user registration (S201).

The user information 30 is stored in, for example, the auxiliary storage device 15, which is not shown in FIG. 1. The user information 30 is a table for managing, for example, information on the users for accessing the supply chain information-linked financial instrument management system 1.

Specifically, the user information 30 holds, for example, information on each of the financial institution 101, the manufacturer 105, the manufacturer 106, and the manufacturer 107 (any one thereof is an example of the user). Each record of the user information 30 includes, for example, a user ID, a user name, an organization to which the user belongs, a classification of the user (for example, a creditor, a debtor, and the like), a business type of the user, an access right of the user, contact information of the user, coupling information to the ERP and the EDI system held by the user and the production management system 3, and the like (a data configuration of the user information 30 is not shown).

The registration management module 21 registers the information received in Step S200 in the financial instrument information 31 and executes management of the financial instrument in response to the request for the provision of the financial instrument received in Step S200 (S202).

In Step S202, the registration management module 21 periodically (for example, monthly) updates, based on a value calculated in supply chain cooperation management processing of Step S203 described later, a value of the item which is indicated by the status field 128 of the financial instrument information 31, and to which the target is set. Moreover, the registration management module 21 determines whether or not the item value of the status field 128 exceeds the target value of the

target value field 126 (has achieved the target), and stores a determination result in the status field 128. The registration management module 21 determines which of the interest rate at the time of achievement of the target or the interest rate at the time of underachievement of the target indicated by the interest rate field 125 is to be employed in accordance with the determination result.

For example, in a record having a financial instrument ID of "F01" in the example of the financial instrument information 31 of FIG. 2A and FIG. 2B, "2.7 kg" is stored as the emission amount in the status field 128, and "2.7" kg does not exceed "2,000 kg" indicated by the target value field 126. As a result, in the status field 128, "within range" is stored as the state, and further, "2.0%/year" being the interest rate at the time of achievement of the target indicated by the interest rate field 125 is employed.

The EDI system 108 held by each of the manufacturers 105 to 107 executes EDI system cooperation processing of acquiring various types of information stored in the supply chain information 32 and the economic rationality information 34 (S221), and transmits the acquired information to the production management system 3. In Step S221, each EDI system 108 may acquire the information through the input via the input device, or may automatically acquire the information from the production facility 4 and the production situation measurement sensor 5.

The production plan/record management module 41 of the production management system 3 uses the information received from the EDI system 108 to execute production plan/record management processing (S211), and transmits the information stored in the supply chain information 32 and the economic rationality information 34 to the supply chain information-linked financial instrument management system 1. In Step S211, the production plan/record management module 41 executes processing of unifying the information on the manufacturers 105 to 107 for each supply chain, and then transmits the information to the supply chain information-linked financial instrument management system 1 as required.

The supply chain cooperation management module 24 executes the supply chain cooperation management processing (S203). In Step S203, the supply chain

cooperation management module 24 registers or updates the supply chain information 32 in accordance with the information received from the production management system 3.

5 The supply chain cooperation management module 24 calculates an emission amount for each supply chain task based on the value in the estimated environmental load field 137 and the value in the progress rate field 145 of the supply chain information 32. For example, in a record of the supply chain information 32 of FIG. 3A, FIG. 3B, and FIG. 3C which has "SC01" in the supply chain task ID, an estimated environmental load is "3 kg," and the progress rate is "90%" in the supply chain. Thus, 10 the supply chain cooperation management module 24 calculates "3 kg×90%=2.7 kg" as the emission amount in the supply chain having "U001" in the order reception user ID and having "SC01" in the supply chain task ID. In Step S202 described above, the registration management module 21 stores "2.7 kg" being the emission amount in the supply chain in the status field 128 of the financial instrument information 31 having 15 "U001" in the user ID. When the same user is the order reception user of a plurality of supply chain tasks, for example, a total value of the emission amounts (and/or the emission amount in each task) in the plurality of supply chain tasks is stored in the status field 128 of the user.

For example, the supply chain cooperation management module 24 may 20 receive information indicating a production amount (task amount) of each order reception user from the production management system 3, and may calculate the progress rate corresponding to the order placement and reception from the production amount and the number of products in the received order. For example, in the record of the supply chain information 32 of FIG. 3A, FIG. 3B, and FIG. 3C which has "SC01" 25 in the supply chain task ID, information indicating that "90" products have been produced with respect to the number "100" of products in the received order indicated by the number-of-products-in-received-order field 135 is received, and hence "90%" is stored in the progress rate field 145.

After that, the environmental load calculation module 22 executes the

environmental load calculation processing (S204). In Step S204, the environmental load calculation module 22 calculates a controllable quota for each record (each placed or received order) of the supply chain information 32. Specifically, for example, the environmental load calculation module 22 calculates, for each record, as the controllable quota, a value obtained by multiplying the value indicated by the estimated environmental load field 137 by a remaining task rate (100%-progress rate). For example, in the order placement and reception in the record which is on the uppermost row of the supply chain information 32 of FIG. 3A, FIG. 3B, and FIG. 3C and has "SC01" in the supply chain task ID, "0.3 kg" corresponding to 10% (=100%-progress rate 90%) of the estimated environmental load of "3 kg" is the controllable quota.

Moreover, in the above-mentioned example, the example in which the information indicating the estimated environmental load is received from the production management system 3 in Step S203 is described, but the environmental load calculation module 22 may calculate the estimated environmental load, and may store the estimated environmental load in the supply chain information 32 in Step S204. For example, it is assumed that the CO₂ emission amount per consumed electric power and consumed electric power for each work facility are defined in advance. For example, in the order placement and reception in the record which is on the uppermost row of the supply chain information 32 of FIG. 3A, FIG. 3B, and FIG. 3C and has "SC01" in the supply chain task ID, a "press facility A" was used for "2 hours." Thus, when the CO₂ emission amount per 1 kWh of the consumed electric power is 0.4 kg, and the consumed electric power of the press facility A is 3.75 kWh, "3.75 kWh×2 hours×0.4=3 kg" is calculated as the estimated environmental load.

After that, the economic rationality estimation module 25 executes the value evaluation and economic rationality estimation processing (S205).

FIG. 7 is a flowchart for illustrating an example of the value evaluation and economic rationality estimation processing of Step S205. The economic rationality estimation module 25 selects, among the supply chain task IDs included in the supply chain information 32, one supply chain task ID which is to be evaluated and has not

been selected (S701). The supply chain task ID to be evaluated may be determined in advance, and a part of the supply chain task IDs may be to be evaluated or all of the supply chain task IDs may be to be evaluated. For example, in Step S701, the economic rationality estimation module 25 selects the supply chain task ID "SC01."

5 The economic rationality estimation module 25 acquires, from the economic rationality information 34, information on the economic rationality arithmetic expression included in the record corresponding to the supply chain task ID selected in Step S701 (S702). Specifically, for example, the economic rationality estimation module 25 acquires, as the information on the economic rationality arithmetic expression, from
10 the economic rationality information 34, the economic rationality ID, the supply chain task ID, the task classification, the economic rationality arithmetic expression, the description, and the parameters of the economic rationality arithmetic expression (among the stock/time shift, the facility shift, and the urgency, parameters whose values have been acquired).

15 For example, when the supply chain task ID "SC01" is selected in Step S701, the economic rationality estimation module 25 acquires, from the economic rationality information 34, the economic rationality ID "E01," the supply chain task ID "SC01," the task classification "manufacturing," the economic rationality arithmetic expression " $y=ax-b$," the description "Preferentially use held stock, amount in stock is used as
20 variable x ," the stock/time shift "stock first out, $a=30$," and the facility shift "delivery cost, $b=30$ " in Step S702.

 This economic rationality arithmetic expression is expressed as a linear function of " $y=ax-b$." " y " indicates the economic rationality. The independent variable " x " indicates a held amount in stock to be used. A constant " a " indicates a
25 profit gained by using one product in the held stock. A constant " b " indicates a cost incurred additionally (cost incurred by the delivery of the held stock). Necessity of the execution of the manufacturing task is reduced by an amount of the held stock used preferentially by the order reception user, and hence the production facility is not to be operated. As a result, the environmental load caused by the scheduled emission

decreases. This economic rationality arithmetic expression " $y=ax-b$ " indicates a profit derived from the manufacturing task which is not required to be conducted.

5 A determination of the economic rationality is made through comparison between a cost incurred by an increase in interest rate due to failure in the reduction in environmental load (due to the underachievement of the target) and an amount lost by stopping or shifting the production task to reduce the environmental load, details of which are described later.

10 The economic rationality information 34 of FIG. 4A and FIG. 4B includes a plurality of (two) records having "SC01" in the supply chain task ID. In Step S702, for example, the value of a record advantageous (for example, small) in the value of " y " of the economic rationality arithmetic expression among the plurality of records may be acquired or the plurality of records may be presented to the user of the supply chain information-linked financial instrument management system 1 (may be displayed on the output device 13), and the record to be acquired may be determined through input
15 of the user.

The economic rationality estimation module 25 acquires information (for example, all items of FIG. 3A, FIG. 3B, and FIG. 3C) on the production situation included in each record corresponding to the supply chain task ID selected in Step S701 from the supply chain information 32 (S703).

20 For example, when the supply chain task ID "SC01" is selected in Step S701, the economic rationality estimation module 25 acquires, from the supply chain information 32, the supply chain task ID "SC01," an order reception user ID "U001," a task classification "manufacturing," a delivery date "April 11, 2022," the number "100" of products in the received order, finished products in stock "200," an estimated
25 environmental load "3 kg," an estimated profit unit price "100," an order placement user ID "U321," a work period "-April 11, 2022," a work facility "press facility A," a facility operation time "2 hours," a material type "metal, aluminum, U shape," a component/material in stock "1,000," and a progress rate "90%" in Step S703.

The EDI system 108 may execute the EDI system cooperation processing of

acquiring the above-mentioned information on the production situation from the production facility 4 and the production situation measurement sensor 5 and transmitting the acquired information to the supply chain information-linked financial instrument management system 1 as illustrated in Step S222 of FIG. 6B, and the economic rationality estimation module 25 may update the supply chain information 32 based on the received information on the production situation in Step S703.

The economic rationality estimation module 25 uses the information acquired in Step S702 (when a plurality of supply chain task IDs are selected, may use a value obtained by summing the values in the records having the corresponding supply chain task ID) to estimate a value of the economic rationality, and stores the estimated value together with a date of calculation in the economic rationality field 162 (S704). For example, when the supply chain task ID "SC01" is selected in Step S701, the economic rationality estimation module 25 calculates, as the value of the economic rationality, " $y=ax-b=30 \times 10-30=270$ (yen)" in Step S704.

The economic rationality estimation module 25 compares the value of the economic rationality calculated in Step S704 and the cost at the time of underachievement of the target with each other (S705). For example, when the supply chain task ID "SC01" is selected in Step S701, the economic rationality estimation module 25 calculates, as the cost at the time of underachievement of the target, " $(\text{estimated environmental load } 3 \text{ kg} \times (1 - \text{progress rate } 90\%) / \text{target value } 2,000 \text{ kg}) / \text{loan amount } 10 \text{ million yen} \times \text{annual interest rate } 2.0\% / \text{year} = 30 \text{ yen}$ " in Step S705. Moreover, the progress rate is 90% with respect to the number "100" of products in the received order, and hence the remaining required number of products to be produced is " $100 \times (1 - \text{progress rate } 90\%) = 10$." A cost per product caused by the increase in interest rate is 3 yen.

The value of the above-mentioned economic rationality "y" is 270 yen and the cost per product due to the increase in interest rate is 3 yen. In other words, the value of the economic rationality is larger than the cost, and hence the economic rationality estimation module 25 stores "1" and an interchangeable amount 0.3 kg (estimated

environmental load 3 kg×remaining progress rate (1-90%)) in the control target field 161 corresponding to "E01" being this economic rationality ID in the economic rationality information 34 in a processing step of Step S707 described later.

It is assumed that the interest rate of the loan amount is represented by a rate per year, and the target value is also represented as a numerical value per year in the above-mentioned example. When the unit period of the interest rate and the unit period of the target value are different from each other, it is required to match the unit periods with each other. For example, in a case in which only an environmental load caused by direct work influences the interest rate (there is also a case in which an emission amount in indirect work and a task such as transport also influences the interest rate), an interest rate per direct work is calculated as, for example, "number of work days 10/365 days*annual interest rate 4%=0.0011%."

The economic rationality estimation module 25 determines whether or not all of the supply chain task IDs which are to be evaluated among the supply chain task IDs included in the supply chain information 32 have been selected (S706). When the economic rationality estimation module 25 determines that a supply chain task ID which has not been selected among those supply chain IDs exists (NO in S706), the economic rationality estimation module 25 returns the process to Step S701.

When the economic rationality estimation module 25 determines that a supply chain task ID which has not been selected among those supply chain task IDs does not exist (YES in S706), the economic rationality estimation module 25 reflects the comparison result in the economic rationality information 34 (S707), and finishes the value evaluation/economic rationality estimation processing. In Step S707, for example, the economic rationality estimation module 25 stores, for the economic rationality ID for which the value of the economic rationality calculated in Step S704 is larger than the cost at the time of underachievement of the target, "1" in the control target field 161 corresponding to the economic rationality ID in the economic rationality information 34.

Urgency "c" may be considered as in an economic rationality arithmetic

expression " $y=(ax-b)\times(-c)$ " in a record having "E02" in the economic rationality ID in the economic rationality information 34 of FIG. 4A and FIG. 4B. The economic rationality decreases as the urgency increases in the economic rationality arithmetic expression. The profit may change from initial estimation due to, for example, a change in delivery date caused by deficiency in component, allocation of personnel, a request from another facility or a customer, and the like in the manufacturing industry, and those circumstances can be reflected by incorporating the urgency into the arithmetic expression. The urgency "c" is, as described above, the index which takes a higher value as the work amount in the task becomes larger and takes a higher value as the remaining days to the delivery date becomes smaller.

For example, the value of the urgency "c" may directly be given through the EDI system cooperation, or may be calculated by the economic rationality estimation module 25 based on the remaining work amount and the number of remaining days to the delivery date. An example in which the economic rationality estimation module 25 calculates the urgency "c" of the supply chain task having "SC01" of the supply chain information 32 of FIG. 3A, FIG. 3B, and FIG. 3C is now described. For example, the progress rate is 90% with respect to the number "100" of products in the received order of the supply chain task, and hence the facility operation time required to produce the remaining " $100\times(1-90\%)=10$ " products is "2 hours $\times$ 10=20 hours." The delivery date is April 11, 2022, and hence the number of days which can be used for the work is 3 days when the current date is April 7, 2022. In this case, the urgency "c" is 0.95, which is a value obtained by dividing 20 hours being the facility operation time required for producing the remaining 10 products by 21 hours being the number of days which can be used for the work.

FIG. 6A and FIG. 6B are now described again. After that, the supply chain information-linked financial instrument management system 1 and the production management system 3 execute the interchange processing (S206). Moreover, the production management system 3 transmits an interchange plan based on a result of the interchange processing to each EDI system 8, and each EDI system 8 executes

the EDI system cooperation processing of controlling the production facility 4 in accordance with the interchange plan (S223).

FIG. 8 is a flowchart for illustrating an example of the interchange processing. An example in which the supply chain cooperation management module 24 included in the supply chain information-linked financial instrument management system 1 executes the interchange processing is described in the following description, but the interchange processing module 42 included in the production management system 3 may execute the interchange processing (after information required for the interchange processing is acquired from the supply chain information-linked financial instrument management system 1). The supply chain cooperation management module 24 selects one supply chain task ID which is a supply chain task ID in a record having "1" stored in the control target field 161 of the economic rationality information 34 and has not been selected (S801). In the example of the economic rationality information 34 of FIG. 4A and FIG. 4B, for example, the supply chain task ID "SC01" is selected in Step S801.

The supply chain cooperation management module 24 identifies an order placement and reception relationship of the task having the supply chain task ID identified in Step S801 (S802). Specifically, for example, the supply chain cooperation management module 24 acquires all records each including the supply chain task ID selected in Step S801 from the supply chain information 32. The supply chain cooperation management module 24 identifies a hierarchical structure (tree structure) of the order placement and reception in the supply chain task by routing through the order placement user ID and the order reception user ID among those acquired records. Moreover, the supply chain cooperation management module 24 refers to the financial instrument information 31 to identify users which are included in the order placement and reception relationship and are debtors.

The supply chain cooperation management module 24 calculates an interchangeable quota between the order placement and reception users identified in Step S802 in the supply chain task selected in Step S801 (S803). Specifically, for

example, the supply chain cooperation management module 24 acquires the values in the estimated environmental load fields 137 with respect to the supply chain task IDs in the entire tree having the supply chain task ID selected in Step S801 as a top (that is, the environmental load which occurs when the task is performed). When the supply chain task ID "SC01" is selected in Step S801, the estimated environmental load corresponding to "SC01" is "3 kg" in the example of FIG. 3A, FIG. 3B, and FIG. 3C, and hence the maximum interchangeable amount at the time when the task of "SC01" is not conducted is 3 kg. The progress rate corresponding to "SC01" is 90% (that is, 10% of the work has not been completed), and hence "3 kg×10%=0.3 kg" is set as the interchangeable quota. When a plurality of pieces of work to be controlled exist, the interchangeable quota is calculated as a sum of the interchangeable quotas thereof.

The supply chain cooperation management module 24 determines whether or not all of the supply chain task IDs to be controlled have been selected (S804). When the supply chain cooperation management module 24 determines that a supply chain task ID which has not been selected exists in the supply chain task IDs to be controlled (NO in S804), the economic rationality estimation module 25 returns the process to Step S801.

When the supply chain cooperation management module 24 determines that all of the supply chain task IDs to be controlled have been selected (YES in S804), the supply chain cooperation management module 24 sets information relating to the interchange (S805), and finishes the interchange processing. In Step S805, for example, the supply chain cooperation management module 24 stores "1" being the value of the flag indicating the control target and the interchangeable quota calculated in Step S803 in the control target field 161 corresponding to each supply chain task ID selected in Step S801 in the economic rationality information 34. The interchange based on the interchangeable quota is executed through, for example, an interchange processing screen of FIG. 10 described later.

FIG. 6A and FIG. 6B are now described again. After that, the credit

management module 26 executes the control right sale and purchase processing (S207). Specifically, in Step S207, for example, the following procedure and processing are executed.

5 The financial institution 101 determines a financial instrument being a target of the control right sale and purchase, and shows, to business partners of the financial institution 101 and the like (for example, investors), that the control right can be sold and purchased. The financial institution 101 and the business partner make a sale contract of the control right (the financial institution 101 is a seller of the control right and the business partner is a buyer of the control right).

10 The credit management module 26, for example, acquires the financial instrument ID of the financial institution through input to the operation system 102 or the like by a person in charge of the financial institution 101, and identifies, in the financial instrument information 31, the target of the control target (control right) based on the user ID corresponding to the acquired financial instrument ID. Specifically, the
15 credit management module 26 identifies, in the supply chain information 32, the supply chain task ID which includes the user ID as the order reception user or the order placement user, and extracts, as a control target, from the economic rationality information 34, a record which corresponds to the identified supply chain task ID, and has "1" stored in the control target field 161.

20 The credit management module 26 identifies the economic rationality ID of the extracted record, and identifies the control amount corresponding to the identified economic rationality ID in the facility control information 33. The credit management module 26 stores, as a trade amount, the identified control amount in the control right sale and purchase record field 129 corresponding to the financial instrument ID in the
25 financial instrument information 31.

Moreover, the credit management module 26 acquires a date of the sale and purchase contract and a name of the business partner through input to the operation system 102 or the like from the person in charge of the financial institution 101, and stores the date and the name in the control right sale and purchase record field 129

corresponding to the financial instrument ID of the financial instrument information 31.

Moreover, the credit management module 26 stores a control right trading price in the control right sale and purchase record field 129 corresponding to the financial instrument ID of the financial instrument information 31. For example, the credit management module 26 calculates the control right trading price based on the control amount. Specifically, for example, the credit management module 26 sets the control right trading price corresponding to the control amount (control ID) in accordance with an instruction of the seller of the control right, and presents the control right trading price to the buyer. The control right trading price is determined when the credit management module 26 receives, from the buyer, a notification of the purchase of the control right at the control right trading price. Moreover, the control right trading price may be determined through price negotiation between the financial institution 101 and the business partner, or the control right trading price may be determined by another system.

In the above-mentioned example, the financial institution 101 sells the control right to the business partner being a third party, but the control right may be sold to, for example, a business partner of the business partner through intermediation of a securities company. In this case, a sale and purchase history is stored in the control right sale and purchase record field 129.

After that, the facility control module 23 executes facility control processing (S208).

FIG. 9 is a flowchart for illustrating an example of the facility control processing. The facility control module 23 selects, from the economic rationality information 34, one economic rationality ID which is an economic rationality ID included in a record storing the flag having the value of "1" indicating the control target and has not been selected, and acquires a record including the selected economic rationality ID from the facility control information 33 (S901).

The facility control module 23 acquires the control command (indicating a control method set for each facility) from the selected record (S902). In the control

command field 174 of the facility control information 33, a control command for reducing the environmental load (for example, reducing or eliminating the emission amount of the CO₂) is stored. Any one of turning off the facility, power down (reducing operation output), a weak operation, and an intermittent operation is an example of the control command.

The facility control module 23 determines a control amount of the facility being selected (S903). For example, in the economic rationality information 34 of FIG. 4A and FIG. 4B, the flag having the value of "1" is stored in the control target field 161 of the record having the economic rationality ID "E01," and the record includes the supply chain task ID "SC01." In the record having the supply chain task ID "SC01" in the supply chain information 32 of FIG. 3A, FIG. 3B, and FIG. 3C, the facility operation time is 2 hours and the progress rate is 90%. Thus, the control for "2 hours×(1-90%) = 12 min" is to be executed. Accordingly, in this example, the facility control module 23 stores "12 min" in the control amount field 175 in the record having "E01" in the economic rationality ID of the facility control information 33 of FIG. 6.

The facility control module 23 generates a control message directed to the facility being selected, and transmits the generated control message to an address in the address field 172 corresponding to the facility being selected (S904).

A generation method for the control message directed to the facility ID "3" in the facility control information 33 of FIG. 5 is now described. The facility control module 23 generates a control message obtained through uniform resource locator (URL) conversion such as "http://xxxx/Device/00032/date_time=10:00-10:12&command=off" based on an address indicated in the address field 172 to achieve OFF (control command) for 12 min (control amount) on, for example, 2022.4.10 (date indicated by the economic rationality field 162 of the record having "E01" in the economic rationality ID in the economic rationality information 34 of FIG. 4A and FIG. 4B) (however, time specification of "10:00-10:12" indicated in the condition field 176 is made). The specified time "10:00-10:12" indicated in the condition field 176 is determined, for example, by "12 min" indicated by the control amount field 175

and a control start time of "10:00" specified by a user owning the facility.

The facility control module 23 determines whether or not all of the economic rationality IDs included in the records each storing the flag having the value of "1" indicating the control target have been selected in the economic rationality information 34 (S905). When the facility control module 23 determines that an economic rationality ID which has not been selected among the economic rationality IDs included in the records each storing the flag having the value of "1" indicating the control target exists in the economic rationality information 34 (NO in S905), the facility control module 23 returns the process to Step S901.

When the facility control module 23 determines that all of the economic rationality IDs included in the records each storing the flag having the value of "1" indicating the control target have been selected in the economic rationality information 34 (YES in S905), the facility control module 23 registers the control execution result (S906), and finishes the facility control processing.

In Step S906, for example, when the facility control module 23 has received, from the production management system 3 or the EDI system 108, a response indicating completion of the execution of the facility control indicated by the control message, a time of execution, executed control, and the like, the facility control module 23 identifies the economic rationality ID corresponding to the facility in the facility control information 33, changes the value of the flag stored in the control target field 161 corresponding to the identified economic rationality ID to "0" in the economic rationality information 34, and stores, in the control target field 161, a log indicating the time of execution and the executed control indicated by the response. Moreover, the facility control module 23 also executes overwrite with a similar message in the production management system 3 (for example, it is assumed that the supply chain information-linked financial instrument management system 1 shares, with the production management system 3, information including the control target and the control amount).

In Step S903, the facility control module 23 executes processing of

determining a supply chain task which possibly serves as the control target based on the target value of the environmental load, the record of the emission amount, and the estimated emission amount in the number of remaining days.

Specifically, for example, the following processing is executed. The facility control module 23 selects one record including the flag having the value of "1" stored in the control target field 161 of the economic rationality information 34 (as priority for selecting the record, for example, a record having a larger value in the economic rationality field 162 is selected first). For example, it is assumed that the facility control module 23 selects the record having "E01" in the economic rationality ID of the economic rationality information 34 of FIG. 4A and FIG. 4B. The facility control module 23 identifies the supply chain task ID "SC01" indicated by the record, and identifies the order reception user ID "U001" of the record having "SC01" in the supply chain task ID in the supply chain information 32 of FIG. 3A and FIG. 3B. Further, the facility control module 23 identifies a record including the order reception user ID "U001" as the user ID (debtor) from the financial instrument information 31 of FIG. 2A and FIG. 2B.

The target value is "2,000 kg" in the record having "F01" in the financial instrument ID of the financial instrument information 31 of FIG. 2A and FIG. 2B, the emission amount at the time of "20220401" indicated by the status in the record is 2.7 kg, and a start date of the period in this record is "20220322" and an end date thereof is "20240301."

That is, the emission amount in ten days from "20220322" being the start date to "20220401" indicated by the status is "2.7 kg," and hence the facility control module 23 calculates $2.7 \text{ kg} / 10 = 0.27 \text{ kg}$ as the emission amount per day.

Further, the facility control module 23 acquires the current date. It is assumed that the current date is, for example, "October 1, 2022." The facility control module 23 calculates 548 days being the number of remaining days from the current date "October 1, 2022" to the end date "20240331" of the period. The facility control module 23 calculates "number of remaining days $548 \times$ emission amount per day 0.27

kg=emission amount 147.96 kg." The emission amount 147.96 kg emitted in the number of remaining days is smaller than the target value "2,000 kg," and hence the facility control module 23 determines that the task indicated by the supply chain task ID "SC01" corresponding to the economic rationality ID "E01" possibly serves as the control target.

The facility control module 23 applies the above-mentioned processing (however, within a range in which the CO₂ emission amount does not exceed the target value) to each record including the flag having the value "1" in the control target field 161 of the economic rationality information 34.

Moreover, the facility control module 23 may execute, for example, in Step S903, the following processing as the processing of determining the supply chain task which possibly serves as the control target. The target value in the record having "F01" in the financial instrument ID of the financial instrument information 31 of FIG. 2A and FIG. 2B is "2,000 kg," and the user ID indicated in the record is "U001." The supply chain task ID of the record including the user ID "U001" as the order reception user in the supply chain information 32 is "SC01," and the estimated environmental load indicated by this record is "3 kg." Thus, when the supply chain task identified by "SC01" is completed, 3 kg of CO₂ has been emitted.

In other words, when the number of days of work of the supply chain task identified by "SC01" is 10 days, CO₂ of "30 kg/10 days=3 kg/day" is emitted. Thus, when the above-mentioned estimated environmental load is maintained, the CO₂ emission amount first exceeds the target value when 666.666 days obtained by dividing the target value 2,000 kg by 3 kg/day have elapsed since the start of the work.

Moreover, the loan period corresponding to the financial instrument ID "F01" is from "20220322" to "20240331," and the number of remaining days until the end date of the loan period is 724 days when the current date is April 7, 2022. In this case, 724-666.666=57.344. That is, there exists a margin of 57 days or more until the loan period end date when the CO₂ emission amount exceeds the target value after the supply chain task identified by "SC01" is conducted every day. As described above,

when the difference obtained by subtracting the number of days until the CO₂ emission amount exceeds the target value from the number of remaining days until the end date of the loan period is a positive value, and a record identified by the supply chain task ID having high economic rationality exists, a determination of repeated execution is made.

Moreover, the above-mentioned determination of the repeated execution is made until the above-mentioned condition in the determination is satisfied sequentially from a supply chain task ID which corresponds to the highest value in the economic rationality field 162 after the interest rate comparison among the supply chain task IDs of the economic rationality information 34.

Moreover, when the target of the environmental load is not achieved even after the interchange processing and the facility control processing are executed, the higher interest rate at the time of underachievement of the target is applied in principle. However, the debtor of the financial institute can apply the lower interest rate at the time of achievement of the target by negotiating with the financial institution or purchasing the emission right from the trade destination or the interchange destination, for example.

FIG. 10 is a view for illustrating a screen configuration example of an interchange processing screen. An interchange processing screen 1000 is displayed in the EDI system 108 of each manufacturer (which may be only each manufacturer being the debtor or only the manufacturer at the highest level in the tree structure of the supply chain) and the like through the EDI system cooperation processing of Step S223 when the interchange processing of Step S206 is executed.

The interchange processing screen 1000 includes, for example, an interchange remaining number display area 1001, an interchangeable list display area 1002, a request content display area 1003, a request execution button 1004, and a cancel button 1005.

In the interchange remaining number display area 1001, a display frame for the interchange remaining number calculated from the target value of the

environmental load defined in the financial instrument is displayed. In the example of FIG. 10, in the interchange remaining number display area 1001, it is displayed that the interchange remaining number of the CO₂ emission amount is 32.2 kg, and an estimated excess of the CO₂ emission amount (from the target value) of 0.02 kg is generated when the task of the received order is completed. It is preferred that, for example, the calculation of the interchange remaining number and the excess estimation be executed together with the calculation of the interchangeable quota in Step S803.

In the interchangeable list display area 1002, a list of users in the supply chain which can interchange the environmental load is displayed as a flow (the orders in the supply chain are placed from the left to the right). In the example of FIG. 10, in the interchangeable list display area 1002, information on a manufacturer of each user which can offer the interchange, such as a company name, a department in charge, content of business, and a name of person in charge, and an interchangeable quota and a response (which indicates, for example, a production facility used for work to be interchanged and task classification and a delivery date of the work to be interchanged) are displayed.

When one user displayed in the interchangeable list display area 1002 is selected, request content which is directed to the selected user and relates to the interchange of the environmental load (for example, the control amount, the condition, and the like which are indicated by the facility control information 33 and are in the facility owned by the selected user (correspondence between the facility and the user which owns this facility is defined in advance)) is displayed in the request content display area 1003. As the request content, for example, request content including a date, a date and time, an interchange item, and processing for the interchange is displayed.

Under the state in which one user displayed in the interchangeable list display area 1002 is selected and the request content is displayed in the request content display area 1003, when the request execution button 1004 is selected, the request

content is transmitted to the selected user. Moreover, when the cancel button 1005 is selected, for example, the interchange processing screen 1000 is finished.

As described above, the supply chain information-linked financial instrument management system 1 according to the at least one embodiment determines a facility
5 which possibly serves as the control target based on the result of comparison between the value of the economic rationality of the user in the supply chain and the cost at the time of underachievement of the financial instrument linked to the environmental load, to thereby make a determination economically rational for the user.

Moreover, the supply chain information-linked financial instrument
10 management system 1 allows the user being the debtor to achieve the target value of the environmental load, to consequently reduce the environmental load, to thereby receive the low interest rate at the time of achievement of the target through the cooperative interchange of the environmental load among the users in the supply chain.

This invention is not limited to the above-described embodiments but includes
15 various modifications. The above-described embodiments are explained in details for better understanding of this invention and are not limited to those including all the configurations described above. A part of the configuration of one embodiment may be replaced with that of another embodiment; the configuration of one embodiment may be incorporated to the configuration of another embodiment. A part of the
20 configuration of each embodiment may be added, deleted, or replaced by that of a different configuration. The above-described configurations, functions, and processors, for all or a part of them, may be implemented by hardware: for example, by designing an integrated circuit.

The above-described configurations and functions may be implemented by
25 software, which means that a processor interprets and executes programs providing the functions. The information of programs, tables, and files to implement the functions may be stored in a storage device such as a memory, a hard disk drive, or an SSD (Solid State Drive), or a storage medium such as an IC card, or an SD card.

The drawings show control lines and information lines as considered

necessary for explanations but do not show all control lines or information lines in the products. It can be considered that almost of all components are actually interconnected.

What is claimed is:

1. A financial instrument management system, comprising:

a processor; and

5 a memory,

wherein the memory holds:

supply chain information indicating content of a task conducted by a user included in a supply chain, a facility used for the task, and an environmental load caused by the task;

10 financial instrument information indicating a financial instrument having the user included in the supply chain as a debtor, an interest rate at a time when a target value of the environmental load is achieved by the user, and an interest rate at a time when the target value is underachieved by the user; and

economic rationality information indicating an arithmetic expression for
15 calculating an economic value generated by conducting the task, and

wherein the processor is configured to:

determine a facility that possibly serves as a control target based on a result of comparison between a cost incurred when the interest rate at the time of underachievement of the target value based on the environmental load indicated by
20 the supply chain information and the financial instrument information is applied and the economic value based on the arithmetic expression and the supply chain information;
and

generate a control message directed to the determined facility.

25 2. The financial instrument management system according to claim 1,

wherein the supply chain information indicates at least one of an operation time of the facility in the task, a type of a material required for the task, an amount in stock of the material of the task, or an amount in stock of finished products of the task,
and

wherein the processor is configured to calculate the economic value by assigning the at least one of the operation time, the type of the material, the amount in stock of the material, or the amount in stock of the finished products to the arithmetic expression.

5

3. The financial instrument management system according to claim 1,

wherein the memory holds facility control information indicating a control command for each facility,

wherein the supply chain information indicates an operation time of the facility

10 in the task and a progress rate of the task, and

wherein the processor is configured to:

refer to the supply chain information to acquire the operation time of the determined facility and the progress rate;

15 determine a control amount of the facility based on the acquired operation time and progress rate; and

include, in the control message, the determined control amount and the control command for the determined facility indicated by the facility control information.

20

4. The financial instrument management system according to claim 1,

wherein the supply chain information indicates a progress rate of the task and a relationship between order placement and order reception of the task of the user included in the supply chain, and

wherein the processor is configured to:

25

calculate an interchangeable quota of the environmental load of the user included in the supply chain based on the environmental load, the progress rate, and the relationship indicated by the supply chain information; and

determine interchange of the environmental load between users included in the supply chain based on the calculated interchangeable quota.

5. The financial instrument management system according to claim 4, wherein the processor is configured to generate data for displaying a screen indicating the users included in the supply chain, the relationship, and the interchangeable quota.

5

6. A financial instrument management method executed by a financial instrument management system,

wherein the financial instrument management system includes a processor; and a memory,

10 wherein the memory holds:

supply chain information indicating content of a task conducted by a user included in a supply chain, a facility used for the task, and an environmental load caused by the task;

15 financial instrument information indicating a financial instrument having the user included in the supply chain as a debtor, an interest rate at a time when a target value of the environmental load is achieved by the user, and an interest rate at a time when the target value is underachieved by the user; and

economic rationality information indicating an arithmetic expression for calculating an economic value generated by conducting the task, and

20 the financial instrument management method comprising:

determining, by the processor, a facility that possibly serves as a control target based on a result of comparison between a cost incurred when the interest rate at the time of underachievement of the target value based on the environmental load indicated by the supply chain information and the financial instrument information is applied and the economic value based on the arithmetic expression and the supply chain information; and

generating, by the processor, a control message directed to the determined facility.

7. The financial instrument management method according to claim 6,
wherein the supply chain information indicates at least one of an operation
time of the facility in the task, a type of a material required for the task, an amount in
stock of the material of the task, or an amount in stock of finished products of the task,
5 and

the financial instrument management method further comprising calculating,
by the processor, the economic value by assigning the at least one of the operation
time, the type of the material, the amount in stock of the material, or the amount in
stock of the finished products to the arithmetic expression.

10

8. The financial instrument management method according to claim 6,
wherein the memory holds facility control information indicating a control
command for each facility,

wherein the supply chain information indicates an operation time of the facility
15 in the task and a progress rate of the task, and

the financial instrument management method further comprising:

referring, by the processor, to the supply chain information to acquire
the operation time of the determined facility and the progress rate;

determining, by the processor, a control amount of the facility based
20 on the acquired operation time and progress rate; and

including, by the processor, in the control message, the determined
control amount and the control command for the determined facility indicated by the
facility control information.

25 9. The financial instrument management method according to claim 6,
wherein the supply chain information indicates a progress rate of the task and
a relationship between order placement and order reception of the task of the user
included in the supply chain, and

the financial instrument management method further comprising:

calculating, by the processor, an interchangeable quota of the environmental load of the user included in the supply chain based on the environmental load, the progress rate, and the relationship indicated by the supply chain information; and

5 determining, by the processor, interchange of the environmental load between users included in the supply chain based on the calculated interchangeable quota.

10 10. The financial instrument management method according to claim 9, further comprising generating, by the processor, data for displaying a screen indicating the users included in the supply chain, the relationship, and the interchangeable quota.