ORIGINAL RESEARCH ARTICLE

Feasibility study of realizing human resources salary management system based on cloud computing

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ABSTRACT

With the development of science and technology and the advent of the knowledge-based economy, enterprise managers gradually realise that the informationisation of human resource management will become an inevitable trend for future development. Cloud computing technology, as a new generation of resource sharing and utilization mode, has the characteristics of self-service of demand and measure service. The introduction of cloud computing technology into HR management systems can have a significant impact on talent recruitment. Performance management and payroll management, and HR management work will become more process-oriented, standardised and transparent.

Keywords: cloud computing; human resource management system; talent acquisition; performance management; compensation management

1. Introduction

Small and medium-sized enterprises (SMEs) play an important role in the development of the national economy and are growing rapidly, but their management methods are still backward compared to those of large enterprises[1]. Although the size and number of SMEs are growing, their profits are not increasing much and the competition in the market is intensifying, management problems are beginning to emerge and the long-term development of the enterprises is limited. Unlike large enterprises, SMEs do not have sufficient funds and personnel to promote the process of management implementation, and there are problems such as lower management levels, inadequate management systems and low levels of outsourcing of human resources[2]. In a less-than-robust economy, the rational allocation of enterprise human resources and the improvement of enterprise efficiency have become a problem in front of many SMEs. The traditional enterprise information technology construction model mainly refers to the management software developed by specialised software providers for SMEs, focusing on sales, automation and finance, etc. The choice of their information technology construction model and business outsourcing usually takes into account factors such as initial investment costs, post-system maintenance costs, system flexibility and adaptability. Although these common software can meet the management needs of a few enterprises to a certain extent, SMEs are diverse in type and business size, and crucially, as SMEs grow these functions cannot continuously and dynamically to

meet the needs of enterprises[3].

For SMEs, the emergence of cloud computing technology presents both opportunities and challenges. As a new delivery model for IT resources, cloud computing leads the innovation of information technology by sending huge resource information to the cloud, providing unlimited storage space and super computing power[4]. In today's fierce business competition, SMEs need to choose cloud computing technology according to their actual situation, to address the dynamic needs of SMEs' resources and technology updates, to improve the operational efficiency of enterprises, reduce various costs, rationalise the allocation of resources and promote the development of information technology, and more importantly, to make reasonable use of human resources, so as to achieve the same level of management as large enterprises. Therefore, combining cloud computing technology and SME human resource management at the entry point of this paper, and exploring the research of cloud computing-based SME human resource management becomes the research direction of this paper[5].

2. Related work

Prabhu et al.[6] used an economic model to measure cloud services and found that in terms of cloud computing technology, if a rental pricing strategy can be applied to SaaS, cloud service providers get paid accordingly by supplying quality services and renting them to users. Potter et al.[7] argues that cloud computing offers more advanced information technology and the idea of systems working to better serve business by examining all aspects of the cloud computing model in terms of its definition, technology and characteristics. Zhou et al.[8] argues that cloud computing technology needs to improve privacy protection, focusing mainly on both legal compliance and improving user trust, and that privacy needs to be added to the design of cloud service models at all stages of cloud computing services, and that the corresponding influencing factors for privacy evaluation should be proposed[9]. Zhou et al.[10] argues that cloud computing can provide standardised management, and that standardisation will take full advantage of the application flexibility and sharing of cloud computing to technically support business expansion and innovation in enterprises. Kim and Jeong[11] argues that in the cloud services market there are not only cloud computing providers, but also multiple stakeholders in the cloud industry chain, such as cloud service infrastructure providers and cloud service consultants, and that strategic cooperation among these stakeholders can greatly enhance the development and promotion of cloud computing[12,13]. Wang et al.[14] argues that cloud service users will only be able to find as much potential value as possible from their own use of cloud computing if they choose well-matched cloud computing application services and usage models.

Jung et al.[15] pointed out that the data storage model of cloud computing lacks corresponding regulation and conflicts with the existing national laws and regulations, which to a certain extent will lead to the failure of the security protection system for users, so corresponding new systems and laws must be established to solve the problem, and there is also a need to create a third party with high market recognition to provide cloud services[16,17].

These five cities already have a good foundation of informatization and have successively introduced a series of industrial promotion measures, they also have the policy environment and industrial environment for the development of cloud computing industry. The positioning, objectives and key application areas of cloud computing in these five cities are different.

3. Cloud computing

3.1. Definition and characteristics of cloud computing

IBM sees cloud computing as an emerging computing model that makes IT resources, data, storage, etc. available to users through a network, forming a pool of IT resources in the platform and visualising the

resources in the pool for users' use[18].

The China Cloud Computing Special Committee considers cloud computing to be the consolidation and provisioning of computing resources in a network and the simultaneous provision of services to a large number of users with a unified interface that allows users to use these computing resources on an on-demand metered basis.

The Canadian Standards Association CSA sees a cloud as a service consisting of "pools" of computing, networking, information and storage that can be scaled down and up to provide users with a pay-as-you-go service model similar to utility computing[19].

In summary, this paper argues that cloud computing is the convergent development and commercial application of computer information technologies such as distributed computing, network storage and large data centres. From a service perspective, cloud computing is a series of computer information technologies integrated in one piece, and these technologies are commercialised into product services, providing users with massive resources such as network, storage and computing, and users buy or rent resources on demand.

3.2. Cloud computing features

The continuous development of cloud computing technology has enabled off-site file processing, applications between multiple devices and internal data sharing. Data in the cloud are simply stored in the cloud, and if you want to use data in the cloud directly connect to the network using a device that meets the permission to access and share data[20]. The sharing of data and information files is achieved through cloud technology. Greatly simplifying the previous process of use and thus advancing teamwork and data sharing between companies.

Cloud computing achieves resource sharing through the Internet, as long as a computer can be connected to the Internet and linked to the cloud platform, technical problems are solved by cloud computing service providers, users do not need much knowledge of network technology to use cloud resources, regardless of office location and time constraints, convenient, fast and flexible[21].

3.3. Application structure

The application structure of cloud computing consists of 5 parts, namely application layer, platform layer, resource layer, user access layer and management layer, and its application structure is shown in **Figure 1**.
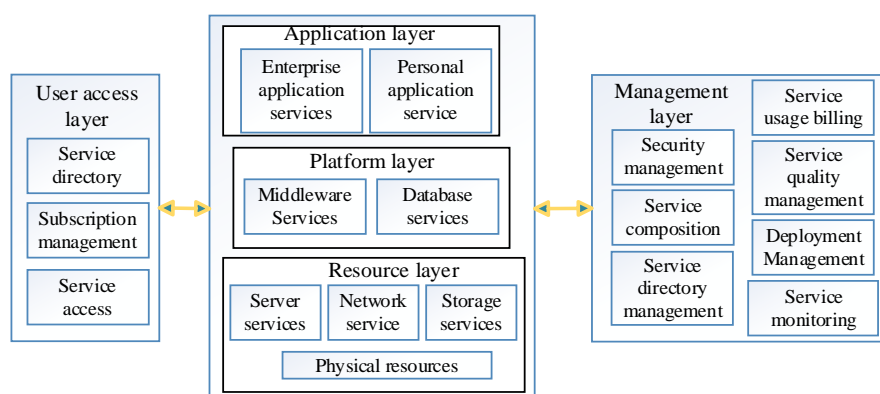
**Figure 1.** Cloud computing application architecture.

4. Cloud HRM architecture

4.1. Design concept and principles

In cloud computing, the network that provides the resources is referred to as the 'cloud', and since cloud computing provides resources as a service, this paper refers to it as a 'cloud service' and the provider of the

network resources as a 'cloud service provider'. The application carrier of human resource management for SMEs is the cloud computing platform, which provides shared computing and storage, server equipment, storage equipment, network equipment, security equipment, development environment platform construction, support service software and other services for enterprises, which is conducive to the fast and efficient completion of human affairs work, reducing human resource management costs and putting more time and energy into strategic goal setting and The company is able to spend more time and energy on strategic goal setting and implementation. In addition, a large amount of data related to human resource management can be collected, collated and analysed in a timely manner through the software, which provides strong support for the formation, implementation and execution of corporate strategic decisions, thus enhancing the soft power of the enterprise as a whole[22–25].

4.2. Cloud architecture design

Based on the idea and technology of cloud computing, cloud computing technology is applied to the construction of a cloud platform for human resource management of SMEs, and various service resources can be quickly and securely deployed uniformly on the cloud platform for human resource management, forming information infrastructure such as software, hardware and platforms, as well as visualized shared resource pools of different levels and specifications, thus forming a cloud architecture for human resource management of SMEs, and its conceptual model as shown in **Figure 2**.
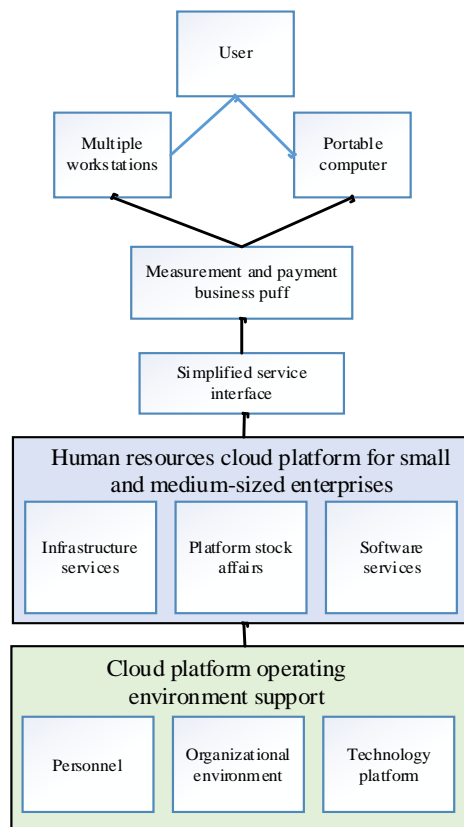
**Figure 2.** Conceptual model of SME HRM cloud architecture.

Roles in the SME HRM cloud architecture mainly consist of the cloud service provider, HRM users and the cloud service platform (middleware)[26]. The cloud service provider is responsible for providing various resources, solutions and diversified cloud services for a wide range of users; on the SME HRM cloud platform, various cloud services are provided to users in a flexible and variable manner according to service requests; with the support of the cloud platform, users can select various cloud services on the platform according to their actual needs and can realize the sharing of human resources among multiple entities.

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The cloud platform operating environment consists of three key elements: (1) people (including service users and service providers); (2) the organisational environment (including operational guarantee mechanisms); and (3) the technical platform (system), the relationship between the three is shown in **Figure 3**.
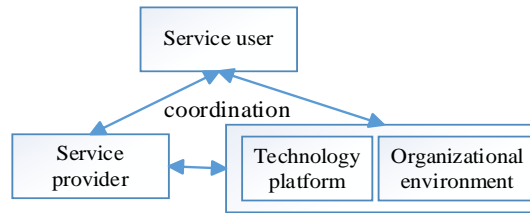
Figure 3. Relationship between the three key elements.

The SME HRM cloud platform builds a technical platform for personalised services for SMEs through the integrated use of advanced technologies such as cloud computing and the Internet, as well as intelligent decision support systems, as shown in **Figure 4**. The cloud platform can effectively integrate, unify and share a series of available HRM service resources, while dynamically adjusting the service process in a timely manner through HR demand analysis in order to allocate service resources in a balanced manner, and ultimately transforming service resources into HRM cloud services that can be directly deployed and used according to the actual or potential needs of different enterprises[27].
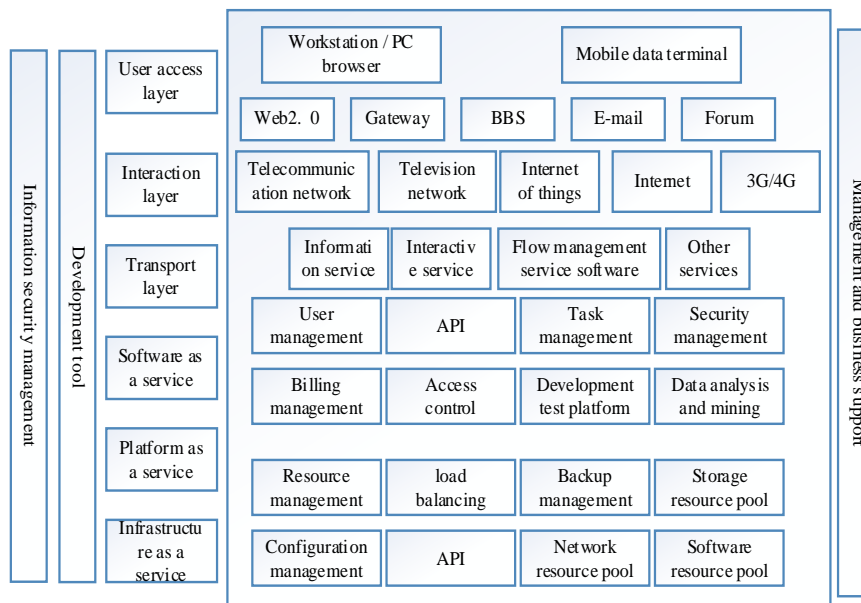
Figure 4. Overall architecture of the SME HRM cloud platform.

In this paper, the overall architecture of the SME HRM cloud platform (shown in **Figure 4**) is constructed by drawing on existing cloud platform construction technologies and platform architecture design, and combining them with the service requirements of SME HRM. In the overall architecture, SME users can call resources on demand from top to bottom, and provide service support layer by layer from bottom to top, ultimately providing technical support for SME HRM alliances, shared services, HRM systems and consulting services, etc.

4.3. Flow of use of cloud services

Adoption of cloud computing by SMEs has been accompanied by rapid development of information technology and the emergence of binding mechanisms. A service level agreement (SLA)[23] is a contract signed between a cloud service provider and an SME user regarding service quality requirements, mainly for

computing, network and security services to ensure service quality, define the service content and promise to strictly fulfill their default responsibilities. SMEs are better protected if they implement information technology through an SLA, which adequately protects the rights of both the enterprise and the cloud service provider. According to the SLA, the cloud service provider is required to monitor and manage the performance of the network provided by the cloud through the use of various technologies and solutions so that it meets the requirements of the SLA, and the SME subscriber pays the corresponding fees as required by the SLA. Any breach of the signed SLA between the two parties will be subject to the default obligations set out in the agreement. Based on this, the paper summarises the process of using cloud services (**Figure 5**).

| Business process analysis and positioning before service	Tongye determines service requirements by combing its own business processes
Primary selection of cloud service products	Negotiate with cloud agents and preliminarily select cloud service products
Training for specific posts	Train users on how to start and use cloud service products
Free trial	Through free trial, users can understand their own informatization needs and application effects
Determine cooperation intention	Users understand the product effect through trial with the enterprise's own informatization status
Sign SLA level agreement	The user signs an SA agreement with the cloud agent to fee payment, default risk, etc.
Service depth customization	According to the actual situation of users and trial results, the service is deeply customized to meet the personalized needs of users
Maintenance and upgrade	Cloud agents are responsible for later product maintenance and upgrade services

Figure 5. Cloud service usage flow.

For many companies in China, there is an urgent need for human resource management to be more efficient, and managers are eager to be freed from transactional work to engage in decision-making or strategic work. This is why HRMS[24] have been more widely used. However, there is a gap between the current functionality of HRMS and the expectations of HR managers. Cloud computing technology has powerful data collection functions, and its introduction into HRMS can optimise the workflow of HRMS and greatly improve management efficiency.

5. Case studies

The reason for the failure of performance appraisals in many companies is the inappropriate choice of performance appraisal tools. Performance management systems are based on cloud computing technology automatically match the characteristics of employees with those of the performance appraisal tool and flexibly select the appropriate tool according to the job characteristics of the person being appraised. For example, the 360-degree performance appraisal method focuses on assessing employees' abilities and development

potential, and is used for the selection of reserve cadres or managers. Key performance indicators (KPI) appraisals are a top-down system that can be used in conjunction with management by objectives (MBO) appraisals. Critical incident method (CIM) is often used as an adjunct to other performance appraisal tools. Behaviourally anchored scoring is suitable for appraising employees who perform operations. Cloud computing technology helps implementers of performance appraisal to select appraisal tools accurately and flexibly as showed in **Figure 6**.
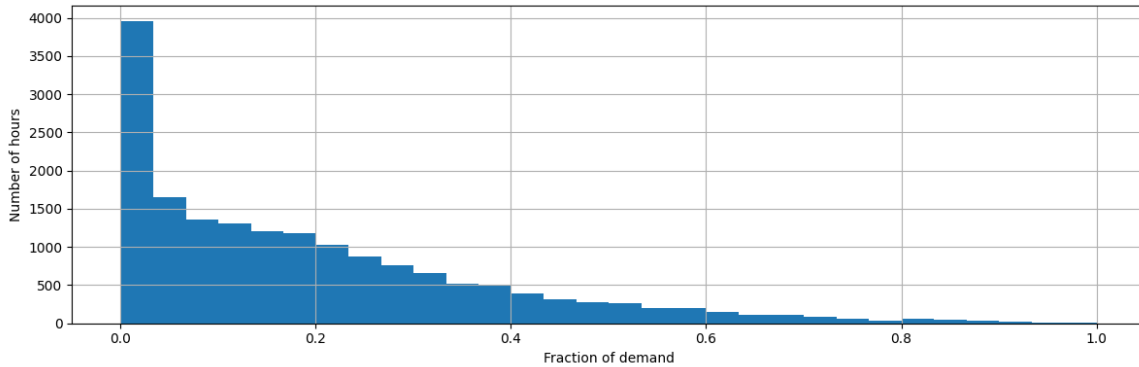
**Figure 6.** Effectiveness of HR appraisal under cloud computing.

As showing in **Figure 7**, the HRMS focuses more on data storage. With the introduction of cloud computing technology, the HRMS will focus more on the standardisation of processes. When implementing performance appraisals, such as the key performance indicator KPI performance appraisal, the strategic objectives of the enterprise are decomposed into actionable work objectives by setting, sampling, calculating and analysing the key parameters of the input side and output side of the processes within the organisation in the cloud, decomposing the performance criteria to each employee and specifying the individual indicators[25]. When conducting the appraisal, the employee's performance results are compared with the KPIs and automatically matched to produce the results. The performance appraisal process based on cloud computing technology will be more standardised and systematic.
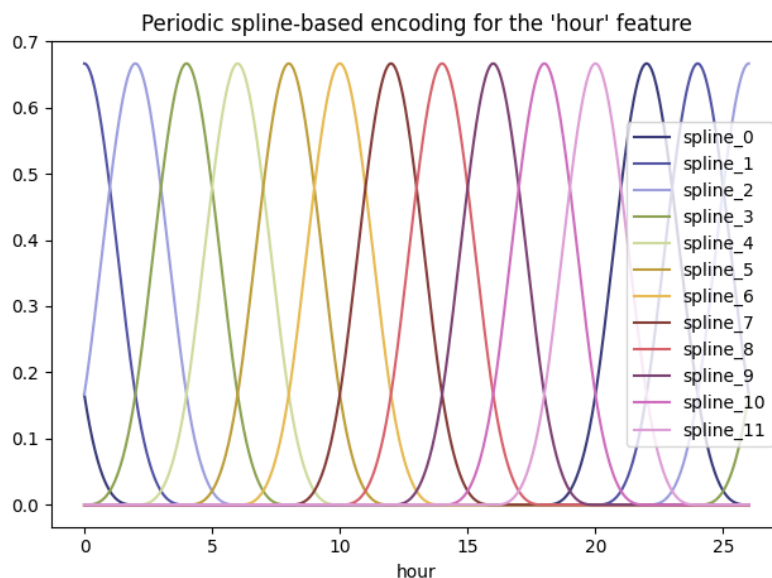
**Figure 7.** Duration effect of split lines for different clouds.

The HRMS has payroll statistics and calculations. The data dictionary and model dictionary compiled in the cloud computing technology isomorphic design ensures that employee payroll data is accounted for more easily and efficiently[27]. The vendor provides advanced payroll calculation procedures, so that when a new set

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of compensation and benefit packages is issued, the system can respond quickly and implement them simultaneously. Employees can also log into the system via self-service to check their salaries, promoting a green paperless office as showed in **Figure 8**.
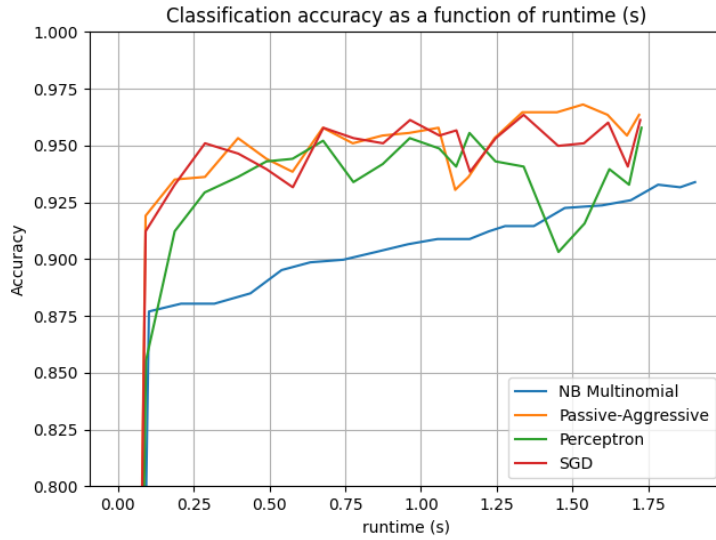
Figure 8. Accuracy of assessment for different business needs.

A cloud-based HRMS with more powerful data mining and data analysis capabilities. Existing companies are putting new demands on the processing and analysis capabilities of payroll data. The frequency of data reads operations in a cloud-based HRMS are much greater than the frequency of data updates as showed in **Figure 9**, so the distributed storage approach used by cloud computing technology ensures that the HRMS can manage big data efficiently. This enables specific data to be quickly identified for analysis in a large data set. This results in more accurate and effective payroll data analysis.
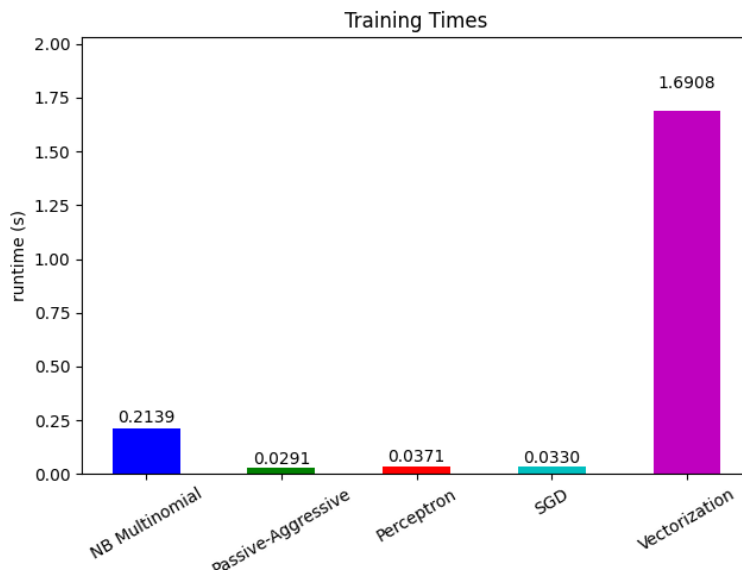
Figure 9. Computing time with different devices.

6. Conclusions

As a cutting-edge network application technology, cloud computing technology has been developed and applied in many areas of society due to its super-scale, high reliability, versatility and high scalability. With the popularity of information technology, the introduction of cloud computing technology into the HRMS construction of the HR department, which is an important department of an enterprise, will certainly bring a

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new face to HR management. Cloud computing technology has shown outstanding advantages in talent recruitment, performance management and payroll management systems, and its introduction into HRMS will certainly have a profound impact on the future development of enterprises and changes in management.

Author contributions

Conceptualization, MJ and NSM; methodology, MJ; software, MJ; validation, MJ, NSM and SG; formal analysis, MJ; investigation, MJ; resources, MJ; data curation, MJ; writing—original draft preparation, NSM; writing—review and editing, NSM; visualization, NSM; supervision, SG; project administration, NSM; funding acquisition, NSM. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

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