

DISTRIBUTED LEDGER CREDIT LINE MANAGEMENT SYSTEMS AND METHODS

TECHNICAL FIELD

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The present disclosure relates to systems and methods for the management of credit lines using a distributed ledger.

BACKGROUND

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Many small businesses do not make full use of credit lines provided by financial institutions such as banks. One of the reasons for this is that the process for requesting and obtaining approval of a credit line can be time consuming. Further, financial institutions may be deterred from providing credit to small businesses because the financial health of the business may quickly change and it can be difficult for the financial institution to enforce how a business will use the credit line provided.

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SUMMARY OF THE INVENTION

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According to an first aspect of the present disclosure, a method of initiating a transaction is provided. The method comprises: receiving financial data associated with an entity; calculating a first financial health score for the entity using the financial data; receiving a funding requirement indication from a device associated with the entity; generating a credit line request for the entity, the credit line request comprising an indication of the first financial health score and an indication of the funding requirement indication; sending the credit line request to a server associated with a lending institution; receiving a credit line response from the server associated with the lending institution, the credit line request comprising an interest rate dependency indication, the interest rate dependency indication indicating a dependency of an interest rate on a financial health score for the entity; storing a smart contract on a distributed ledger, the smart contract corresponding to a pre-approved credit line for the entity, the pre-approved credit line having an interest rate set according to the interest rate dependency indication; receiving further financial

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data associated with the entity; calculating a second financial health score using the further financial data; receiving a credit line usage request from the device associated with the entity; and executing the smart contract on the distributed ledger to initiate a loan from the lending institution to the entity, the loan having an interest
5 rate set using second financial health score and the interest rate dependency.

10 In an embodiment the distributed ledger is a permissioned distributed ledger and the smart contract is stored on a private channel of the permission distributed ledger accessible by the server associated with the lending institution.

In an embodiment the first financial health score and the second financial health score are multidimensional measures derived from the financial data of the entity.

15 In an embodiment the credit line response further comprises an indication of a restriction on use of funding proceeds. The funding requirement indication may comprise an indication of an invoice and the indication of the restriction on the use of funding proceeds comprises an indication that the funding proceeds may only be used for payment of the invoice. The loan may be executed to have the restriction on use of funding proceeds.

20 In an embodiment initiating the loan comprises providing a payment card account with a value associated with the load and placing a restriction on the use of the payment card account.

25 In an embodiment initiating the loan comprises initiating a transfer of a value associated with the loan to a bank account.

In an embodiment initiating the loan comprises providing a payment card account with a value associated with the loan.

30 According to a second aspect of the present disclosure, a credit line management system is provided. The credit line management system comprises a computer processor and a data storage device. The data storage device stores instructions operative by the processor to: receive financial data associated with an entity;

calculate a first financial health score for the entity using the financial data; receive a funding requirement indication from a device associated with the entity; generate a credit line request for the entity, the credit line request comprising an indication of the first financial health score and an indication of the funding requirement indication;

5 send the credit line request to a server associated with a lending institution; receive a credit line response from the server associated with the lending institution, the credit line request comprising an interest rate dependency indication, the interest rate dependency indication indicating a dependency of an interest rate on a financial health score for the entity; store a smart contract on a distributed ledger, the smart

10 contract corresponding to a pre-approved credit line for the entity, the pre-approved credit line having an interest rate set according to the interest rate dependency indication; receive further financial data associated with the entity; calculate a second financial health score using the further financial data; receive a credit line usage request from the device associated with the entity; and execute the smart

15 contact on the distributed ledger to initiate a loan from the lending institution to the entity, the loan having an interest rate set using second financial health score and the interest rate dependency.

Further aspects of the present disclosure may be provided as a software application

20 downloadable into a computer device to facilitate the method. The software application may be a computer program product, which may be stored on a non-transitory computer-readable medium on a tangible data-storage device (such as a storage device of a server, or one within a user device).

25 BRIEF DESCRIPTION OF THE DRAWINGS

In the following, embodiments of the present invention will be described as non-limiting examples with reference to the accompanying drawings in which:

30 FIG.1 is a block diagram showing a network for credit line management comprising a credit line management system according to an embodiment of the present invention;

FIG.2 is a flowchart showing a method of managing a credit line according to an embodiment of the present invention;

FIGS.3A to 3D are tables showing the calculation of parameters of a financial health score for an entity according to an embodiment of the present invention;

FIG.4 is a flowchart showing a method of on-boarding entities to a credit management system according to an embodiment of the present invention;

FIG.5 is a flowchart showing a method of processing requests for a credit line in a credit line management system according to an embodiment of the present invention;

FIG.6 is a flowchart showing a method of executing credit line requests in a credit line management system according to an embodiment of the present invention;

FIG.7 is a flowchart showing a method of controlling the use of disbursement funds in a credit line management system according to an embodiment of the present invention; and

FIG.8 is a block diagram showing a technical architecture of a credit line management system according to an embodiment of the present invention.

DETAILED DESCRIPTION

FIG.1 is a block diagram showing a network for credit line management comprising a credit line management system according to an embodiment of the present invention. The network 100 comprises a credit line management system 110, a client device 120, an enterprise resource planning system 130, a lending institution server 140, a permissioned distributed ledger 150, a payment card provider server 160 and banking institution server 170. The network 100 shown in FIG.1 functions to manage credit lines provided by a lending institution associated with the lending institution server 140 to an entity such as a small business associated with the client device 120. As will be described in more detail below, the credit line management system

110 allows short term loans to be pre-approved based on enterprise resource planning (ERP) data provided by the entity to the enterprise planning resource system 130. These pre-approved loans have dynamic terms such as interest rate, which may change, based on changes to a financial health score calculated by the credit line management system 110 based on the ERP data. The pre-approved short-term loans are stored as smart contracts on the permissioned distributed ledger 150 and may be executed in response to an input from the client device 120. In some embodiments, the short term loans are provided to a virtual pre-paid payment card issued by a payment card provider associated with the payment card provider server 160. This allows controls to be put on the use of the loan proceeds by the lending institution associated with the lending institution server 140.

It should be noted that while FIG.1 shows a single client device 120, a single lending institution server 140, a single payment card provider server 160 and single banking institution server 170, systems with multiple devices and servers are envisaged. FIG.1 is shown in this manner for simplicity. In particular, systems that allow entities associated with a client device 120 to access credit lines provided by multiple lending institutions associated with different lending institution servers are envisaged.

The client device 120 is a computing device such as a personal computer, a tablet computer device, a smart phone or other type of computing device which allows a user associated with an entity to input data and make selections for example by accessing a web page or portal. The entity may be a person in which case the user would be the entity themselves, alternatively, the entity may be a company or other organization. It is noted that the systems and methods described herein are considered to be particularly suited for use by small and medium size entities (SMEs).

The enterprise resource planning system 130 is a system that provides operational support to the entity such as management of accounting data, financial data, and human resources data. Data may be entered into the enterprise resource planning system 130 via the client device 120. This data may include invoices issued to the entity, invoices issued by the entity, employee details, time sheets and other data accounting and resource management for the entity. The enterprise resource

planning system 130 stores and analyses this information. The embodiments of the present invention use the data gathered and stored by the enterprise resource planning system 130 to facilitate the provision of loans and credit, to the entity in a dynamic manner.

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The lending institution server 140 is a server associated with a lending institution. The lending institution may be a “traditional lender” such as a bank, or an “alternative lending platform” such as a funding society or a peer to peer lender. As mentioned above, it is envisaged that a number of servers associated with different lending institutions may be attached to the network 100. Each of the lending institutions provides loans to clients based on terms and conditions and assessments of the clients carried out by the lending institution. Thus, the lending institution server 140 may be configured to receive financial data of a client and generate a loan offer response based on an assessment of the financial data.

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The permissioned distributed ledger 150 is a blockchain network which is capable of storing and executing smart contracts. The smart contracts enforce predefined rules. Various lending institution servers such as the lending institution server 140 shown in FIG.1 are permissioned nodes that constitute the blockchain network which stores the permissioned distributed ledger 150. The permissioned distributed ledger 150 may be implemented on a platform such as Hyperledger Fabric.

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The payment card provider server 160 is associated with a payment card issuer. In some embodiments, as will be described in more detail below, when a loan is issued to the entity associated with the client device 120, that loan is provided as a balance on a virtual pre-paid payment card. This allows the lending institution to place restrictions on how the loan is used. This may be enforced by restricting the use of the pre-paid payment card to a specific merchant.

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The banking institution server 170 is a server associated with a banking institution which holds a bank account for the entity associated with the client device 120. In some embodiments, the loan may be paid into this bank account. In alternative embodiments, the banking institution may receive a payment corresponding to the

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loan into an escrow account to make a payment on behalf of the entity associated with the client device 120.

The credit line management system 110 is a computer system which implements a number of modules which may be implemented as software which is executed on a processor or specifically programmed hardware or a combination of the two. The credit line management system comprises an ERP interface module 111, a financial health score calculation module 112, a client interface module 113, a lending interface module 114, a distributed ledger module 115, a payment card provision module 116 and a banking institution interface module 117. The ERP interface module 111 operates to receive ERP data from the enterprise resource planning system 130. The financial health score calculation module 112 is operable to calculate a financial health score for the entity associated with the client device 120 based on the ERP data for that entity. The client interface module 113 provides an interface such as a web portal through which the entity associated with the client device 120 can input data, and documentation into the credit line management system 110. The client interface module 113 also allows input of information such as loan funding requirements and a selection of a loan by the entity. The lending institution interface module 114 provides an interface between the lending institution server 140 and the credit line management system 110. This interface may be application programming interface. The distributed ledger module 115 manages the permissioned distributed ledger 150. The distributed ledger module 115 stores smart contracts on the permissioned distributed ledger 150 which represent pre-approved loans from the lending institution associated with the lending institution server 140 to the entity associated with the client device 120. The distributed ledger module 115 also operates to execute the smart contracts in response to inputs from the client device 120 via the client interface module 113. The payment card provision module 116 provides an interface between the credit line management system 110 and the payment card provider server 160 to facilitate the creation of pre-paid payment cards. A detailed technical architecture of the credit line management system is described in detail below with reference to FIG.8.

FIG.2 is a flowchart showing a method of managing a credit line according to an embodiment of the present invention. The method 200 is carried out by the credit line

management system 110 shown in FIG.1. The method 200 facilitates the process of an entity applying for a credit line and using the credit line to receive a loan from a lending institution.

- 5 In step 202, the EPR interface module 111 of the credit line management system 110 receives financial data associated with the entity. The financial data is received from the enterprise resource planning system 130. The enterprise resource planning system 130 receives financial data relating to the entity from the client device 120. The financial data may comprise indications of invoices issued by the entity,
10 indications of payments received by the entity, indications of numbers of staff working for the entity, the salaries and costs payable to the staff of the entity, indications of invoices received by the entity, and other financial data related to the entity.
- 15 In step 204, the financial health score calculation module 112 of the credit line management system calculates a financial health score for the entity. The financial health score is a multidimensional objective measure of the health of the entity based on data recorded by the enterprise resource planning system 130. The various dimensions of the financial health score are a correlation of business activity
20 with financial activity in the enterprise resource planning system 130. The financial health score may be based upon the following factors: aging and velocity aspects of sales and / or purchase invoices; employee ramp up statistics, employee overtime statistics. In some embodiments, interactions between the entity and other businesses which also use the enterprise management system may be taken into
25 account in the financial health score.

Some examples of the calculation of the financial health score will now be described with reference to FIG.3A, FIG.3B, FIG.3C and FIG.3D. FIGS.3A to 3D are tables showing the calculation of parameters of a financial health score for an entity
30 according to an embodiment of the present invention.

FIG.3A is a table showing an example of calculation of parameters of a financial health score for an entity using sales invoice settlement rate. As shown in FIG.3A, the number of invoices and the value of invoices paid before the due date, on the

due date, 1-10 days after the due date, 10-20 days after the due date due for more than 20 days are extracted from the financial data of the entity for each of a plurality of periods. In this example the periods are Q1, Q2 and Q3. Based on this data, a parameter of the score for each period is calculated. As can be seen in the table of FIG.3A, the number of invoices due for more than 20 days is higher for Q3 than for Q2 and Q1, thus, the score for Q3 is lower than the score for Q2 and Q1. Thus in this example, a higher score represents higher financial health for the entity.

FIG.3B is a table showing an example of calculation of parameters of a financial health score for an entity using invoice generation rate. As shown in FIG.3B, the number of invoices generated in each period and the total value of the invoices for each period is extracted from the financial data of the entity.

FIG.3C is a table showing an example of calculation of parameters of a financial health score for an entity using employee ramp up rate. The number of employees and the relationship with sales invoice generation may be taken into account. Thus an entity which has an increasing number of employees but flat or decreasing sales level may be considered to have a decreasing financial health. This aspect of the financial health score is the business forecasting ratio of the entity.

FIG.3D is a table showing an example of calculation of parameters of a financial health score for an entity using correlations between sales invoice generation with purchase order generation. For this parameter, the financial health score is indicative of the working capital management score.

In some embodiments, the ERP interface module 111 may obtain information relating to customers or suppliers of the entity which is also stored in the enterprise resource planning system 130 in order to calculate parts of the financial health score for the entity.

Returning now to FIG.2, in step 206, the client interface module 113 of the credit line management system 110 receives a funding requirement indication from the client device 120. Step 206 may comprise a user accessing a portal provided by the credit line management system to input a funding requirement indication. The funding

requirement indication may comprise an indication of the intended use of the funding. For example, the funding requirement indication may include an indication of an invoice to be paid using the loan. In such cases, the funding requirement indication may comprise an indication of invoice details such as the invoice amount, the party
5 to be paid and a due date for the payment.

In step 208, the lending institution interface module 114 of the credit line management system 110 generates a credit line request for the entity. The credit line request comprises an indication of the entity, an indication of the financial health
10 score for the entity and an indication of the funding requirement for the entity.

In step 210, the lending institution interface module 114 of the credit line management system 110 sends the credit line request for the entity to the lending institution server 140.
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Upon receiving the credit line request, the lending institution server 140 performs a processing and approval workflow on the credit line request. This comprises assessing the risk involved in lending to the entity and making a decision on whether to provide credit to the entity. Further, the lending institution server 140 also specifies
20 how an interest rate may fluctuate with changes in the financial health score of the entity. The lending institution server 140 may also specify restrictions on the use of proceeds of the loan. For example, if the credit line request includes an invoice from a specific supplying entity, the lending institution server 140 may specify that the proceeds of a loan under the credit line may only be used to make a payment to that
25 specific supplier entity. This information is included in a credit line response generated by the lending institution server 140.

In step 212, the lending institution interface module 114 of the credit line management system 110 receives the credit line response from the lending institution server 140.
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In step 214, the distributed ledger module 115 of the credit line management system 110 generates a smart contract which corresponds to the credit line offered by the lending institution based on the information included in the credit line response

generated by the lending institution server 140. The smart contract is stored by the distributed ledger module 115 on the permissioned distributed ledger 150. The smart contract corresponds to a pre-approved credit line for the entity. The smart contract includes an interest rate dependency indication which indicates how the interest rate
5 depends on the financial health score for the entity.

The smart contract is stored on a private channel in the permissioned distributed ledger 150. This means that the smart contract is only accessible by the credit line management system 110 and the lending institution server 140. As mentioned above,
10 the network 100 may comprise multiple lending institution servers. These lending institutions each have private channels in the permissioned distributed ledger 150. This means that smart contracts corresponding to pre-approved credit lines issued by one lending institution are not accessible or visible to other lending institutions.

15 At a later time, in step 216, the ERP interface module 111 of the credit line management system 110 receives updated financial data associated with the entity.

In step 218, the financial health score calculation module 112 of the credit line management system calculates an updated financial health score for the entity using
20 the updated financial data associated with the entity. The financial health score is calculated in a similar manner to step 204 described above.

In step 220, the client interface module 113 of the credit line management system 110 receives a credit line usage request from the client device 120. The credit usage
25 request comprises an indication that the entity wishes to make use of the pre-approved credit line offered by the lending institution.

In step 222, the distributed ledger module 115 of the credit line management system 110 executes the smart contract corresponding to the credit line usage request. This
30 causes a transaction corresponding to the loan to be initiated between the lending institution and the entity. The transaction may take various forms. In some embodiments, the smart contract executes to cause a pre-paid virtual payment card to be issued and loaded with loan amount by the payment card provision module 116 interacting with the payment card service provider server 160. In other embodiments,

the execution of the smart contract initiates a transfer of funds to an account associated with entity from an account of the lending institution. In such embodiments, the banking institution interface module 117 may receive an indication that the transaction has successfully been carried out and in response to this, the client device may be provided with a corresponding indication via the client interface module 113.

It is noted that in step 222, the smart contract is executed to issue a loan from the lending institution to the entity at an interest rate set according to the updated financial health score for the entity and the interest rate dependency in the smart contract.

FIG.4 is a flowchart showing a method of on-boarding entities to a credit management system according to an embodiment of the present invention. The method 400 shown in FIG.4 may take place before the method 200 shown in FIG.2.

In step 402, the EPR interface module 111 of the credit line management system 100 receives ERP data associated with the entity from the enterprise resource planning system 130. In some embodiments, the client interface module 113 of the credit line management system 110 prompts the user of the client device 120 to enter preferences relating the credit line for the entity. This may include preferences on which lending institutions the entity would prefer to use to obtain a credit line. The client interface module 113 of the credit line management system 110 may also prompt the user of the client device 120 to upload supporting documentation, for example if the lending institutions are required by national regulations to perform know your customer (KYC) checks on the identity of the entity or the authorization of the user of the client device 120 to act on behalf of the entity.

In step 404, the lending institution interface module 114 of the credit line management system 110 provides the information on the entity to the lending institutions. This step may be implemented by the lending institution interface module 114 using an API call to the lending institution server 140.

In step 406, the lending institution server 140 processes the received information. Step 406 may comprise the lending institution performing platform specific validations and risk assessments into order to determine whether to approve the onboarding of the entity.

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In step 408, the lending institution server 140 sends a response to the credit line management system 110. This response may be sent as an API call to the lending institution interface module 114 of the credit line management system 110.

10 Following the method shown in FIG.4, the credit line management system 110 may store indications of which lending institutions have approved on-boarding of which entities.

FIG.5 is a flowchart showing a method of processing requests for a credit line in a credit line management system according to an embodiment of the present invention. The method 500 shown in FIG.5 may take place after the method 400 shown in FIG.4.

15 In step 502, the client interface module 113 of the credit line management system 110 receives a request for a credit line from the client device 120. The request for the credit line may comprise a funding requirement indication as described above in relation to step 206 of the method 200 shown in FIG.2. The funding requirement indication may comprise details of the use of the credit line, for example details of an invoice or invoices to be paid using the credit line.

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In step 504, the credit line management system 110 identifies lending institutions suitable for providing the credit line. Step 504 may comprise accessing information stored following the execution of the method 400 shown in FIG.4 as this information comprises indications of which lending institutions have approved on-boarding of which entities. Thus, the lending institutions that have approved the on-boarding of the entity making the request for a credit line may be identified in step 504 as suitable for providing the credit line.

In step 506, the lending institution interface module 114 of the credit line management system 110 broadcasts a credit line request to the lending institutions identified in step 504. The credit line request includes the financial health score for the entity which is calculated as described above with reference to step 204 of the method 200 shown in FIG.2.

Following step 506, each lending institution server 140 receives the credit line request and generates a response message. The response message comprises an indication of an approved credit line for the entity and a base interest rate. The response message also comprises an indication of a period of validity of the credit line. The response message further comprises an indication of how the interest rate will fluctuate depending on changes in the financial health score of the entity. The response message may also comprise an indication of a whether there is a requirement for enforcement of the use of the proceeds of the credit line. For example, the lending institution may specify that the credit line can only be used to pay a certain company or merchant such as the company that issued the invoice identified in the funding requirement indication.

In step 508, the lending institution interface module 114 of the credit line management system 110 receives response messages from each lending institution server 140.

In step 510, the distributed ledger module 115 of the credit line management system 110 stores a set of smart contracts on the permissioned distributed ledger 150. Each smart contract corresponds to a pre-approved credit line offered by one of the lending institutions to the entity. The smart contracts each include details of the credit line offered by the respective lending institution, such as the interest rate, the dependence of the interest rate on the financial health score for the entity, and any restrictions to be imposed on the use of the proceeds of the loan.

Step 510 may be implemented by the distributed ledger module 115 invoking APIs for the permissioned distributed ledger to create entries on a private channel between the credit line management system 110 and the lending institution server 140 corresponding to the lending institution that has offered the credit line. Thus, the

lending instruction server 140 is able to access only the smart contracts corresponding to its private channel. The smart contracts are then stored on the permissioned distributed ledger 150 until the entity decides to use a pre-approved credit line or they expire.

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FIG.6 is a flowchart showing a method of executing credit line requests in a credit line management system according to an embodiment of the present invention. The method 600 shown in FIG.6 involves executing one of the smart contracts described above with reference to the method 500 shown in FIG.5 to initiate loan.

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In step 602, an indication of the offered credit lines is sent to the client device 120 by the client interface module 113. Step 602 may comprise a user accessing a portal using the client device 120 to see a listing of available credit lines.

15 In step 604, an indication of an entity acceptance of a credit line is received by the client interface module 113 of the credit line management system 110. This indication may be the result of the user of the client device making a selection of one of the offered credit lines.

20 Following step 604, financial health score calculation module 112 of the credit line management system 110 determines the current financial health score for the entity.

In step 606, the distributed ledger module 115 of the credit line management system 110 executes the smart contract corresponding to the credit line accepted by the
25 entity. The distributed ledger module 115 may call an API to invoke the smart contract which triggers transfer of funds between the lending institution and the entity requesting the credit line. In some embodiments, the transfer of funds is made to an escrow account maintained by the credit line management system 110, for example with the banking institution corresponding to the banking institution server 170.

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In some embodiments, for example in which the lending institution wishes to place restrictions on the use of the funds, the execution of the smart contract may trigger creation of a pre-paid payment card loaded with the funds. This is described below with reference to FIG.7.

FIG.7 is a flowchart showing a method of controlling the use of disbursement funds in a credit line management system according to an embodiment of the present invention. The method 700 shown in FIG.7 may be carried out as step 606 of the method 600 shown in FIG.6.

In step 702, the smart contract is executed by the distributed ledger module 115 of the credit line management system 110. The execution of the smart contract causes an instruction to be sent to the payment card provider server 160 to open a pre-paid payment card account in the name of the entity for the loan amount. In the event that restrictions are to be placed on the use of the funds, the payment card provider server is also provided with details of these restrictions. The restrictions may take the form of an identifier of a specific merchant corresponding to the company that issued the invoice for which the credit line is provided.

Following step 702, the details of the pre-paid payment card are provided to the entity, for example by sending a message from the client interface module 113 of the credit line management system 110 to the client device 120. Then the entity initiates payment of the invoice by providing the pre-paid payment card details to the company that issued the invoice.

A payment card transaction authorization request is then generated and this is sent to the payment card provider server 160 to authorize the request.

In step 704, the payment card provider server 160 determines if fund utilization parameters are satisfied by comparing the merchant identifier included in the transaction authorization request with merchant identifier corresponding to the company that issued the invoice. If the merchant identifiers match, then the payment card provider server 160 generates a transaction authorization response authorizing the payment transaction.

FIG.8 is a block diagram showing a technical architecture 800 of the credit line management system 110 for performing steps of exemplary methods described above. Typically, the methods are implemented by a number of computers each

having a data-processing unit. The block diagram as shown in FIG.8 illustrates a technical architecture 800 of a computer which is suitable for implementing one or more embodiments herein.

5 The technical architecture 800 includes a processor 822 (which may be referred to as a central processor unit or CPU) that is in communication with memory devices including secondary storage 824 (such as disk drives), read only memory (ROM) 826, random access memory (RAM) 828. The processor 822 may be implemented as one or more CPU chips. The technical architecture 820 may further comprise input/output
10 (I/O) devices 830, and network connectivity devices 832.

The secondary storage 824 is typically comprised of one or more disk drives or tape drives and is used for non-volatile storage of data and as an over-flow data storage device if RAM 828 is not large enough to hold all working data. Secondary storage
15 824 may be used to store programs which are loaded into RAM 828 when such programs are selected for execution. In this embodiment, the secondary storage 824 has an ERP interface module 111, a financial health score calculation module 112, a client interface module 113, a lending institution interface module 114, a distributed ledger module 115, a payment card provision module 116 and a banking institution
20 interface module 117 comprising non-transitory instructions operative by the processor 822 to perform various operations of the method of the present disclosure. As depicted in FIG.8, the modules 111 to 117 are distinct modules which perform respective functions implemented by the credit line management system 110. It will be appreciated that the boundaries between these modules are exemplary only, and
25 that alternative embodiments may merge modules or impose an alternative decomposition of functionality of modules. For example, the modules discussed herein may be decomposed into sub-modules to be executed as multiple computer processes, and, optionally, on multiple computers. Moreover, alternative embodiments may combine multiple instances of a particular module or sub-module.
30 It will also be appreciated that, while a software implementation of the modules 111 to 117 is described herein, these may alternatively be implemented as one or more hardware modules (such as field-programmable gate array(s) or application-specific integrated circuit(s)) comprising circuitry which implements equivalent functionality to that implemented in software. The ROM 826 is used to store instructions and

perhaps data which are read during program execution. The secondary storage 824, the RAM 828, and/or the ROM 826 may be referred to in some contexts as computer readable storage media and/or non-transitory computer readable media.

- 5 The I/O devices may include printers, video monitors, liquid crystal displays (LCDs), plasma displays, touch screen displays, keyboards, keypads, switches, dials, mice, track balls, voice recognizers, card readers, paper tape readers, or other well-known input devices.
- 10 The network connectivity devices 832 may take the form of modems, modem banks, Ethernet cards, universal serial bus (USB) interface cards, serial interfaces, token ring cards, fiber distributed data interface (FDDI) cards, wireless local area network (WLAN) cards, radio transceiver cards that promote radio communications using protocols such as code division multiple access (CDMA), global system for mobile
- 15 communications (GSM), long-term evolution (LTE), worldwide interoperability for microwave access (WiMAX), near field communications (NFC), radio frequency identity (RFID), and/or other air interface protocol radio transceiver cards, and other well-known network devices. These network connectivity devices 832 may enable the processor 822 to communicate with the Internet or one or more intranets. With
- 20 such a network connection, it is contemplated that the processor 822 might receive information from the network, or might output information to the network in the course of performing the method operations described herein. Such information, which is often represented as a sequence of instructions to be executed using processor 822, may be received from and outputted to the network, for example, in
- 25 the form of a computer data signal embodied in a carrier wave.

The processor 822 executes instructions, codes, computer programs, scripts which it accesses from hard disk, floppy disk, optical disk (these various disk based systems may all be considered secondary storage 824), flash drive, ROM 826, RAM 828, or

30 the network connectivity devices 832. While only one processor 822 is shown, multiple processors may be present. Thus, while instructions may be discussed as executed by a processor, the instructions may be executed simultaneously, serially, or otherwise executed by one or multiple processors.

It is understood that by programming and/or loading executable instructions onto the technical architecture 800, at least one of the CPU 822, the RAM 828, and the ROM 826 are changed, transforming the technical architecture 800 in part into a specific purpose machine or apparatus having the novel functionality taught by the present disclosure. It is fundamental to the electrical engineering and software engineering arts that functionality that can be implemented by loading executable software into a computer can be converted to a hardware implementation by well-known design rules.

Although the technical architecture 800 is described with reference to a computer, it should be appreciated that the technical architecture may be formed by two or more computers in communication with each other that collaborate to perform a task. For example, but not by way of limitation, an application may be partitioned in such a way as to permit concurrent and/or parallel processing of the instructions of the application. Alternatively, the data processed by the application may be partitioned in such a way as to permit concurrent and/or parallel processing of different portions of a data set by the two or more computers. In an embodiment, virtualization software may be employed by the technical architecture 800 to provide the functionality of a number of servers that is not directly bound to the number of computers in the technical architecture 800. In an embodiment, the functionality disclosed above may be provided by executing the application and/or applications in a cloud computing environment. Cloud computing may comprise providing computing services via a network connection using dynamically scalable computing resources. A cloud computing environment may be established by an enterprise and/or may be hired on an as-needed basis from a third party provider.

Whilst the foregoing description has described exemplary embodiments, it will be understood by those skilled in the art that many variations of the embodiments can be made within the scope and spirit of the present invention.

CLAIMS

1. A method of initiating a transaction, the method comprising:
 - receiving financial data associated with an entity;
 - calculating a first financial health score for the entity using the financial data;
 - receiving a funding requirement indication from a device associated with the entity;
 - generating a credit line request for the entity, the credit line request comprising an indication of the first financial health score and an indication of the funding requirement indication;
 - sending the credit line request to a server associated with a lending institution;
 - receiving a credit line response from the server associated with the lending institution, the credit line response comprising an interest rate dependency indication, the interest rate dependency indication indicating a dependency of an interest rate on a financial health score for the entity;
 - storing a smart contract on a distributed ledger, the smart contract corresponding to a pre-approved credit line for the entity, the pre-approved credit line having an interest rate set according to the interest rate dependency indication;
 - receiving further financial data associated with the entity;
 - calculating a second financial health score using the further financial data;
 - receiving a credit line usage request from the device associated with the entity; and
 - executing the smart contract on the distributed ledger to initiate a loan from the lending institution to the entity, the loan having an interest rate set using the second financial health score and the interest rate dependency.
2. A method according to claim 1, wherein the distributed ledger is a permissioned distributed ledger and the smart contract is stored on a private channel of the permission distributed ledger accessible by the server associated with the lending institution.
3. A method according to claim 1 or claim 2, wherein the first financial health score and the second financial health score are multidimensional measures derived from the financial data of the entity.

4. A method according to any preceding claim, wherein the credit line response further comprises an indication of a restriction on use of funding proceeds.
5. A method according to claim 4, wherein the funding requirement indication comprises an indication of an invoice and the indication of the restriction on the use of funding proceeds comprises an indication that the funding proceeds may only be used for payment of the invoice.
6. A method according to any one of claims 4 or 5, wherein the loan is executed to have the restriction on use of funding proceeds.
7. A method according to claim 6, wherein initiating the loan comprises providing a payment card account with a value associated with the loan and placing a restriction on the use of the payment card account.
8. A method according to any one of claims 1 to 6, wherein initiating the loan comprises initiating a transfer of a value associated with the loan to a bank account.
9. A method according to any one of claims 1 to 6, wherein initiating the loan comprises providing a payment card account with a value associated with the loan.
10. A computer readable medium carrying computer executable instructions which when executed on at least one processor cause the at least one processor to carry out a method according to any one of claims 1 to 9.
11. A credit line management system comprising a computer processor and a data storage device, the data storage device storing instructions operative by the processor to:
 - receive financial data associated with an entity;
 - calculate a first financial health score for the entity using the financial data;
 - receive a funding requirement indication from a device associated with the entity;

generate a credit line request for the entity, the credit line request comprising an indication of the first financial health score and an indication of the funding requirement indication;

send the credit line request to a server associated with a lending institution;

receive a credit line response from the server associated with the lending institution, the credit line response comprising an interest rate dependency indication, the interest rate dependency indication indicating a dependency of an interest rate on a financial health score for the entity;

store a smart contract on a distributed ledger, the smart contract corresponding to a pre-approved credit line for the entity, the pre-approved credit line having an interest rate set according to the interest rate dependency indication;

receive further financial data associated with the entity;

calculate a second financial health score using the further financial data;

receive a credit line usage request from the device associated with the entity;

and

execute the smart contract on the distributed ledger to initiate a loan from the lending institution to the entity, the loan having an interest rate set using the second financial health score and the interest rate dependency.

12. A system according to claim 11, wherein the distributed ledger is a permissioned distributed ledger and the smart contract is stored on a private channel of the permission distributed ledger accessible by the server associated with the lending institution.

13. A system according to claim 11 or claim 12, wherein the first financial health score and the second financial health score are multidimensional measures derived from the financial data of the entity.

14. A system according to any one of claims 11 to 13, wherein the credit line response further comprises an indication of a restriction on use of funding proceeds.

15. A system according to claim 14, wherein the funding requirement indication comprises an indication of an invoice and the indication of the restriction on the use

of funding proceeds comprises an indication that the funding proceeds may only be used for payment of the invoice.

16. A system to any one of claims 14 or 15, wherein the loan is executed to have the restriction on use of funding proceeds.

17. A system according to claim 16, wherein initiating the loan comprises providing a payment card account with a value associated with the loan and placing a restriction on the use of the payment card account.

18. A system according to any one of claims 11 to 16, wherein initiating the loan comprises initiating a transfer of a value associated with the loan to a bank account.

19. A system according to any one of claims 11 to 16, wherein initiating the loan comprises providing a payment card account with a value associated with the loan.